ASSIST
AUSTRALIAN SCHOOL SCIENCE INFORMATION SUPPORT FOR TEACHERS AND TECHNICIANS

QUESTIONS and ANSWERS (Q&As)

A compilation of Q&As regarding biological science activities answered by Science ASSIST for Australian schools

Introduction

This compilation of Questions and Answers (Q&As) has been created from the Q&As posted on the Science ASSIST website prior to its closure in December 2021. They are grouped by their science area focus and hyperlinked from the contents page to enable easy navigation.

They have been compiled so that they can continue to be available to support schools after the closure of the Science ASSIST website in December 2021. Note: The Q&As have not been revised since the date of publication in the answer, so many of the links to further information may no longer be current.

The questions were all asked by Australian schools and answered by the Science ASSIST Team (SAT) and supported by references to information from reputable sources.

These Questions and Answers (Q&As) were produced by the Science ASSIST project which was managed by the Australian Science Teachers Association (ASTA) in consultation with the Science Education Technicians Association (SETA).

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Biological science

Depth Studies

Posted by Anonymous on Mon, 2019-05-20 14:50

Depth Studies: Can you suggest ideas for (NSW) Depth Studies in biology?

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Cancel rating
No votes yet
Rate
Year Level:•
Senior Secondary
Laboratory Technicians:•
Laboratory Technicians
Contact Number:•
0408888147

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Depth Studies

Submitted by sat on 20 May 2019

Information regarding the requirements for Depth Studies can be found on the NSW Education Standards Authority website:
https://educationstandards.nsw.edu.au/wps/portal/nesa/11-12/stage-6-lear...

Information specific to biology can be found here:
https://educationstandards.nsw.edu.au/wps/portal/nesa/11-12/stage-6-lear...••

There are several different organisations that provide opportunities and programs to engage with schools to help them meet their curriculum requirements. These include commercial

companies, government departments and other educational institutions and organisations.

Some suggestions for investigations/activities are:

‘Biology depth study ideas’, Latitude Group Travel website, https://latitudegrouptravel.com.au/special-programs/depth-studies-fieldw...• (Accessed May 2019) Includes information on fieldwork.

‘Depth Study- Genetic Technologies, DNA & Disease’, Garvan Institute of Medical Research website,• https://www.garvan.org.au/research/kinghorn-centre-for-clinical-genomics... (Accessed May 2019) Includes information and a link to a Depth Study Teachers Guide.

‘Engage with us’, Macquarie University –Biological Sciences website, https://www.mq.edu.au/about/about-the-university/faculties-and-departmen... (Accessed May 2019) Includes links to DNA Depth studies.

‘Kickstart Science’, The University of Sydney Faculty of Science website, https://sydney.edu.au/science/industry-and-community/community-engagemen... (Accessed May 2019) Information on workshops and regional tours for Year 11 and 12 students for physics, chemistry and biology.

‘Practical Biology’, Nuffield Foundation website, https://www.nuffieldfoundation.org/practical-biology (Accessed May 2019) Includes a collection of experiments that demonstrate biological concepts and processes.

‘Programs & resources –High school’, Sydney Water website,• https://www.sydneywater.com.au/education/programs-resources/high-school.html•(Link updated July 2019). Includes a range of excursions, programs and resources for the NSW syllabus, including stage 6 depth studies.

•‘Science and Plants for Schools –Secondary’, Science and Plants for Schools website, http://www.saps.org.uk/secondary• (Accessed May 2019) Includes a range of resources regarding plant science.

Southern Biological. n.d. Working with Enzymes, Southern Biological website, https://file.southernbiological.com/Assets/Products/Chemicals/Enzymes/En...• (Accessed May 2019) Ideas for activities with enzymes.

•‘UNSW Science Resources for Secondary Teachers’, UNSW Science website, https://www.openlearning.com/unswscience (Accessed May 2019) Includes a number of resources to support teachers of stage 6 Physics, Chemistry, Biology and Earth and Environmental Science)

•‘Year 11 Depth Study: Wildlife at Risk’, Taronga Conservation Society Australia website, https://taronga.org.au/education/full-day-programs/wildlife-at-risk (Accessed May 2019) Information about the ‘Wildlife at risk’ program.

DNA Extraction

Posted by Anonymous on Fri, 2020-04-17 07:36

Biology Activity DNA Extraction: I recently watched a video in which someone did a DNA extraction from a salt water mouth gargle using the same technique we used for extracting DNA from fruits. Do you think I could do the same in a NSW school?

Voting:•
Cancel rating
No votes yet
Rate
Year Level:•
10
Senior Secondary
Laboratory Technicians:•
Laboratory Technicians
Contact Number:•
0403933380

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DNA Extraction

Submitted by sat on 17 April 2020

In brief, we do not recommend this activity.

Schools must follow the policies and procedures in their jurisdiction. The technique described uses a salt water solution being gargled and then spat into a cup to collect cheek cells.

In NSW government schools, science experiments using human blood, blood products, and

human tissue, e.g. cheek cells must not be conducted. Further information is available from the NSW Department of Education's Chemical Safety in Schools Package (CSIS) online (DoE intranet) to all staff in all government schools in NSW.•Go to Section 3.2.6 for the Safe use of biological materials/organisms/tissues.

Other sectors/states/territories may have different policies, such as being subject to a risk assessment. However human tissue and body fluids have the potential to transmit infectious diseases. See our previous Q&A on Using body fluids in science for more details on this topic.

Science ASSIST•does not recommend the use of human tissue or body fluids in school science practical classes due to the risk of disease transmission.

References

'Using body fluids in science', Science ASSIST Q&A, Science ASSIST website, https://assist.asta.edu.au/question/3273/using-body-fluids-science (22 October 2015)

NSW Department of Education and Communities '**Chemical Safety in Schools (CSIS)**' resource package. NSW DoE website•https://education.nsw.gov.au/ •DoE Intranet, login required.

DNA Extraction

Submitted by on 09 September 2020

Not during COVID. We can't even have food stalls till it's over.

Effective enzymes pH

Posted by Anonymous on Fri, 2016-03-18 12:31

Effective enzymes pH: Could I have some info on how I do the ph for the jelly for the pineapple prac please Exploring Human Biological Science Stage 2 Body Works Activity 27 Page 176. I have been asked to make a 3, 5 and 7 and 2 basics.

Voting:
Cancel rating
No votes yet
Rate
Year Level:
7
8
9
10
Senior Secondary
Laboratory Technicians:
Laboratory Technicians

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Effective Enzymes PH

Submitted by sat on 20 April 2016

In brief

Using pineapple in a jelly is a good way to observe the effects of an enzyme on the setting of a jelly.

Enzyme activity is dependent on variables such as temperature and pH. Enzymes are generally effective within a small pH range, depending on the specific enzyme. Altering the pH to be outside the working range of an enzyme can lead to changes in the intermolecular bonds, shape and effectiveness of the enzyme[1].

Commercial jelly is made of gelatine, water, sugar and food colouring[2]. Gelatine is produced from the protein collagen, which is the principal constituent of connective tissues and bones in vertebrate animals[3], and is the key component for allowing jelly to set. Jelly will firm and set when prepared following the instructions on the package. The addition of an acid or a base to the jelly during preparation may alter its ability to set.

Fresh, uncooked pineapple contains Bromelain, a proteolytic enzyme which breaks down gelatine destroying its gelling ability. However, tinned pineapple will allow the jelly to set, as the Bromelain is denatured due to the heat used in the canning process. Bromelain activity is optimal at pH 5.5 to 8[4].

Altering the pH of a jelly can have an effect on any enzymes present, as well as the ability of the jelly to set, so it is important to consider this in the design of an activity. The following suggested method treats the pineapple prior to use.

Method for investigating the effect of pH on setting of gelatine

The following method is adapted from Beware the Biology[5]. A site-specific risk assessment should be undertaken before proceeding with this activity.

Equipment:

- 10 disposal plastic cups
- 1M hydrochloric acid
- 1M sodium hydroxide
- Gelatine made up as per package for 100mL
- Fresh pineapple juice
- pH strips (0–14)
- water

Method:

- Prepare fresh pineapple juice by running pineapple through a juice extractor or slice and squeeze by hand
- Label 5 cups for pineapple juice pH3J, pH5J, pH7J, pH9J, pH11J
- Label 5 cups for control pH3C, pH5C, pH7C, pH9C, pH11C
- Place 3 mL fresh pineapple juice in each cup labelled ‘J’
- Adjust the pH accordingly with 1M hydrochloric acid or 1M sodium hydroxide. Check the pH with a pH strip.
- Place 3 mL water in each cup labelled ‘C’
- Adjust the pH accordingly with 1M hydrochloric acid or 1M sodium hydroxide. Check the pH with a pH strip.
- Pour 10 mL gelatine into each cup. Mix thoroughly

- Leave for 30-60 minutes before checking the setting of each cup

The addition of 1M hydrochloric acid or 1M sodium hydroxide will alter the pH of the pineapple juice. Students should see the gelatine NOT set within the optimal range of pH 5.5-8.0 for the Bromelain enzyme•when fresh pineapple juice is used because the enzyme is active for those samples.

To prepare acid and base solutions, see Science ASSIST SOP Diluting concentrated hydrochloric acid and Preparing sodium hydroxide solutions.

Additional information

Setting of agar plates provides an explanation of the chemistry on pH and the setting of agar plates.

Enzyme preparation experiments gives further information on the handling of enzymes.

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[1] 'Enzymes', Chemistry for Royal Society of Chemistry website, https://www.rsb.org.uk/education/teaching-resources/secondary-schools/chemistry-for-biologists (Accessed March 2016)

[2] 'What exactly is Jell-O made from?' *How Stuff Works* website, https://recipes.howstuffworks.com/j-ello.htm (Accessed March 2016)

[3] Gelatin Manufacturers Institute of America. 2012, *Gelatin Handbook*, can be downloaded from the GMIA website,•http://www.gelatin-gmia.com/technical-data.html•(Updated May 2019)

[4] 'Pineapple enzyme –Bromelain', Curenature.com website, http://www.curenature.com/2013/05/pineapple-enzyme-bromelain.html (Accessed April 2016)

[5] 'The Effects of pH on the enzyme Bromelain' *Beware the Biology* blog http://bewarethebiology.blogspot.com.au/2014/02/the-effects-of-ph-on-enzyme-bromelain.html • (Accessed April 2016)

Eye Dissection

Posted by Anonymous on Wed, 2016-08-03 12:01

Eye Dissection: In the SOP for eye dissections I noticed that scalpels are included in your equipment list. Could you please rethink this as an option.

The previous Head of department here banned scalpels for eye dissection as a WHS issue. Unless specifically requested by teacher, we only issue scissors, probe and forceps. I have asked this question of other laboratory personnel from a variety of schools and so far all have responded saying they do NOT use scalpels for eye dissectins.It IS hard to cut through the hard exterior, but scissors do manage it in a safer manner. We also only issue scalpels for ANY dissection if a teacher specifically requests them.

When students use scalpels to cut into the eyeball, they can 'stab' into it and then the contents of the eye are squirted out. We have had occasions where the contents have sprayed onto students chest area. If it sprayed onto their faces, then the contents could enter their nose, mouth and up under safety glasses and into their eyes.

The outer layer of the eye is tough to cut and it is very easy for a scalpel to slide off the slippery tissue and cut into a hand - the students own hand or the students assisting. Many students hold the eye ball in their hands while cutting, which makes them very vulnerable to a stab/cut injury from the scalpel. This practice of holding the eye in their hand is something we inform students to NOT do, but there are always one or two who think it is easy to do so.

If required I have prepared the eyes ahead of time by using a scalpel and making a slit into the eye so that students can then use the scissors to cut around it.

Voting:•

Cancel rating

No votes yet

Rate

Laboratory Technicians:•

Laboratory Technicians

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Eye Dissection

Submitted by sat on 15 August 2016

In Brief

School science dissections can be educationally sound and highly motivating activities when done with respect and safely organised. Appropriate Standard Operating Procedures and safety guidelines must be in place and observed at all times. A site specific risk assessment should be carried out prior to the dissection and the use of scalpels or scissors be based upon the results of this assessment. Consideration should be given to the experience of the teacher, technician and age and ability of students involved.

We can fully appreciate your safety concerns regarding the use of scalpels for eye dissections. However similar hazards are also encountered when using scissors. Scissors should have pointy ends to enable a clean entry point to be made. The scissors could slip just as easily as a scalpel and stab or cut the user.

It is important that the eyeball should never be held in the hand to dissect. The cornea and the sclera of the eyeball are tough and extra care is required when trying to cut into them. There is the chance of the vitreous and aqueous humour squirting out when using either scissors or scalpels. Therefore aprons, safety glasses or goggles should always be worn in case there is a sudden spurt of this fluid when an eyeball is being opened up. The teacher and/or laboratory technician could use a scalpel to make the initial slit in the eyes for students, who are then able to continue the dissection using scissors, which then removes the need for the students to handle scalpels.

In response to your feedback we have updated the information for the SOP. Click on this link to access the updated SOP: Performing an eye dissection

Additional information:

Safe use of dissection instruments

Before a dissection it is recommended the teacher or laboratory technician trial the dissecting instruments (scalpels, scissors and pointed forceps) to establish that they are sufficiently sharp enough.

It is very important that the teacher clearly demonstrates to students the correct dissection procedure and how to use dissection instruments safely:

- The dissection should take place on a surface that will absorb any impact with the

dissection instruments such as a wooden dissection board, foam or wax tray

- Hold the instruments so that any sharp points or exposed sharp edges point down into the dissection board or tray. If there is any slippage when using the instrument, the point/exposed edge will be absorbed by the board/foam or wax tray.
- To reduce the possibility of stab wounds or cuts from slippage always point sharp pointed instruments or edges away from yourself
- Scalpels should be provided in and returned to a lined container, blade end down.
- All dissecting equipment (scalpels, scissors, forceps, probes and dissecting needles) should always be counted out and in.

Student safety rules for dissection:

- Properly mount dissection material or specimen onto the dissecting board or tray.
- The specimen should never be held in the hand to dissect.
- Handle scalpels with extreme care and always cut away from your body and away from others.
- Scalpels must always remain on the top of the laboratory benches and are not to be removed from the bench area i.e. no walking around with them.

The following links provide additional general information for dissections:

‘Dissection safety tips’, Flinn Scientific website. https://www.flinnsci.com/dissection-safety2/dc10490/ (Link Updated November 2021)

‘Dissection Safety Policy and Procedures’ Flinn Scientific website. https://www.flinnsci.com/media/948812/sf10490.pdf (2013)

Roy, K. 2007. ‘Dissection: Don’t Cut Out Safety’, NSTA website, https://my.nsta.org/resource/3510 (Link updated January 2021, subscription now required)

References

CLEAPSS. 2014. *G268 Dissection: a guide to safe practice*. Uxbridge UK.

‘Dissection safety tips’, Flinn Scientific website. https://www.flinnsci.com/dissection-safety2/dc10490/

(Link Updated November 2021)

‘Dissection Safety Policy and Procedures’ Flinn Scientific website, https://www.flinnsci.com/globalassets/flinn-scientific/all-free-pdfs/dc1... (Updated December, 2016)

Food tests: glucose, starch and gelatine solutions

Posted by Anonymous on Fri, 2018-08-03 08:29

Food tests: glucose, starch and gelatine solutions: I have to make up solutions for a prac where students are working out if select foods are a protein, carbohydrate or sugar. I have a couple of questions. I have made a 1% glucose mix, will that be enough or does it have to be stronger? Also can someone give me a good recipe for making up a starch solution? Again not sure how concentrated it needs to be?

Voting:•

Give Food tests: glucos starch and gelatine solutions 5/5

Average: 5 (1 vote)

Rate

Laboratory Technicians:•

Laboratory Technicians

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Food tests: glucose, starch and gelatine solutions

Submitted by sat on 03 August 2018

Food testing is routinely carried out in senior biology classes. Students test a variety of food samples for carbohydrates, such as sugar and starch; lipids; proteins and vitamin C. •In response to this question we have developed an information sheet. See Laboratory Notes: Food Tests

Food tests: glucose, starch and gelatine solutions

Submitted by sue misselbrook on 14 August 2018

Positive Test Results for Test 1: Glucose When you add Bendeict's solution, the solution turns blue. As it heats the colour changes from Blue Green Yellow Tomato Red at the end NOTE: When starch is heated it also breaks down to a simple sugar and so shows a positive result. Test 2: Fat/Oils When the oil has been rubbed into the brown paper, if you hold it up to the light it should be translucent. Test 3: Starch After the Iodine - I2/KI has been added the starch solution should be coloured anywhere from purple through to black. Test 4: Protein No colour change should occur when the sodium hydroxide –NaOH is added. After the copper sulfate – CuSO4 is added it should change from light blue to dark blue to purple. Foods: To avoid contamination make sure the students cut each piece of food up in a different area on the cutting board. Also make sure they wash the knife after each food. Preparations of Solutions: Keep in fridge until required for use. Then return when finished. Glucose: Dissolve 1 teaspoon of glucose in 200ml of water. (Do not use sugar) Protein: Dissolve ¼ teaspoon of gelatine in 200ml of water. Heat to nearly boiling to dissolve. Starch: Dissolve 1 teaspoon of powdered starch in 200ml of water. Heat to boiling to dissolve. If you do not heat, the solution will remain cloudy. Egg White: Use raw. Beat egg white with 100ml water. Store in small dropping bottles.

Forensic entomology

Posted by Anonymous on Tue, 2015-03-17 07:05

Forensic entomology: Are Grade 9 forensic elective students alllowed to do the following? Leave a whole raw chicken outside in the sun for 1/2 hour, then bury it, dig it up after 1 week and look for larvae. What PPE is required?

Voting:•
Cancel rating
No votes yet
Rate

Australian Curriculum:•
Ecosystems consist of communities of interdependent organisms and abiotic components of the environment; matter and energy flow through these systems

Year Level:•
9

Laboratory Technicians:•
Laboratory Technicians

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forensic entomology

Submitted by sat on 08 April 2015

Science ASSIST recommends a risk assessment be conducted prior to the use of all biological materials, and all appropriate control measures be identified and implemented. Science ASSIST has developed a one-page risk assessment template, see Risk Assessment Template. Where the risks are too high, elimination of the activity or substitution of a safer activity is recommended.

Science ASSIST considers this a high-risk activity and advises against its implementation in school science laboratories. The requirements of appropriate facilities and biosafety training and experience in order to deal with anything dead or decaying, puts this activity beyond the scope of most, if not all, schools.

Instead, we suggest that you consider an alternative activity to demonstrate the decomposition process. One idea is to suggest that the students perform a risk assessment on the proposed activity to identify the hazards, evaluate the risks and determine ways to eliminate or control the risks.

The following is a link to a University of Western Australia web page that contains information and alternative activities for teachers and students on Forensic Entomology using pictures, dichotomous keys and board games:•http://www.clt.uwa.edu.au/asistm/forensic/entomology

We are also including some additional background information and useful links to the decomposition process at the end of the information below.

Biohazards

- The primary hazards of concern in fresh raw poultry meat are salmonella and campylobacter spp. They are both the cause of many cases of food poisoning even in low numbers [1, 2]. See http://www.foodstandards.gov.au/publications/documents/complete_safefood... In particular chapter 3 pages 37-41, section on potentially hazardous food.
- Salmonella species, campylobacter species and many soil microorganisms such as clostridium and some bacillus species are classified as Risk Group 2.
- By incubating the raw chicken in the sun for 30 minutes, followed by burial in the ground, you are providing good conditions for the growth of microorganisms whose presence, concentration and pathogenicity is unknown. These microorganisms can include: those that occur naturally, but in low numbers, on the fresh raw material; bacteria; and other pathogens involved in the decomposing process as well as microorganisms from the soil, all of which can cause infection and disease.
- Burial also provides an anaerobic environment (i.e., without air), which encourages the growth of some very hazardous bacteria. •In addition, there is a risk that the buried carcass may be dug up by local wildlife.
- Whilst there are some maggots that live underground, there is no guarantee regarding this. It has been suggested to leave the carcass on the surface, but the unpleasant odour from the decomposing carcass would be overwhelming and may also attract animals such as rats or local wildlife. Students generally do not cope well with the smell of appropriately sourced biological materials for dissections.
- It is recommended that microbiological material for use by students in school laboratories should not be taken from unknown origins or uncontrolled environments, which are likely to pose a health risk. All biological materials should be treated as if contaminated and potentially hazardous to health, and with standard precautions.

- For further information see•https://education.qld.gov.au/curriculum/stages-of-schooling/CARA/activity-guidelines/biological-activities•(link updated April 2020).•We also suggest reading the infection control guidelines developed by Sydney University: INFECTION CONTROL PROCEDURES - University of Sydney

Facilities

- Infectious microorganisms could be released in the form of aerosols when manipulating the decomposed carcass while extracting larvae from the decomposing carcass for examination in the laboratory. This would need to be done using strict aseptic techniques in a controlled environment and appropriate PPE, such as safety glasses, latex/nitrile gloves, laboratory coat, closed-in shoes and potentially a mask, to avoid any contact with microorganisms involved in the decaying process.
- School science laboratories are generally classified as Physical Containment level 1 (PC1), if•they conform to the requirements specified in Section 5 of AS/NZS 2243.3:2010 Safety in Laboratories –Microbiological safety and containment.•Some science laboratories may not even fit this criteria. If they do conform to these requirements, then they are only suitable for work with microorganisms where the hazard levels are low, and where laboratory or facility personnel can be adequately protected by standard laboratory practice. Microorganisms that are classified as Risk Group 1 are the only ones that should be used in PC1 laboratories.
- Higher levels of physical containment are required for handling fresh human tissues or body fluids and microorganisms of Risk Groups 2-4 [3].
- Schools would require a classification of PC2 to safely handle microorganisms from Risk Group 2 and therefore do not have the correct facilities to deal with the microorganisms that could be present in this activity.

Training

- The National Hazard Exposure Worker Surveillance: Exposure to Biological Hazards and the Provision of Controls against Biological Hazards in Australian Workplaces report states:
    - *"The levels of training in the safe handling of biological hazards need improvement, particularly where workers are exposed to animals or animal products."* [4] p3
    - •"*Poor understanding of biological hazards leads to poor risk assessments in workplaces."* [4]*p21*
- Staff should have specific training in biohazards and possess suitable microbiological knowledge and training to deal with the potential hazards associated with anything dead or decaying.

Background information on forensic entomology

Forensic entomology is the study of the presence and life cycles of insects that colonise a decomposing body to estimate the time of death, often aiding criminal investigations.

Decomposition of a body begins with the action of microorganisms such as bacteria and fungi followed by the action of a series of insects. Decomposition is affected by the following factors.

1. The environmental conditions such as temperature, exposure to sunlight, humidity and oxygen levels.
2. Where the specimen is located (e.g. in water, enclosed space, buried, soil type and vegetation in the area).
3. The state of the body (e.g. size, weight, cause of death, if burnt, if clothed).
4. The presence of scavengers and insects, in particular, flies.

Weather conditions will affect how slowly or quickly a body decomposes. In general, the warmer the temperature, the faster the rate of decomposition. Temperature is also the most important factor affecting the rate of insect development.

The following links provide good information on various aspects of the decomposition process:

http://australianmuseum.net.au/movie/stages-of-decomposition

http://australianmuseum.net.au/decomposition-fly-life-cycles

https://en.wikipedia.org/wiki/Microbiology_of_decomposition

http://www.ento.csiro.au/biology/fly/fly.php

http://www.clt.uwa.edu.au/__data/assets/pdf_file/0014/2301611/fse06_magg...

References

Australia New Zealand Food Authority. 2001. *Safe Food Australia A guide to the Food Safety Standards.* 2nd Edition. Canberra, ACT.
http://www.foodstandards.gov.au/publications/documents/complete_safefood.pdf

Queensland Department of Education, Training and Employment.• *Biological Activities*.• https://education.qld.gov.au/curriculum/stages-of-schooling/CARA/activity-guidelines/biological-activities•(link updated April 2020)

Forbes, Shari Professor. School of Chemistry and Forensic Science, University of Technology, Sydney, New South Wales. Personal communication. March 2015.

Lewis, Simon Professor of Forensic and Analytical Chemistry, Director of Teaching and Learning, Department of Chemistry, Faculty of Science and Engineering, Curtin University, Perth, Western Australia. Personal communication. March 2015.

Safe Work Australia. 2011. National Hazard Exposure Worker Surveillance: Exposure to Biological Hazards and the Provision of Controls against Biological Hazards in Australian Workplaces.

Standards Australia. 2010. AS NZS 2243.3-2010. Safety in Laboratories –Microbiological safety and containment

Wallman, James Associate Professor Faculty of Science, Medicine and Health and School of Biological Sciences, University of Wollongong, New South Wales. Personal communication. March 2015.

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[1] Australia New Zealand Food Authority. 2001. *Safe Food Australia A guide to the Food Safety Standards*. 2nd Edition. Canberra, ACT. http://foodsafety.ood.telligence.net.au/food-poisoning-bacteria-and-viru... (last accessed 29 June 2016).

[2] Australian Government Department of Health, *Food poisoning and contamination* Department of Health website, http://www.health.gov.au/internet/publications/publishing.nsf/Content/oh... (November 2010) ••

[3] Australian Standards AS NZS 2243.3-2010. *Safety in Laboratories –Microbiological safety and containment*

[4] Safe Work Australia *National Hazard Exposure Worker Surveillance: Exposure to Biological Hazards and the Provision of Controls against Biological Hazards in Australian Workplaces*. March 2011 http://www.safeworkaustralia.gov.au/sites/SWA/about/Publications/Documen... •

Source URL: https://assist.asta.edu.au/question/2710/forensic-entomology

Method for testing pH and catalase in liver for Yr 12 biology

Posted by Anonymous on Wed, 2019-02-13 13:23

Method for testing pH and catalase in liver for Yr 12 biology: I am looking for materials and method for a practical that tests pH and catalase in liver for year 12 biology.

The idea is to use detergent to measure foam levels, buffer solutions and universal indicator with chopped up liver using a range of pH. (optimal level is 7). Do you have anything, or can you make a list that I could give to our lab technician?

Voting:•
Cancel rating
No votes yet
Rate
Year Level:•
Senior Secondary
Laboratory Technicians:•
Laboratory Technicians

Showing 1-2 of 2 Responses

Answer by labsupport on question pH and enzymes (catalase in liver)

Submitted by sat on 13 February 2019

The Biology Corner website has an investigation on enzymes (https://www.biologycorner.com/worksheets/enzyme_lab.html) that is well set out and may be suitable for your needs. It does not include the use of detergent; however, you could add

universal indicator and some detergent to Part D to achieve the outcome you are looking for. As with all new activities, it is recommended that you and/or your technician trial the activity to ensure that it suits your purposes and is workable.

A few other links that may be helpful are listed below:

‘Factors affecting enzyme activity’, Nuffield Foundation website, http://www.nuffieldfoundation.org/practical-biology/factors-affecting-en... (Accessed February 2019) (some examples of a range of different enzymes and activities)

'Liver Stinks!’, Science Buddies website, https://www.sciencebuddies.org/science-fair-projects/project-ideas/BioCh... (28 July 2017) (an activity testing under different conditions without test tubes)

‘Practical Enzyme Experiments Anyone Can Do’, Practical Biology: science for everyone website, http://practicalbio.blogspot.com/2012/11/easy-enzyme-experiments-anyone-... (November 2012) (a blog on enzymes including 2 activities using the catalase enzyme)

‘The Effect of Hydrogen Peroxide on Liver: Hypothesis, Apparatus, Method’, Schoolworkhelper website, https://schoolworkhelper.net/the-effect-of-hydrogen-peroxide-on-liver-hy... (2017) (some general information)

‘The Liver: Helping Enzymes Help You!’, Scientific American website, https://www.scientificamerican.com/article/bring-science-home-liver-help... (8 March 2012) (an activity testing under different conditions without test tubes)

Method for testing pH and catalase in liver for Yr 12 biology

Submitted by Jo Faye on 19 February 2019

Rather than using liver, consider using grated potato. Method: place 2g of freshly grated potato into a25 or 50ml measuring cylinder. Add 2-5ml of water or buffer depending on your variable. Add a drop or two of detergent and Mix . Add 1ml 3% hydrogen peroxide. Read the height of the foam column after a set time. potato is much nicer to clean up than liver especially if temperature is your variable.

Mitosis in onion root tip

Posted by Anonymous on Thu, 2017-08-10 09:33

Mitosis in onion root tip: Are there alternative stains for mitosis in root tips please? It needs to be inexpensive (I've been quoted $150 for 5 gm orcein, including postage), not too hazardous, easy to prepare, and the method of staining not too time consuming.

Voting:•
Cancel rating
No votes yet
Rate
Year Level:•
7
8
9
10
Senior Secondary
Laboratory Technicians:•
Laboratory Technicians

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Mitosis in onion root tip

Submitted by sat on 01 September 2017

Aceto-orcein stain is an effective procedure for the visualisation of mitosis in root tips of onions or garlic. Orcein can be purchased in solid form, the solution is prepared with acetic acid. A full method for stain preparation and procedure can be found at Mitosis in Growing Root Tips[1].

Alternatively, Aceto-orcein can be purchased as a 1% solution to be used undiluted[2]. Each student group requires one drop of stain, so the prepared stain is cost effective. The cost of the stain and delivery charges vary between suppliers, and is moderately priced. Refer to our School science suppliers list for suppliers of biological chemicals. Aceto-orcein solution is suitable for laboratory use for students in Years 11 and 12[3].

Alternative stains: The following stains will also show mitosis in root tips. The cost of these stains is similar to Orcein. Methylene Blue and Toluidine Blue stains are relatively quick to prepare, and staining procedures are similar in each.

1. Toluidine blue: http://www.gtac.edu.au/wp-content/uploads/2016/01/Mitosis_Roottips_LabPr...
2. Methylene blue: https://www.flinnsci.com/making-mitosis-slides/dc10945/
3. Shiffs Reagent (also known as Feulgen stain[4]): http://w3.marietta.edu/~biol/introlab/Onion%20root%20mitosis.pdf• Whilst the preparation of this reagent is more complicated, this procedure does include a good method for softening the roots, by using a micro-tube placed in a water bath at 60℃.

Science ASSIST recommends you consult the relevant Safety Data Sheet first and our List of recommended chemicals for science in Australian schools to ascertain the suitability of these stains for your staff and students.

References:

[1] 'Mitosis in growing root tips'. Gene Technology Access Centre website. http://www.gtac.edu.au/wp-content/uploads/2016/01/Mitosis_Roottips_LabPr... (accessed August 2017)

[2] 'Aceto-orcein 1% SI1' product description. Southern Biological. https://www.southernbiological.com/chemicals/stains-and-indicators/si1-aceto-orcein-1/•(Link updated July 2019)

[3] Science ASSIST. 2016. List of recommended chemicals for science in Australian schools. https://assist.asta.edu.au/sites/assist.asta.edu.au/files/ListOfRecommen...

[4] Reader S. February 2003. A modified method of preparing Feulgen stain or Shiff's Reagent. https://web.archive.org/web/20130903160922/http://www.jic.ac.uk:80/staff... (The original resource is no longer available on this website, this copy made available by the Internet Archive, December 2018).

Mosquito larvae

Posted by Anonymous on Wed, 2015-12-09 07:21

Mosquite larvae. I'm putting together some activities for Year 2 students and was wondering if we are still able to use mosquito larvae in the classroom? I am hoping to demonstrate how having mosquito larvae in pond water covered by a layer of oil will stop them being able to take in oxygen and so die.

Voting:•

Cancel rating

No votes yet

Rate

Australian Curriculum:•

Living things grow, change and have offspring similar to themselves

Year Level:•

2
3
4
5
6
7
8
9
10
Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Answer by ritasteffe on question Mosquito larvae

Submitted by sat on 09 December 2015

In brief

Keeping live animals in the classroom is an engaging activity for younger students, and encourages them to observe life cycles of different insect species whilst discussing and recording changes in development. The Animals in the classroom resource from the Museum of Victoria also have some interesting activities for preparation for Year 2 and 3 classrooms.

Animal ethics

You may keep invertebrates (animals without backbones) such as mosquito larvae (wrigglers) in the school classroom without the prior approval of an ethics committee. Refer to the Use of animals in schools section below.

Assessing the risks

Observing mosquito larvae under oil to demonstrate that mosquitoes need oxygen to breathe can be conducted as a classroom activity. However, adequate safety measures should be in place to prevent any mosquito larvae from emerging into the adult mosquito stage and escaping. Because mosquitoes can bite people and cause local irritation or disease, teachers have a duty of care to themselves and others to minimise any harm of being bitten over the duration of this activity.

A layer of oil on top of the water prevents mosquitoes breeding in two ways: larvae in the water cannot penetrate the film of oil with their breathing siphon, and so drown and die; the film of oil also prevents adult mosquitoes from laying eggs in the water.

Science Assist recommends you conduct a site-specific risk assessment prior to any activity to assess and control the risks. We have developed a Risk Assessment template for schools to use, see Risk Assessment Template.

Control measures

Consider implementing the following to minimise risks.

- This activity should be conducted by the teacher only and is strictly observational for Year 2 students.
- Conduct the experiment before the larvae turn into adult mosquitoes. Depending on temperature conditions, they can mature from egg to larvae to pupa within 5–14 days. Refer to Mosquitoes and their life cycle below.
- Choose a small, clear fish tank or clear plastic container or jar and cover it with a securely fitting mesh, gauze or nylon stocking. In the event of any mosquitoes hatching, this should prevent any from escaping into the classroom.
- An oil depth of 5mm should be adequate to stop the mosquitoes penetrating it with their breathing tube.

- Vegetable oil is okay to use but may become rancid over time. An alternative is paraffin oil.
- Make sure the system set up for this activity is tamper proof and kept in an area where it is secure and can be well supervised.
- Before disposal, make sure all mosquito larvae are dead. DO NOT, release live larvae into the environment.
- Absorb the oil on to paper towel before disposal into the regular waste. Pour the remaining water onto the garden.

Additional Information

Use of animals in schools

Animal ethics committee approval is required when certain animals are used in schools for scientific purposes, teaching activities or classroom observation.

Ethics committee approval, as specified in the Animal Welfare Act, is required when research is being conducted on live non-human vertebrate animals and cephalopods. This includes any activity that removes an animal from its normal environment, such as examining blood flow in fish or tadpole tails under a microscope. To be granted a licence, the school must agree to comply by the approved research Code of Practice. The animal research decision guide can be found on the ***NHMRC Australian Code*** *for the Care and use of animals for scientific purposes.*

Mosquitoes and their life cycle

You can collect mosquito eggs (oval-shaped, brown egg rafts) or larvae from ponds or standing water such as: water tanks, old tires, driveway puddles, unfiltered fish ponds, empty flowerpots, and any item that can hold water for more than a few days at a time. Alternatively, some pet stores or aquarium suppliers may cultivate or keep mosquito larvae as a food supply for their fish stocks.

Mosquitoes are small midge-like flies which belong to the family Culicidae (scientific name for the mosquito family).

Their lifecycle has 4 stages egg, larvae, pupa and adult. The larval stage is the most active aquatic form of the mosquito. Mosquito larvae are small worm-like creatures covered in tiny hair-like spines that assist the larvae to float in water. The ability to float is important, because mosquito larvae require air to survive. They have developed a specialized structure called a breathing siphon to allow them to take in air. See the link Mosquito lifecycle for more information.

Public health focus

Sensitivity to mosquito bites varies, with most people having only a mild reaction. However, some people develop severe symptoms from the saliva of mosquitoes, including: swelling, redness and irritation at the site of the sting or puncture. If the bites are scratched, they may become infected with bacteria and a secondary infection may occur.

Mosquitoes are vectors or transmitters of infectious disease. Mosquito-borne diseases in Australia include Dengue fever, Australian encephalitis (AE), Ross River (RR) virus disease, Barmah Forest virus disease and, in recent times, Malaria.

Dengue fever is restricted to Queensland where the major vector *Aedes aegypti* occurs. Cases of AE occur sporadically in northern Australia and in the northwest of WA.

Ross River disease is the most commonly reported mosquito disease to humans and occurs in all states of Australia. The diagnosis of mosquito-borne diseases including Dengue, Australian encephalitis, Ross River ,Barmah Forest viruses and Malaria can only be confirmed with appropriate blood tests.'[2]

See the link Australian Government Department of Health for mosquito control information.

References

[1,2] 'Mosquitoes', NSW Arbovirus Surveillance and Mosquito Monitoring Program, Department of Medical Entomology, University of Sydney website https://medent.usyd.edu.au/arbovirus/mosquit/mosqfact.htm (Accessed November 2015)

'Mosquito', Wikipedia website, https://en.m.wikipedia.org/wiki/Mosquito#Lifecycle (Accessed November 2015)

'Preventing mosquito breeding', The Australian Government Department of Health website. http://www.health.gov.au/internet/publications/publishing.nsf/Content/ohp-enhealth-raintank-cnt-l~ohp-enhealth-raintank-cnt-l-5~ohp-enhealth-raintank-cnt-l-5.5 (March 2011)

Museum Victoria, *Bug*s, Animals in the classroom. Teacher notes. Museum Victoria website http://museumvictoria.com.au/bugs/pdf/bugsactivities36p1019.pdf (Accessed November 2015)

Piglet Dissection

Posted by Anonymous on Mon, 2016-06-20 09:27

Piglet Dissection: One of our Human Biology Teachers have requested a piglet dissection prac.

Are we able to perform piglet dissections in Secondary Schools ?

Voting:•
Cancel rating
No votes yet
Rate
Year Level:•
Senior Secondary
Laboratory Technicians:•
Laboratory Technicians

Showing 1-1 of 1 Responses

Piglet Dissection

Submitted by sat on 15 July 2016

In brief:

Jurisdictional legislation and policies: It is essential to consult your school or school sector to determine the policies and procedures they require you to follow regarding dissections. When considering dissections in schools, there are two main areas for consideration: the ethical and safety concerns.

Ethical Considerations:

There are different ethical viewpoints concerning the use of animals for dissections in schools. In Australia, THE NHMRC have published an Australian code for the care and use of animals for scientific purposes 8th edition (2013) see https://www.nhmrc.gov.au/about-us/publications/australian-code-care-and-use-animals-scientific-purposes/australian-code-care-and-use-animals-scientific-purposes-code . Each state and territory has its own additional legislative requirements as well. It is a decision for either the school or school sector to make the ethical decision regarding whether they will permit the dissection of animals. In most jurisdictions there are requirements for reporting to an animal ethics committee and sometimes permission is required before arranging to conduct a dissection.

Safety Considerations:

For the safety of staff and students, it is essential that all materials used for dissections are free from disease. Therefore dissection materials should either be sourced from suppliers that supply for human consumption, such as from a butcher, supermarket or abattoir or from prepared specimens from biological suppliers. See our list of School science suppliers for companies that supply biological specimens for dissection.

Additional information:

Science ASSIST has prepared a number of SOPs regarding dissections. I draw your attention to the SOP - Performing a rat dissection, where in the introduction we address both these aspects:

“Prior to conducting a rat dissection, teachers should ensure that they are able to meet the requirements of the Schools Animal Ethics Committee (SAEC) in their jurisdiction. It is recommended that they consider the educational objectives for this activity, explore the ethical considerations with students and aim to reduce the total number of rats required for this activity. Students should not be forced to participate in a dissection and alternative activities such as videos and virtual dissections can be used for these students instead, as well as to supplement the actual activity.

Rats that have been humanely euthanised and are disease (or infection) free should be sourced from ethical and licenced suppliers. They can be supplied as freshly euthanised, frozen or preserved specimens.”

With above considerations in mind, we provide the following links for some further reading:

Australian references with state/territory based links:

- National Health and Medical Research Council. 2013. *Australian code for the care and use of animals for scientific purposes 8th edition*, 8th edition. National Health and Medical Research Council: Canberra, NHMRC website, https://www.nhmrc.gov.au/about-us/publications/australian-code-care-and-use-animals-scientific-purposes/australian-code-care-and-use-animals-scientific-purposes-code
- **ACT:** ACT Government, Department of Education and Training. 2009. *Care and use of animals in ACT schools*

, CUAAS200906, ACT DET website, http://www.det.act.gov.au/__data/assets/pdf_file/0003/65640/Care_and_Use...

- **NSW:** 'Animals in schools', Animals in schools website http://nswschoolanimals.com/ (Accessed July 2016). In particular see http://nswschoolanimals.com/index/dissection-of-animals/
- **NT:** Northern Territory Department of Education. 2013. *Animals in schools policy*, NT DET website, https://education.nt.gov.au/__data/assets/pdf_file/0016/436003/ANIMALS-I... **in particular see page 1: Dissection of animals in schools in prohibited. (Updated July, 2017).**
- **Qld:** 'Queensland Schools Animal Ethics Committee', Qld Government Education website, https://education.qld.gov.au/curriculum/stages-of-schooling/animals-in-education/QSAEC•(link Updated April 2020)
- **SA:** 'Animal ethics', Association of Independent Schools of SA website, https://web.archive.org/web/20180313071911/http://www.ais.sa.edu.au/home... (Internet Archive Version, April 2018)
- **SA:** Government of SA, Department of Education and Children's Services, 2010. *Dissection of animals in schools*, AIS website, https://web.archive.org/web/20180319143254/http://www.ais.sa.edu.au/__fi... (Internet Archive Version, April 2018)
- **Tasmania:** 'Animal Ethics Committee', Department of Primary Industries, Parks, Water and Environment (Tasmania) website, http://dpipwe.tas.gov.au/animal-ethics-committee (June 2016)
- **Vic:** 'Animals in Schools', Victorian State Government Education and Training website, http://www.education.vic.gov.au/school/principals/spag/curriculum/Pages/animals.aspx (September 2014)
- **WA:** 'Animal Ethics –Complying with the Australian code of practice for the care and use of animals for scientific purposes', WA Department of Education website, http://det.wa.edu.au/curriculumsupport/animalethics/detcms/portal/ (Accessed July 2016)

Additional references (USA, Canada)

- **USA:** National Science Teachers Association. 2008. *NSTA Position Statement Responsible Use of Live Animals and Dissection in the Science Classroom*, NSTA website, https://static.nsta.org/pdfs/PositionStatement_LiveAnimalsAndDissection.pdf
- **USA:** National Association of Biology Teachers**.** 2008. *NABT Position Statement The Use of Animals in Biology Education*' The National Association of Biology Teachers website,
- http://www.nabt.org/Position-Statements-The-Use-of-Animals-in-Biology-Ed... (Updated May 2017)
- **Canada:** Oakley, J. 2012. Science teachers and the dissection debate: Perspectives on animal dissection and alternatives. *International Journal of Environmental & Science Education* 7: 253-267. Institute of Education Services website, https://files.eric.ed.gov/fulltext/EJ990519.pdf

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Plankton

Posted by Anonymous on Wed, 2016-06-08 13:00

Plankton: We catch live plankton weekly and would like to preserve the specimens. We would like to collect a long term sequence we can use as a data set>

Voting:•
Cancel rating
No votes yet
Rate
Year Level:•
7
8
9
10
Senior Secondary
Laboratory Technicians:•
Laboratory Technicians

Showing 1-1 of 1 Responses

Plankton

Submitted by sat on 12 July 2016

In Brief

Plankton collection samples are usually fixed and preserved before they are analysed for estimation of biomass, enumeration (counting) and identification of plankton genus/species. Data obtained is used for estimation of faunal and species biodiversity of the study area or ecosystem.

Science ASSIST recommends 70% alcohol for use in schools for the preservation of plankton. Under these conditions, without prior fixation with formaldehyde, it should be noted that the shelf life of the specimens will be expected to be in the order of 1-2 years. **Science ASSIST does not recommend formaldehyde for use in schools.**

Ethanol[1] (Ethyl alcohol) usually comes in the 95% concentrated form. It is also a suitable preservative and method of choice for long-term preservation and storage for most plankton. It is usually diluted with distilled water to 70-75% strength. This is the lowest concentration at which preservation will be maintained. Samples will become a bit brittle in alcohol, a lot of the pigment will be extracted and there are evaporation issues. Some reports state that the addition of 1% glycerol aids in maintaining some flexibility of the samples and helps retard evaporation[2]. Alcohol is highly flammable, usually safe to handle, but can cause irritation to the skin in cases of prolonged contact.

Simple 2 stage method using 70% ethanol for the preservation of plankton in schools[3]

(Note: % v/v is used for concentrations of solutions of liquids and is calculated as [(volume solute)/(volume of final solution)] x 100%. For example, 70% v/v means that 100 mL of solution contains 70 mL of the solute.)

Stage 1: At the collection site add 95% ethanol to the sample of seawater/zooplankton in a ratio of 50:50. You will initially get a white milky colouration of the solution but this will slowly disappear.

This first stage is done fairly quickly after collection as the zooplankton will start to eat each other and begin to rot.

Stage 2: Back in the lab carefully tip off the solution and replace with fresh 70% ethanol solution and store in wide mouthed clear glass jars so students can see the specimens clearly. It is important to use tight fitting lids to prevent evaporation. The use of Parafilm or some silicone sealant can be used to provide a good seal. Note: You need to be careful if using plastic containers. Some become very brittle and craze with the alcohol.

70% alcohol will not overly dehydrate the tissue. Concentrations higher than this are not recommended as they can excessively dehydrate the tissue. At 70%, ethanol is an effective biocide. The preservative should be changed within the first 6 months for better shelf life of samples.

Store under conditions to prevent any deterioration i.e. a cool dry place in low light levels and out of direct sunlight. There are evaporation and flammability issues with the use of alcohol so the specimens should be monitored regularly and topped up as needed and stored in the flammable liquids cabinet[4].

Note: A good activity is to encourage students to look at the zooplankton live as they are very interesting to examine. Many can survive for 24hrs in a bucket if kept in the dark.

Additional information

The chemicals used to fix and preserve specimens can be hazardous. Science ASSIST recommends you refer to the specific SDS for any chemicals being used and conduct a site specific risk assessment to assess and control any risks. You will need to make sure that all chemicals are approved for use in your jurisdiction and educational sector and are disposed of appropriately following local guidelines.

Fixation: should be carried out as soon as possible after collection or narcotising (if required) to avoid damage to tissue by bacterial action and autolysis. The choice of fixative should preserve the tissue against microbial activity, osmotic damage and autolysis. It should also allow the structure of the tissue to remain as close as possible to its original state. Some plankton react to the fixative used by contracting and distorting that can leave them in an unidentifiable state.

Formaldehyde[5] is toxic, carcinogenic, highly irritating and acts as a potent sensitizer. Whilst formaldehyde at a concentration of 4-5% in distilled water is regarded as the best fixative to maintain taxonomic and morphological characters of mixed marine plankton[1], it is toxic by all routes of exposure, has irritating fumes to the eyes, skin and mucous membranes and is a known human carcinogen[6,7]. It is for these reasons that **Science ASSIST does not recommend formaldehyde for use in schools.** See Science ASSIST List of recommended chemicals for science in Australian schools.

Narcotisation: Some specimens require narcotising to relax the specimen allowing them to be fixed without any distortion[8,9]. However, narcotising is not usually done in schools unless you specifically want to do some specialised work on some of the zooplankton sample, e.g. histology.

If narcotising specimens is required samples are concentrated into sample buckets and then transferred to 500 ml plastic sample storage bottles. Samples should be refrigerated as soon as possible after collection,[8,9,10]. The narcotising solution is added drop by drop to the water containing the specimens and left to stand for up to 30 minutes in the refrigerator.

The following narcotising solutions are recommended for use [9,10,11]

- 70% ethyl alcohol –add the alcohol drop by drop to the sample water concentrate
- Carbonated water(soda water) 1:20 by volume –combine 1 part soda water with 19 parts of sample water concentrate
- Clove oil –place tip of pipette with clove oil just under the surface of the sample water concentrate and add 1 to 2 drops at a time
- Magnesium sulphate (Epsom salts) 20-30% aqueous solution –slowly add the solution drop by drop to the sample water concentrate

Labels

Label the container to include collectors name, type of specimen, type and date of preservative and any other field information. Label both inside and outside of the storage container. This will lessen the likelihood of the specimen and label being separated. It is important to use paper intended for long-term preservation in fluids. There are a several papers that will do including laundry tag paper. See Resistall labels and specimen tags: https://www.universityproducts.com/cart.php?m=product_list&c=241. Soft lead pencil can be used to write on the paper and there are certain inks or ink pens that can be used as well. Any inks used should be of archival quality, resistant to fading and smearing, and be insoluble in the preservative solution. Suitable inks and ink pens can be found in some art or office supply stores and museum supply companies. It is recommended to allow the ink to completely dry before placing the label into the storage solution. Ordinary ballpoint pens should not be used for labelling as they generally dissolve in most preservative solutions. See the Science ASSIST School science suppliers list for local museum supply companies for similar products.

Plankton

Plankton is a diverse group of small and microscopic organisms (phytoplankton –plants and zooplankton –animals) drifting or floating in the sea or fresh water. Plankton consists mainly of diatoms, protozoans, small crustaceans, and the eggs and larval stages of larger animals[1][2] . Many animals are adapted to feed on plankton, especially by filtering the water. Plankton play a vital role in the marine food chain and an important role in the study of the biodiversity of aquatic ecosystems.

Zooplankton includes a wide range of macro and microscopic invertebrate animals. They feed on phytoplankton and in turn represent an important food source to animals higher up in the food chain including fish. Zooplankton are ubiquitous and are found in any aquatic ecosystem. The majority are microscopic unicellular or multicellular forms ranging in size from a few microns to a millimetre or more.

Phytoplankton are photosynthesizing microscopic organisms that inhabit the upper sunlit layer of almost all oceans and bodies of fresh water. They include self-feeding, single celled algae that live near the water surface where there is sufficient light to support photosynthesis. Among the more important groups are the diatoms, cyanobacteria and dinoflagellates.

Further reading:

Science ASSIST previously answered a similar question see: preserved specimens

The extensive list of references contain much recommended reading on this topic.

References:

[1]'Ethanol', Safety Data Sheet, Chem-Supply website, https://www.chemsupply.com.au/documents/EA0431CH89.pdf (October 2015)

[2]Johnson, W.S. and Allen, D.M. 2005. *Zooplankton of the Atlantic and Gulf Coasts: A Guide to Their Identification and Ecology*. Appendix 3 Relaxing, fixing and preserving zooplankton. JHU Press, 2005. https://books.google.com.au/books?id=mpKKZlbuMvwC&pg=PA308&lpg=PA308&dq=...

(Accessed July 2016)

[3]Personal Communication, Professor Iain Suthers. School of Biological, Earth and Environmental Sciences, University of NSW July 2016

[4]Suthers, Iain M and Rissik, David (Eds.). 2009. *Plankton: A guide to their ecology and monitoring for water quality*. CSIRO Publishing, https://www.uv.es/hegigui/ebooksclub.org__Plankton__A_Guide_to_their_Eco...

[5] 'Formaldehyde', Safety Data Sheet, Chem-Supply website, https://www.chemsupply.com.au/documents/FT0031CH2T.pdf (January 2016)

[6] 'Known and Probable Human Carcinogens', American Cancer Society website, https://www.cancer.org/cancer/cancer-causes/general-info/known-and-probable-human-carcinogens.html (Accessed July 2016)

[7] 'Formaldehyde', IARC Monograph 100F, IARC website, https://monographs.iarc.fr/wp-content/uploads/2018/06/mono100F-29.pdf (Updated July 2018)

[8]Steedman, H.F (Ed.) 1976. *Zooplankton fixation and preservation*, UNESCO Press: Paris, UNESCO website, http://unesdoc.unesco.org/images/0001/000185/018592Eo.pdf

[9]National Institute of Oceanography. 2004. *'Zooplankton Methodology, Collection & Identification –a field manual',* NIO website, https://drs.nio.org/drs/bitstream/handle/2264/95/Zooplankton_Manual.pdf?sequence=1&isAllowed=y

[10]Behringer, Marjorie. 1973. *Techniques and Materials in Biology*, McGraw-Hill, Inc. Library of Congress USA.

[11]Dungey, Barbara. 2006. *The Laboratory: a science reference and preparation manual for schools* (Rev. ed), National Library of Australia: Traralgon, Vic.

[12] 'Plankton', Wikipedia website, https://en.wikipedia.org/wiki/Plankton (Accessed June 2016)

•

Black, A.R. and Dodson, S.I. 2003. 'Ethanol a better preservation technique for Daphnia', *Limnology and Oceanography,: Methods* 2003: 45–50, ASLO website, (The link to this reference has been removed because it is no longer freely available; October 2017).

'DNA barcoding plankton', Department of the Environment Australian Antarctic Division website, https://www.antarctica.gov.au/magazine/issue-29-december-2015/science/dn... (Broken link fixed February 2021)

Johnson, W.S. and Allen, D.M. 2005. *Zooplankton of the Atlantic and Gulf Coasts: A Guide to Their Identification and Ecology. Appendix 3 Relaxing, fixing and preserving zooplankton*. JHU Press, 2005. https://books.google.com.au/books?id=mpKKZlbuMvwC&pg=PA308&lpg=PA308&dq=...

National Institute of Oceanography. 2004. *'Zooplankton Methodology, Collection & Identification –a field manual',*

NIO website, https://drs.nio.org/drs/bitstream/handle/2264/95/Zooplankton_Manual.pdf?sequence=1&isAllowed=y

Richardson AJ, Eriksen RS & Rochester W. 2015. *Plankton 2015: State of Australia's oceans*. CSIRO Report. IMOS website, https://imos.org.au/fileadmin/user_upload/shared/Data_Tools/15-00245_OA_Plankton2015_20ppBrochure_WEB_151116.pdf

'Sampling'. Institute of Food and Agricultural Sciences School of Forest Resources & Conservation Program for Fisheries and Aquatic Sciences, University of Florida website, https://ffgs.ifas.ufl.edu/ (Accessed June 2016)

'Standards in the Care of Wet Collections.' Conservation Centre for Natural History Museum, London website, http://conservation.myspecies.info/node/33 (Accessed June 2016)

Steedman, H.F (Ed.) 1976. *Zooplankton fixation and preservation*, UNESCO Press: Paris, UNESCO website, http://unesdoc.unesco.org/images/0001/000185/018592Eo.pdf

United States Environmental Protection Agency. 2005*. Standard Operating Procedure for Zooplankton Sample Collection and Preservation and Secchi Depth Measurement Field Procedures.*

Wilson. R. 2005. *Marine invertebrate sample processing procedures,* Museum Victoria website, https://researchdata.museum.vic.gov.au/amit/Marine_sample_processing_8Sep2005.pdf

'Zooplankton', Marine Education Society of Australasia website, http://www.mesa.edu.au/atoz/zooplankton.asp (Accessed June 2016)

07/09/2016 Edit: added details of personal communication

Snail Dissections

Posted by Anonymous on Tue, 2016-07-19 17:43

Snail Dissections: Hi I have a teacher that wants to do a snail dissection with 13 year old students. I thought we were not allowed to do them due to the number of parasites that snails can carry. Is this the case? As we have not purchased laboratory breed snails.

Voting:
Cancel rating
No votes yet
Rate
Year Level:
8
Laboratory Technicians:
Laboratory Technicians

Showing 1-1 of 1 Responses

Snail Dissections

Submitted by sat on 29 July 2016

In brief

Jurisdictional legislation and policies: It is essential to consult your school or school sector to determine the policies and procedures they require you to follow regarding dissection. When considering dissections in schools, it is important to take into account the ethical and safety concerns involved.

For the safety of staff and students, it is essential that all materials used for dissections are free from disease and sourced from a supplier of food for human consumption or from a biological supplier. We advise against dissecting road kill or dead animals brought in from the family farm!

Therefore when conducting dissection activities schools should consider using dead whole animals e.g. fish, crustaceans and molluscs that are suitable for human consumption and therefore disease free, which can be purchased readily from food outlets. Alternatively, consider using prepared specimens, which can be purchased from biological supply companies. Small vertebrate and invertebrate animals can also be purchased through authorised biological companies. See our list of School science suppliers for details of appropriate suppliers.

Land snails: The likelihood of common garden snails being infected with parasite larvae is very low and the risk of infection comes from eating the raw snails which could be infected with parasite larvae. However, it is still advisable to exercise caution when handling terrestrial gastropods (land snails) and is essential that after any contact with snails, hands are thoroughly washed.

Science ASSIST recommends that snails required for snail dissections, are sourced from either a food outlet, e.g. a snail farm that supplies restaurants, or a biological supplier.

Additional Information:

Snails:

Snails can harbour parasites[1,2]. There have been a number of reports where **land snails have been eaten** and have infected humans with their parasites and caused serious diseases. For example:

- *Angiostrongylus cantonensis*: It is estimated that 5% of common garden snails in and around Sydney, NSW; contain larvae of the parasite *Angiostrongylus cantonensis*, commonly known as the rat lungworm. It is more widespread in Brisbane and occurs on the coast from far north Queensland down to Jervis Bay, NSW. The snails and slugs (molluscs) are infected when they come into contact with larvae in the rat's faeces. These larvae go through developmental stages in the mollusc, and the cycle is completed when slugs and snails are eaten by rats. It becomes a health problem when the slugs and snails are accidently eaten by dogs, wildlife species and humans[3,4,5].

- *Brachylaima cribbi*: Introduced European land snails are common in southern Australia, and their parasites can infect people who accidentally eat them. The parasitic fluke worm *Brachylaima cribbi* is a small trematode flatworm, up to 6mm long that lives as a parasite in the intestines of mammals, birds, and reptiles. It uses land snails as intermediate hosts. The snails become hosts for the worm when they eat their eggs in animal faeces. These then hatch in their gut to produce 'sporocyst' larvae known as cercariae which pass into the environment through the snail's slime trail and infect other snails. When mammals, birds and reptiles eat the snails, juvenile larvae are released,

going on to develop into mature adult worms in the small intestine. People cannot be infected by the eggs of the worm, only by ingesting the juvenile worms from the snail[6,7].

Therefore raw snails should not be eaten and care should be taken with food preparation to ensure that all vegetables are thoroughly washed prior to consumption to remove any snails, so that they are not accidentally eaten.

Land snails in Australia:

Land snails are molluscs –a type of invertebrate (without a backbone). They belong to the class Gastropoda which possess a well-developed head with mouth, tentacles and eyes. They have a soft body containing reproductive and digestive organs and a large foot with a creeping sole. Most land snails have a developed a pulmonary cavity or lung. They also have a shell that houses and protects the snail's soft body parts.

Most of the native snails are restricted to areas with native vegetation.

Garden Snails are found throughout south eastern Australia. They were introduced to Australia from Europe over 120 years ago, and are now established in urban areas, most commonly found in managed gardens and disturbed areas rather than native bushland.

Snails eat a variety of foods, and so can be called omnivores. Some snails feed on plant material; others are carnivorous eating small invertebrates such as insects and other snails and slugs.

Snails are hermaphrodites (which means, they can fertilise each other).

The following websites have some interesting information regarding the identification, distribution and habitat of land snails in Australia:

Garden Snails, Minibeast Wildlife https://www.minibeastwildlife.com.au/resources/garden-snails/

Snail dissections:

The following websites have detailed information regarding terrestrial snail dissections, a YouTube video and basic snail anatomy

Snail Dissection. University of Florida. United States Department of Agriculture http://idtools.org/id/mollusc/dissection_snail.php

Terrestrial Snail Dissection ~~C~~oe ~~Y~~ou Tube https://www.youtube.com/watch?v=3YUpON4-c6M

Land Snail- Wikipedia, the free encyclopedia https://en.wikipedia.org/wiki/Land_snail

Use of animals in schools:

School Animal Ethics Committee (SAEC) approval is required when certain animals are used in schools for scientific purposes, teaching activities or classroom observation. The animal

research decision guide can be found on the ***NHMRC Australian Code*** *for the Care and use of animals for scientific purposes*

Ethical concerns:

It is a decision for either the school or school sector to make the ethical decision regarding whether they will permit the dissection of animals. In most jurisdictions there are requirements for reporting to an animal ethics committee and sometimes permission is required before arranging to conduct a dissection. You may however conduct dissection activities using invertebrates (animals without backbones) such as snails without the prior approval of an ethics committee.

It is recommended that schools consider the educational objectives for the activity and explore the ethical considerations with students. Students should not be forced to participate in a dissection and alternative activities such as videos and virtual dissections can be used for these students instead, as well as to supplement the actual activity.

Science ASSIST has developed an information sheet with links to biological safety and jurisdictional SAECs, see AIS: Links – Biological sciences safety

In addition we have answered related questions which cover various safety aspects of dissections see:

Piglet Dissection:

Preparation of Equipment for Dissections:

fainting during dissections

Lung Dissection

Dissecting cane toads in WA

Dissection materials

References

[1] Snails, Slugs, and Semi-slugs: A Parasitic Disease in Paradise', CDC Public Health Matters Blog website, https://blogs.cdc.gov/publichealthmatters/2009/04/snails-slugs-and-semi-slugs-a-parasitic-disease-in-paradise/ (April 2009)

[2] Parasites - Angiostrongyliasis (also known as Angiostrongylus Infection), CDC website, https://www.cdc.gov/parasites/angiostrongylus/index.html (November 2010)

[3] Malik, Richard and Spielman, Derek. 2016. 'Kids, put down the snails, they could carry rat lungworm', The Conversation website. https://theconversation.com/kids-put-down-the-snails-they-could-carry-rat-lungworm-50183 (March 2016)

[4] Salleh, Anna. 2003. ‘Man's brain infected by eating slugs’, Health and medical news, ABCwebsite, http://www.abc.net.au/science/news/health/HealthRepublish_969551.htm

October 2013)

[5] 'Land snail', Wikipedia website, https://en.wikipedia.org/wiki/Land_snail (Accessed July 2016)

[6] Horstman, Mark. 2002. 'Snails can give you worms'. ABC Science website. http://www.abc.net.au/science/articles/2002/10/18/704700.htm (October 2002)

[7] Butcher, Andrew R. 2016. Children, snails and worms: the *Brachylaima cribbi* story. *Microbiology Australia* March 2016: 30-33, https://www.publish.csiro.au/?act=view_file&file_id=MA16012.pdf

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Water testing for PFOS and PFOA

Posted by Anonymous on Tue, 2016-08-16 10:32

Water testing: Is it possible to do classroom testing for PFOS and PFOA in water samples? If so, how would you go about it?

What other water quality/contamination tests could be done in a classroom?

Thanks.

Voting:•
Cancel rating
No votes yet
Rate
Australian Curriculum:•
Planning and conducting
Year Level:•
Senior Secondary
Laboratory Technicians:•
Laboratory Technicians

Showing 1-1 of 1 Responses

Water testing

Submitted by sat on 24 August 2016

PFOS and PFOAs

PFOs (Perfluorooctane Sulfonate) and PFOA (Perfluorooctanoate) are part of a chemical group that have been used in the manufacture of some common household products such as

non-stick cookware and fabric treatments, and have been used previously in some types of fire-fighting foam[1].

These chemicals do not break down in the environment[1] and are considered environmental contaminants as they are toxic to mammals and bioaccumulative[2]. Commercial testing laboratories use highly sensitive Liquid Chromatography Mass Spectrometry instruments because PFOS and PFOA are present in very small quantities and measured in parts per billion or parts per trillion.[3]

Science ASSIST has found a reference to PFOS and PFOA testing that requires a liquid chromatograph[4]. This instrumentation is not usually found in schools and, whilst this would make an interesting investigation, is definitely beyond the scope of most schools.

Alternative water testing:

Science ASSIST suggests water quality tests that align with the curriculum, student skill sets, and are readily available and cost effective for schools. The following tests are reproducible and meaningful to students:

- **Physical parameters:**
  - Temperature
  - Turbidity using a turbidity tube or data logging equipment
  - pH using test strips or pH meters
  - Salinity using a meter or data logging equipment
  - EC (electrical conductivity) using a meter or data logging equipment. Combined pH and EC meters may be purchased.
  - Dissolved oxygen using a meter or data logging equipment
- **Chemical parameters:**
  - Ammonia, nitrate, nitrite, phosphate and sulfate. Separate test strips or aquarium testing kits are available to quickly perform these tests
- **Biological indicators:**
  - Macroinvertebrates

Test meters can be purchased as ‘hand held’ models, which are effective while field testing. These are generally available from reputable science suppliers at a reasonable cost. Data logging equipment can be used for many applications in school science and it is worth investigating sensors that may suit your testing needs in the biology, chemistry and physics disciplines. See our list of School science suppliers.

Note: Although a number of resources discuss faecal coliform tests, Science ASSIST does not recommend the testing for faecal bacteria due to the risks of cultivating human pathogens. It is however an important indicator for water health and we suggest accessing websites with information regarding Australian drinking water guidelines[5] and Australian guidelines for managing risks in recreational water[6,7].

There are several educational resources available. Note that there may be updated methods available for some of the tests described. Here are some links to some school-based resources:

NSW DET. 2009. *Water quality testing* DET website, http://lrrpublic.cli.det.nsw.edu.au/lrrSecure/Sites/Web/about_fieldwork/...

'Statewide Education Resources' Waterwatch Victoria website. http://www.vic.waterwatch.org.au/cb_pages/education.php (Accessed October 2016)

Department of Environment, Climate Change and Water NSW. 2010. *Senior Waterwatch Teacher's Guide*, Office of Environment and Heritage NSW website, http://www.environment.nsw.gov.au/resources/waterwatch/SnrTeachGuide/200...

References

[1] 'PFOS and PFOA', NSW Government Health website, http://www.health.nsw.gov.au/environment/factsheets/Pages/pfos.aspx (Accessed August 2016)

[2] 'Perfluorooctane Sulfonate (PFOS) and related chemical products', OECD website, https://www.oecd.org/env/ehs/risk-management/perfluorooctanesulfonatepfosandrelatedchemicalproducts.htm (Accessed August 2016)

[3] 'PFOA Testing', Applied Technical Services website, https://atslab.com/chemical-analysis/pfoa-testing/ (Accessed August 2016)

[4] Tracy, Mark; Liu, Xiaodong and Pohl, Christopher. 2008. *Analysis of Perfluorooctane Sulfonate (PFOS) and Perfluorooctanoate (PFOA) in Water Samples Using Reversed-Phase Liquid Chromatography (RPLC) with Suppressed Conductivity Detection*, Dionex Corporation website, http://tools.thermofisher.com/content/sfs/posters/68680-LPN-2133-01-PFOS-note.pdf

[5] NHMRC. 2016. *Australian drinking water guidelines*, NHMRC website, https://www.nhmrc.gov.au/about-us/publications/australian-drinking-water-guidelines

[6] NHMRC. 2008. *Australian guidelines for managing risks in recreational water*, NHMRC website, https://www.nhmrc.gov.au/about-us/publications/guidelines-managing-risks-recreational-water

[7] Department of Health, Western Australia and the University of Western Australia. 2007. *Microbial Quality of Recreational Water* Department of Health, Western Australia website. https://ww2.health.wa.gov.au/~/media/Files/Corporate/general%20documents/water/envwater/other-publications/PDF/Microbial%20Quality-of-Recreational-Water-Guidance-Notes.ashx

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Agar plate experiments

Posted by Anonymous on Mon, 2014-12-22 13:09

Agar plate experiments: Can E. coli and/or Staph epidermidis be cultured from a broth onto an agar plate in a classroom situation. I note that both these cultures can be commercially bought and are labelled as 'Bacteria-Risk Group 1 Suitable for Schools'. I had thought subculture of bacteria was not allowed, only primary exposure of plates, then sealing. The experiment requested involves putting the known culture onto plates then placing discs of antiseptics/disinfectants or antibiotic mast rings onto the plate to demonstrate their effectiveness.

Voting:

No votes yet

Year Level:
7
8
9
10
Senior Secondary

Laboratory Technicians:
Laboratory Technicians

Showing 1-1 of 1 Responses

Answer by labsupport on question Agar plate experiments

Submitted by sat on 19 January 2015

There are many different considerations in a school laboratory regarding the use of microorganisms.• Science ASSIST is currently consulting authorities in order to make nationally consistent sensible and workable recommendations for best practice in school microbiology.•

Edit 10/06/2020 Subsequent to the following answer, Science ASSIST has

- developed•GUIDELINES for best practice for microbiology in Australian schools, which were published in 2017 after being reviewed by members of the Education Special Interest Group of the Australian Society for Microbiology. These guidelines contain information contextualised for the school setting and include several Standard Operating Procedures (SOPs) in Appendix 1; ASSIST Information Sheets in Appendix 2; and 'Laboratory Rules - Microbiology' in Appendix 3.
- answered a related question•Using E. coli bacteria in schools, which•explains why *E.coli* K-12 strain is the Risk Group 1 strain of *E.coli,*•being•suitable for use in schools, with other strains considered Risk Group 2 (being not suitable for schools).

The activity you are describing contains a number of risks and we recommend careful consideration of the many safety issues before proceeding with this activity.

Generally, school science laboratories are classified as Physical Containment level 1 (PC1),•**if** they conform to the requirements specified in Section 5 of AS/NZS 2243.3:2010 Safety in Laboratories –Microbiological safety and containment.• If they conform to these requirements, then they are only suitable for work with microorganisms where the hazard levels are low, and where laboratory or facility personnel can be adequately protected by standard laboratory practice.[i] Microorganisms that are classified as Risk Group 1 are the only ones that should be used in PC1 laboratories. Higher levels of Physical Containment are required for handling fresh human tissues or body fluids and microorganisms of Risk Groups 2-4 [ii].

When carrying out this type of sensitivity test on a microorganism, a lawn culture needs to be produced from a pure broth culture of the organism. The broth culture is either purchased as a live broth or prepared by emulsifying several colonies from a plate culture in a sterile broth in a test tube to a particular density. Then, using a sterile swab, a sample is inoculated over the entire surface of an agar plate. Antibiotic or disinfectant impregnated discs are applied to the inoculated surface and the plate incubated. Sensitivity or resistance is determined by observing zones of inhibition around the discs. Although the cultures that you mention are commercially available and classified as Risk Group 1 there are several aspects to consider regarding this activity.

- **Risks:** It should be remembered that even though the microorganisms are from Risk Group 1, some can still pose a low level of risk to the community as they can be capable of causing disease if provided with appropriate conditions. People who are immuno-suppressed are at greater risk.
- **Jurisdictional Policies:** There are differences between the state and jurisdiction policies regarding whether any manipulation or subculturing of microorganisms is allowed. For example, subculturing of pure cultures is permitted in some jurisdictions subject to following strict safety guidelines. However, it is not permitted in WA Department of Education schools and so schools should check if subculturing is allowed

in their jurisdiction.

- **Training:** It requires good microbiological training to have an appropriate level of understanding and technical expertise to apply correct aseptic techniques when manipulating microorganisms. The majority of teachers and lab techs may not have any formal training in microbiology and may not be able to tell if a culture is contaminated and/or contains pathogens and consequently the wrong microbes may be cultured.
- **Aseptic Technique:**• When dealing with any microbiological culture, and in particular live broth cultures, the use of aseptic techniques to prevent aerosol production is important. Release of microorganisms in the form of aerosols increases the risk of infection by inhalation.
- **Contamination of the culture:** It is important to have a pure culture of the microorganism. Aseptic technique is a fundamental skill in microbiology to maintain pure cultures whilst subculturing, to prevent microbes from being accidently released into the environment and infecting others in the laboratory.•• In a school, teachers and laboratory staff are only able to determine visually if a culture is pure, mixed or contaminated. It is easier to observe if an agar plate contains a pure, mixed or contaminated culture and it is more difficult to be sure that a liquid culture contains a pure culture of microorganisms. Some jurisdictions may allow gram stains to be performed to check for purity of a culture. If there is any doubt about the purity of the bacterial sample, it should not be used.
- **Subculturing:** when subculturing a microorganism from plate to plate the number of subcultures needs to be limited as excessive subculturing increases the risk of phenotypic alteration.
- **Waste disposal:** It is essential that appropriate waste disposal and sterilisation* procedures are adhered to, an appropriate spill kit is available to handle any spill and that staff are trained in its use.
- **Logistics:** If this activity were to be run in the classroom situation, it would require the purchase or aseptic preparation of numerous tubes of sterile broth, sterile agar plates, sterile swabs and sterile forceps to apply discs.• There are logistical constraints of a laboratory technician with regard to time allocation, training and expertise in microbiology techniques to prepare for a classroom situation as well as the fact that school facilities are not generally set up for this level of microbiology.

*Science ASSIST recommends the use of a pressure cooker or autoclave for sterilising rather than chemical sterilisation, which has risks and limitations. For information regarding sterilising agar see AIS: Sterilising Agar.

Here are some additional links to safety considerations on this topic

https://www.sciencebuddies.org/science-fair-projects/project_ideas/Micro_Safety.shtml •

https://intranet.sydney.edu.au/services/safety-wellbeing/standards-guidelines.html

https://microbiologyonline.org/teachers/safety-information

References (added 10/06/2020):

Science ASSIST. 2017. *GUIDELINES for best practice for microbiology in Australian schools* . Science ASSIST website, https://assist.asta.edu.au/resource/4196/guidelines-best-practice-microbiology-australian-schools

'Using *E. coli* bacteria in schools',•Science ASSIST Q&A, Science ASSIST website,• https://assist.asta.edu.au/content/4437/using-e-coli-bacteria-schools (21 February 2019)

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[i] University of Sydney. 2013. Biological Safety –Microbiology https://intranet.sydney.edu.au/services/safety-wellbeing/standards-guidelines.html •(accessed July 2014)

[ii] Australian Standards AS NZS 2243.3-2010. Safety in Laboratories –Microbiological safety and containment

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Agar plate storage in the fridge

Posted by Anonymous on Thu, 2018-09-06 16:31

Agar plate storage in the fridge: Is it necessary to store the agar plates upside down in the fridge? As in the school we are attending to so many things that we are sometimes in a hurry to check if all the agar plates have gelled but stack and seal and put them in fridge for further use. Yes we placing definitely siting them in the incubator upside down so that condensation doesn't fall on the agar plates.

Another question is how long can we store the agar plates in the fridge?

Voting:•

No votes yet

Year Level:•
9
10
Senior Secondary
Laboratory Technicians:•
Laboratory Technicians

Showing 1-1 of 1 Responses

Agar plate storage in the fridge

Submitted by sat on 06 September 2018

Correct aseptic preparation and storage of agar plates away from light and heat is necessary

to protect them from contamination, dehydration and degradation of chemical constituents.

Setting of agar plates: Agar plates when poured should be allowed to set undisturbed at room temperature. It is best practice that when completely set and cooled to room temperature that they should be stored stacked upside down in sealed plastic bags in the fridge at 4 ℃. It is a good idea to reuse the plastic bags from which the sterile Petri dishes came from for storage. Storage this way will prevent:

- Condensation that develops on the lid from dripping onto the agar surface which is a potential source of contamination.
- Moisture loss which leads to the agar drying out and
- Protection from light and heat that can lead to chemical degradation.

Minimising condensation: It is also important to minimise the amount of condensation that is produced. Excess accumulation of condensation on the lids of agar plates occurs when steam is trapped inside the Petri dish when the lid has been replaced when agar is poured at high temperatures. •A significant reduction in the amount of condensation can be achieved by allowing the sterilized agar to cool to 50℃–55℃ before pouring. •A water bath set at 50℃ is useful to store bottles of molten agar to maintain the optimal temperature prior to pouring plates. Remember agar solidifies at around 42℃. When pouring molten agar from a bottle held in a water bath at 50℃ the moisture adhering to the outside of the bottle must be wiped off before pouring the agar as it is not sterile and if left may drip into the sterile agar.

Storage of prepared agar plates: The type of agar used will determine the length of time that it can be stored in the fridge[1]. The recommended media for use in schools is a general-purpose nutrient media such as Nutrient agar. This type of agar plate should be stored at 4 ℃ and used within a month of preparation. Any longer and the agar can begin to dry out. Thinner plates will dry out faster. Any loss of moisture can be visually detected by the appearance of shrinkage away from the plate and macroscopic cracks that develop in the agar.

Storage of inoculated agar plates: Inoculated agar plates are also incubated and stored upside down to prevent condensation dropping onto the agar surface (a potential source of contamination) and causing isolated colonies to spread into each other. Following incubation storage of inoculated plates at 4 ℃ will slow down the growth of cultures allowing you to show students a 1-2 day growth if lessons are a week apart.

Science ASSIST has developed a guideline for best practice for microbiology in Australian school see: GUIDELINES for best practice for microbiology in Australian schools

References and further reading:

[1] ‘Storage of Reconstituted Sterile Media and Poured Plates’, Thermo Scientific Oxoid website, http://www.oxoid.com/au/blue/techsupport/its.asp?itsp=faq&faq=tsfaq007&cat=culture+media%2C+supp (Accessed August 2018)

Science ASSIST. 2017. *GUIDELINES for best practice for microbiology in Australian schools*, Science ASSIST website, https://assist.asta.edu.au/resource/4196/guidelines-best-practice-microbiology-australian-schools

Society for General Microbiology. 2006. *Basic Practical Microbiology –A Manual.* Microbiology Online website, http://www.microbiologyonline.org.uk/file/ca2189fba3b39d24c5a44c1285d008...

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agar plates

Posted by Anonymous on Tue, 2015-07-14 12:28

Agar plates: I've been asked to make up agar plates with different pH values from 3–11 - any information I can find on the net suggests the agar won't set at a low pH. Any ideas?

Voting:
No votes yet

Year Level:
10
Senior Secondary
Laboratory Technicians:
Laboratory Technicians

Showing 1-2 of 2 Responses

agar plates

Submitted by on 16 July 2015

Hi there, Do you have the text 'A Science Reference and Preparation Manual for Schools'? There is a great wealth of information in this book, see Page 198

agar plates

Submitted by sat on 24 July 2015

The ability of agar to set is affected by the concentration of the agar, the sugar content and the pH. Varying the pH of the agar too far (more than 1 unit) away from the neutral (pH 6–8) could result in the agar not setting. In an acid pH range, this is due to the hydrolysis, or chemical breakdown, of the agarose polysaccharides, the units that bind together to form the agar gel. In addition, the effect of pH on the gelling process is more evident after heating. For a detailed explanation of the chemistry see: http://www.agargel.com.br/agar-tec-en.html.

Through further correspondence we understand that the proposed activity is to investigate the effect of pH on probiotics. We have the following suggestions.

1. Narrow the pH range in the investigation from 6.0–8.0 rather than 3–11.
2. Trial increasing the agar concentration.
3. Trial lowering the pH by adding acid under sterile conditions following the heat sterilisation of the agar and before the gel reaches its setting temperature. This may require filter sterilising of the added solution, which may not be possible in a school setting.
4. Add the probiotic to the buffer solution for a period of time and then add a sample of this to a standard agar plate.
5. Using aseptic techniques, inoculate agar plates with a lawn culture of a probiotic such as yoghurt culture and place discs of filter paper soaked in various ranges of pH buffer solutions onto this lawn culture. Incubate and look at the growth patterns demonstrating any signs of inhibition.

Note: After inoculation and incubation, the agar plates should not be opened or subcultured but should be sterilised in a pressure cooker or autoclave prior to being disposed of in the regular waste. See AIS: Sterilising agar and SOP: Operating a pressure cooker and autoclave and related questions such as Agar plate experiments and Inoculating agar plates and sealing them.

It is important that microbiology activities are supervised by staff who are aware of the safety procedures required in dealing with biohazards.

References:

‘Agar-Agar: Properties and Specifications’ Agargel website. http://www.agargel.com.br/agar-tec-en.html (Accessed July 2015)

Starr, M.P., H. Stolp, H.G. Trüper, A. Balows and H.G. Schlegel (Eds.) . 1981 *The prokaryotes: A handbook on habitats, isolation and identification of bacteria* Pg 143, Springer-Verlag: Berlin. https://books.google.com.au/books?id=RpPuCAAAQBAJ&pg=PA143&lpg=PA143&dq=...

Autoclaving disposable Petri dishes

Posted by Anonymous on Wed, 2016-11-09 10:39

Autoclaving disposable Petri dishes: How do you use a biohazard bag and can plastic disposable Petri dishes be autoclaved in them?

We have just purchased an autoclave, and we have a large supply of plastic Petri dishes. I noticed that the plastic Petri dishes melt when I put them into the autoclave. To solve the problem, I am wondering whether it is ok practice to place inoculated agar Petri dishes into a biohazard bag and place it in the autoclave to be sterilized, even if they melt? Also, what is the procedure for using biohazard bags? For example, do you leave them open? Or do you seal them before use? etc.

Thanks in advance for your help.

Voting:

No votes yet

Laboratory Technicians:
Laboratory Technicians

Showing 1-1 of 1 Responses

Autoclaving disposable Petri dishes

Submitted by sat on 11 November 2016

All microbiological waste is required to be sterilised using a pressure cooker or autoclave

before disposal. This process of sterilisation using steam under pressure is carried out at a temperature of 121^{o}C for 15-20 minutes at 15psi pressure. •Plastic Petri dishes are commonly made from clear polystyrene plastic which are heat resistant up to 80^{o}C[1]. They are regarded as a use once disposable item and under sterilisation conditions in an autoclave or pressure cooker they will deform.

The best way to sterilise Petri dishes containing agar inoculated with microorganisms in an autoclave or pressure cooker is by placing them into a bag that will withstand the sterilisation conditions and contain the treated contents. Schools have the option of using two different types of bags:

- Autoclavable biohazard bags which are available from scientific suppliers, see the Science ASSIST•School science suppliers••list. These are made from a heavy duty plastic e.g. polypropylene marked with the international biohazard symbol and usually have the word autoclavable written on them. They are available in a variety of sizes.
- Oven bags which can be purchased from supermarkets. These are also available in different sizes.

If you are unsure if your biohazard bags are suitable for autoclaving we suggest that you contact the supplier for advice.

Procedure for using an autoclavable biohazard or oven bag for sterilising inoculated agar in plastic Petri dishes:

- **Loosely pack agar plates into bags to no more than 2/3 full**. This will ensure that the steam during sterilisation will penetrate the entire load. Bags that are tightly filled to capacity will not allow effective steam penetration and the contents will not be sterilised even if all sterilisation parameters are met.
- **Make sure there are no sharp objects present**•that may puncture the bag.
- **Loosely tape shut the bag leaving an opening of about 5-6cm**•to allow good steam penetration. This can be done with autoclave tape or a rubber band. Never tightly close the bags as they are impervious to steam and therefore the temperature of the inside of the bag will not be sufficient for sterilisation.
- It is advisable to•**place the bag into a secondary container**•within the steriliser to prevent any leakage into the steriliser should the bag rupture. •The container must be able to withstand the autoclaving conditions.
- **Do not overload the steriliser**•with too many bags as this may block steam circulation.
- **Use a sterility compliance strip**•to indicate if the correct time, temperature and pressure have been reached during the run time. These are available from scientific suppliers.
- **Sterilise at 15psi, 121^{o}C for 15-20 minutes.**
- After sterilisation has been verified, the autoclave or oven bag containing waste items should be•**disposed of by placing it into a sturdy garbage bag which is sealed for immediate disposal in industrial bins.**
- **Wear heat protective gloves**•when removing waste from the steriliser.
- **Sterilisation of these items ideally takes place as soon as possible**•after completion of a practical activity and occurs within the science laboratory or prep room area.

Science ASSIST has developed the following resources with related information:

- ·····AIS: Sterilising agar
- ·····SOP: Preparing agar plates
- ·····SOP: Operating a pressure cooker and autoclave

References:

[1]'Petri dishes, plastic', Marienfeld-Superior website.•http://www.marienfeld-superior.com/petri-dishes-plastic.html (Link updated: April 2018)

'Autoclave Use', Environmental Health and Safety Princetown University website.•• https://ehs.princeton.edu/book/export/html/380•(Accessed November 2016)

'Procedures for Decontamination by Autoclaving' Virginia Polytechnic Institute and State University website.• http://www.ehss.vt.edu/programs/BiosafetyDocuments/AutoclavingProcedures_4-18-08.pdf• (Accessed November 2016)

•'Requirements for Decontamination by Autoclaving', Environmental Health & Safety University of Virginia website,• http://ehs.virginia.edu/biosafety/bio.documents/Autoclaving_Guidelines.pdf••(Accessed November 2016)

'Properties of laboratory plastics', The Lab Depot website,• https://www.labdepotinc.com/articles/laboratory-plastics.html•(Accessed November 2016)•

Autoclaving microbiological waste

Posted by Anonymous on Fri, 2018-08-03 16:53

Autoclaving microbiological waste: we have just purchased an autoclave, however it has minimal instructions and no preprogrammed settings. I have read all your related information, which has been helpful. I just want to clarify a few points:

1. Is it okay to sterilise microbiological waste in a marked biohazard bag then put it in general waste?
2. We cloned cauliflower in a growth medium, in 250ml plastic jars, which grew many organisms. We wished to re-use jars so I sterilised them at 121'c for 20min then allowed them to cool. Waste was scrapped out and double bagged, then placed in general waste. I have concerns about this procedure as a rule we never re-open petri dishes. Also I understand sterilisation times are based on clean items. Does this process mean the items are sterilised or merely decontaminated? Have the organisms (bacteria, fungi) been rendered inert? Is 121'c for 20min considered a kill cycle?
3. We always tape around our perti dishes with parafilm to prevent re-opening - will this prevent steam entering the dish and prevent sterilisation?
4. We are keeping a log of our cycles and are deciding which validation strips to purchase to suit our needs (121'c for 20min or 121'c for 15min).

Would greatly appreciate your advice.

Voting:

No votes yet

Year Level:

7
8
9
10
Senior Secondary

Showing 1-1 of 1 Responses

Autoclaving microbiological waste

Submitted by sat on 03 August 2018

1. *Is it okay to sterilise microbiological waste in a marked biohazard bag then put it in general waste?*

After decontamination in an autoclave, an autoclave bag depicting the biohazard symbol should not be placed directly into the general waste bin. These bags should be placed into an unlabeled strong black plastic garbage bag and sealed securely before being placed into the waste bin[1]. This is so that the biohazard symbol is not visible, which could cause unnecessary alarm at the contents.

It is recommended to sterilise microbiological waste in a bag that will withstand the sterilisation conditions of 15psi, 121^0C for 15-20 minutes and contain the treated contents.

An alternative to an autoclave bag is an oven bag which can be purchased from supermarkets and which can also withstand the sterilization conditions. These do not have any biohazard markings on them and are commonly used in schools.

It must be remembered that effective sterilisation is also determined by the correct packing of an autoclave or oven bag. The effectiveness of autoclaving depends on steam being able to penetrate what is being autoclaved

- Do not overfill bags. Loosely pack no more than 2/3 full.
- Do not include any sharp objects that may puncture the bag.
- Do not include any volatile chemicals.
- Lids on any containers must be loosened.
- Do not tightly seal the bag but loosely tape the bag shut leaving an opening of 5-6cm to allow steam penetration.
- Place the bag into another container in the steriliser to capture any leaks should the bag rupture.
- Do not overload the steriliser with too many bags as this will block steam circulation.
- Autoclave clean items and waste separately.
- Use a sterility compliance strip to verify that the sterilisation conditions have been reached.

1. *We cloned cauliflower in a growth medium, in 250ml plastic jars, which grew many organisms. We wished to re-use jars so I sterilised them at 121'c for 20min then allowed them to cool. Waste was scraped out and double bagged, then placed in general waste. I have concerns about this procedure as a rule we never re-open petri dishes.*

Also I understand sterilisation times are based on clean items. Does this process mean the items are sterilised or merely decontaminated? Have the organisms (bacteria, fungi) been rendered inert? Is 121'c for 20min considered a kill cycle?

You are correct that Petri dishes that have grown unknown microorganisms should **never** be opened prior to sterilisation, so that you don't expose yourself or others to harmful microorganisms. All laboratory equipment, materials and wastes contaminated with microorganisms should be sterilised before being washed, stored or discarded.

Effective sterilisation of microbial cultures by autoclaving (121^0C for 15-20 minutes at 15(psi) pounds per square inch) will result in the complete destruction of all living microorganisms including bacterial spores. Therefore, after sterilisation, any reusable containers and their contents would be regarded as sterile and safe to open and clean out for reuse. Autoclaved liquid cultures can be disposed of safely down the sink, whilst any autoclaved solid material can be removed from reusable containers and placed into the general waste.

Remember that sterilization can only be guaranteed when the critical parameters of temperature, steam under pressure and time are reached. It is imperative that timing only begins when the temperature and pressure conditions have been reached.

Sterilisation using the autoclave will denature & coagulate proteins and other cell constituents in the bacterial cell including any spore formers. Fungal cultures including fungal spores are easily killed by heating above 80^oC.

Decontamination on the other hand is defined as a process that will render an environmental area, device, item or material safe from the risk of infection transmission by removing, neutralising or destroying microorganisms. Decontamination can include disinfection, antisepsis or sterilisation.

1. *We always tape around our Petri dishes with parafilm to prevent re-opening - will this prevent steam entering the dish and prevent sterilisation?*

Petri dishes with sticky tape or Parafilm should be placed into the autoclave/oven bag with the tape/Parafilm left on. It will not prevent sterilisation.

Parafilm M is a laboratory sealing film with unique properties. It is a stretchy, waxy film that is very good at moulding around tops of test tubes, bottles, flasks and around Petri dishes to provide a leakproof seal. It is gas permeable with low water permeability making it ideal for use in microbiology and cell culture applications as it does not affect oxygen or carbon dioxide permeability when used as a single layer.

Parafilm M becomes more flexible, softer and stickier at about 54^0C and has a melting point of 60^0C [2,3]. So in an autoclave at 121^0C it will have melted from around the Petri dish or jar no longer forming a seal, therefore allowing sterilisation to occur as steam is allowed to enter the vessel. In addition, the moisture in the agar would also convert to steam to help facilitate the sterilisation process.

Science ASSIST recommends that prior to incubation the lid and base of a Petri dish be taped

with 4 pieces of sticky tape or **one layer (only)** of Parafilm to allow for aerobic conditions and to prevent accidental opening of the plate. Sealing with one layer of Parafilm M, completely around the circumference of the Petri dish will allow students to examine them and will prevent exposure to moisture or drips that may seep out of the Petri dish, which are potential sources of infection.

1. *We are keeping a log of our cycles and are deciding which validation strips to purchase to suit our needs (121'c for 20min or 121'c for 15min). Would greatly appreciate your advice. Thanks*

In a school setting Class 5 integrated chemical indicator strips are suitable to validate the effective operation of an autoclave. These strips are the most accurate of the internal chemical indicators and are considered comparable to Biological Indicators in saturated steam [4]. They react to all the critical parameters and have the advantage of not requiring any incubation, an immediate result is produced.

An indicator strip should be placed in the centre of each load and checked after each run to ensure that the temperature and steam conditions have been met.

Generally there are several ways to determine if an autoclave or pressure cooker is working properly and sterilisation has occurred. These include physical indicators, chemical indicators and biological indicators.

- Physical indicators –involves checking the steriliser gauges or digital display to determine if the correct temperature and pressure have been reached. **This however does not guarantee sterilisation.**
- Chemical indicators –These use chemicals that change colour when exposed to high temperatures and in some cases pressure. There are 2 types of chemical indicators.
    - Integrated chemical indicator strips generally provide a limited validation of only 1 or 2 of the critical parameters (temperature and time). **Class 5 Integrated chemical sterility indicator strips, are the most accurate of the internal chemical indicators and are considered comparable to Biological Indicators in saturated steam.** They react to all the critical parameters. They have an advantage in that they do not require any incubation and an immediate result is produced. **These would be very suitable for the school setting.**
    - **Temperature sensitive tape in the form of autoclave tape or an indicating label on a paper or plastic pouch. These contain a heat sensitive ink and are used extensively in microbiology labs. They however only indicate that an item has gone through a heating process and not that sterility has occurred.**
- Biological indicators –Traditionally the most accepted means of sterilisation monitoring. They contain spores of a heat resistant bacterium such as *B. stearothermophilus* that will germinate if the correct sterilisation conditions are not met. This microorganism is the most resistant strain to steam autoclaving and will be inactivated under correct autoclave conditions. Biological indicators require an incubation step to obtain a result. Professional microbiology labs would regularly test their autoclave using this method. **This would not generally be used in a school setting.**

Both biological and chemical indicators are available from scientific suppliers. See the

Science ASSIST School science suppliers list.

References and further reading:

[1] Sydney University. nd. *Hazardous waste*. Safety Health & Wellbeing, Sydney University website, *https://intranet.sydney.edu.au/content/dam/intranet/documents/employment/safety-health-wellbeing/guidelines-training/hazardous-waste-guide.pdf* (Accessed July 2018)

[2] Sigma-Aldrich. nd. *Product Information –Parafilm®M,* Sigma-Aldrich website,• https://www.sigmaaldrich.com/deepweb/assets/sigmaaldrich/product/documents/421/110/p7543pis.pdf •(Updated July 2019)

[3] 'Parafilm: Frequently asked questions', Camblab website, https://camblab.info/parafilm-frequently-asked-questions/ (17 May 2012))

[4] 3M. nd. *Steam Chemical Indicator Classifications*, 3M website, http://multimedia.3m.com/mws/media/600678O/scic-tutorial-pdf.pdf (Accessed July 2018)

'Autoclave Use', Princeton University website, https://ehs.princeton.edu/book/export/html/380 (Accessed July 2018)

NSW Department of Education and Communities, *Chemical Safety in Schools (CSIS) resource package*, NSW DEC website, https://education.nsw.gov.au/ (DEC Intranet, login required.)

Science ASSIST. 2016. Autoclaving disposable Petri dishes, Science ASSIST website

Science ASSIST. 2017. GUIDELINES for best practice for microbiology in Australian schools, Science ASSIST website

Standards Australia. 2010. AS/NZS 2243 *Safety in Laboratories, Part 3: 2010 Microbiological safety and containment*. Sydney, Australia.

Tilbrook, Dr Peta. 2015. Technical Services Manager, Department of Environment and Agriculture, School of Science, Curtin University, WA. Personal communication.

University of Adelaide. 2016. *3.14 Biological Safety Management Autoclave Information Sheet,* The University of Adelaide website,

https://web.archive.org/web/20190201072339/https://www.adelaide.edu.au/hr/hsw/docs/biological-autoclave-info-sheet.pdf•(Original link no longer available. This archived copy made available by the Internet Archive's Wayback Machine May 2020)

Bacteria (Micrococcus luteus)

Posted by Anonymous on Wed, 2015-11-11 18:21

Bacteria (*Micrococcus luteus*): Is there any reason *Micrococcus luteus* can not be used in non-government schools in WA?

Voting:

No votes yet

Year Level:
9
10
Senior Secondary
Laboratory Technicians:
Laboratory Technicians

Showing 1-1 of 1 Responses

Bacteria

Submitted by sat on 23 November 2015

In Brief:

Legislation: Regulations are not prescriptive to this level, however, there are general principles that need to be observed for providing a safe workplace and adequate training to workers. Schools determine their policies and procedures based upon legislation and good advice such as the Australian Standards in order to provide a safe working environment for

staff and a safe learning environment for students.

Currently in Australia, there are differences between the state/territory educational jurisdictional policies on whether certain microbiological activities can be carried out. Schools are advised to check what activities are permitted in their jurisdiction/school sector before proceeding to work with any microorganisms.

School policies: Government and non-government educational sectors formulate their own school policies regarding the types of manipulations allowed when handling microorganisms.

1. Opening and subculturing of bacteria is not permitted in WA Department of Education (DoE) schools. (1)
2. Generally, non-government schools in WA follow the safety policies as WA DoE schools. Schools that are considering using microorganisms need to ensure that proper facilities are in place for microbiological activities, relevant staff are trained in microbiology, a site-specific risk assessment completed and strict safety guidelines followed.

Laboratory classification: Generally, Australian school science laboratories are classified as Physical Containment level 1 (PC1), and this is only **if** they conform to the requirements specified in Section 5 of AS/NZS 2243.3:2010 Safety in Laboratories –Microbiological safety and containment. At this level they are only suitable for work with microorganisms where the hazard levels are low, and where laboratory personnel can be adequately protected by standard laboratory practice (2). Microorganisms that are classified as Risk Group 1 are the only group that should be handled in PC1 laboratories. Risk Group 1 microorganisms are those that are considered non-pathogenic to healthy individuals.

Micrococccus luteus *(3,4)* is a gram positive, aerobic microorganism typically found on human skin, in the mouth and respiratory system, in soil, dust, water and air; it is classed a Risk Group 1 microorganism. *M. luteus* can be handled safely in a Physical Containment level 1 laboratory (PC1)(4) using standard laboratory practice. *Micrococcus luteus* can be sourced from a number of reputable suppliers that can guarantee its purity.

Questions for schools: Before schools embark on working with microorganisms, they should ask the following questions and perform a site-specific biological risk assessment.

- Do the school facilities comply with the requirements of PC1 laboratories?
- Does the school have the necessary equipment for sterilisation and decontamination procedures?
- Do the staff have training in microbiological skills?
- What microorganism is being used?
- What manipulations are being performed with the microorganism? Are methods being used to eliminate or minimize exposure to potentially infectious material via aerosols, splashes, ingestion, absorption and accidental inoculation?(5)
- Are any staff or students wishing to participate in microbiological activities immunocompromised or immunosuppressed (Include those who are pregnant or may become pregnant, or are living with or caring for an immunocompromised individual)? These individuals are more prone to infections. If so, it has been suggested that they should consult a doctor to determine whether their participation is appropriate. (6)

Biological risk assessment: According to *Biosafety in microbiological and biomedical laboratories* (BMBL)[7], the following five steps should be considered.

1. Identify agent hazards and perform an initial assessment of risk.
2. Identify laboratory procedure hazards.
3. Make a determination of the appropriate biosafety level and select additional precautions indicated by the risk assessment.
4. Evaluate the proficiencies of staff regarding safe practices and the integrity of safety equipment.
5. Review the risk assessment with a biosafety professional.

For an example of an SOP from the University of Sydney see Working with risk group 1 microorganisms.

Additional information:

Safety issues, are a significant consideration in microbiology as there is a potential for infectious hazards. The use of sound microbiological techniques and the strict observance of correct microbiological procedures will enable students and staff to work safely with microorganisms. It is accepted practice that all microorganisms be treated as potential pathogens and always handled with universal precautions [2].

There are many aspects regarding the use of microorganisms in school science laboratories that should be considered. Science ASSIST recommends the following:

- **Training:** It requires good microbiological training to have an appropriate level of understanding and technical expertise to apply correct aseptic techniques when manipulating microorganisms. Teachers supervising students, and technicians who prepare and dispose of the material should have some basic microbiological training.
- **RG1 microorganisms:** It should be remembered that, even though microorganisms are from Risk Group 1, some can still pose a low level of risk to the community as they can be capable of causing disease, if provided with appropriate conditions (opportunistic). People who are immunosuppressed or immunocompromised are at greater risk.

- **Aseptic Technique:** Aseptic techniques should be used at all times. A significant risk associated with microbiology is the generation of microbial aerosols. Release of microorganisms in the form of aerosols increases the risk of infection by inhalation.
- **Media:** The type of media used should not be selective for pathogens. Nutrient agar is a basic media that supports the growth of a wide variety of bacteria and moulds and is suitable for use in school laboratories. Media such as Blood and MacConkey Agar, designed to select for more fastidious microorganisms and pathogens should not be used.
- **Incubation:** Cultures should be sealed to allow for aerobic growth and incubated at temperatures of 30◦ C or below to avoid the growth of potential human pathogens.
- **Subculturing:** When subculturing a microorganism from plate to plate, the number of subcultures needs to be limited as excessive repeated subculturing increases the risk of phenotypic alteration.
- **Environmental sampling:** When culturing from the environment, samples **should not**

be taken from areas likely to contain organisms harmful to humans, such as toilet areas.
- **Waste disposal:** It is essential that appropriate waste disposal and sterilisation procedures are adhered to, and also that an appropriate spill kit is available to handle any spill and staff are trained in its use. Sterilisation should be conducted in an autoclave or pressure cooker (15 psi. 121◦ C for 15–20min) before disposal into the regular waste.

Science ASSIST is in the process of consulting authorities in order to make nationally consistent sensible and workable recommendations for best practice in school microbiology.

Science ASSIST has previously answered a number of questions relating to microbiology, see:

Microbiology (cultivating temperatures)

Inoculating agar plates and sealing them

Students investigating mould and bacterial growth on food items

References:

(1) WA Department of Education Laboratory manual

(2) 'Microbiology' University of Sydney WHS website October 2013. https://intranet.sydney.edu.au/services/safety-wellbeing/standards-guidelines.html (accessed November 2015)

(3) 'Public Health Image Library (PHIL) 9756' Centers for Disease Control and Prevention website. https://phil.cdc.gov/phil/details.asp?pid=9756 (Accessed November 2015)

(4) 'Micrococcus Pathogen Safety Data Sheet –Infectious Substances'. Public Health Agency of Canada website. https://www.canada.ca/en/public-health/services/laboratory-biosafety-biosecurity/pathogen-safety-data-sheets-risk-assessment/micrococcus.html (accessed November 2015)

(5) US Aid TB Care1. *SOP Use of personal protective equipment in an AFB microscopy laboratory* (Website no longer available as of 2019)

(6) American Society for microbiology Guidelines for Biosafety in Teaching Laboratories. 2012. http://www.uab.cat/doc/teaching_lab_ASM

(7) Biosafety in microbiological and biomedical laboratories (BMBL) 5th Edition. 2009. Section II Biological risk assessment. https://www.cdc.gov/biosafety/publications/bmbl5/

'Guidelines for best practice for microbiology in Australian schools'. Science ASSIST website, https://assist.asta.edu.au/resource/4196/guidelines-best-practice-microb... (Added October 2019)

Standards Australia. 2010. AS/NZS 2243 *Safety in Laboratories, Part 3: 2010 Microbiological safety and containment*. Sydney, Australia.

Bacteria in yoghurt

Posted by Anonymous on Fri, 2019-04-05 16:56

Bacteria in yoghurt: Are yoghurt strains of bacteria suitable for use in schools? Are they safe to use in the biology practical “What causes Yogurtness”?

Voting:

No votes yet

Year Level:
Senior Secondary
Laboratory Technicians:
Laboratory Technicians

Showing 1-1 of 1 Responses

Biology Practical: Bacteria in yoghurt

Submitted by sat on 05 April 2019

When conducting a microbiology activity, it is important to consider what microorganism is being used and how it is being used.

The type of bacteria used in the production of yoghurt are suitable for human consumption. They are not human pathogens, so are suitable for use in schools.

When considering a certain microbiology activity it is important to evaluate:

- The actual activities that will be conducted
- the types of manipulations being performed
- the level of staff training in microbiological techniques

Science ASSIST has produced "GUIDELINES for best practice for microbiology in Australian schools" see https://assist.asta.edu.au/resource/4196/guidelines-best-practice-microbiology-australian-schools.• We recommend that your school is familiar with the content of this guide before contemplating the delivery of practical activities in microbiology. In particular, see chapter 3 and 4 regarding risk assessment; school work levels; staff training and microbiology rules. From page 13:

"Before schools embark on working with microorganisms they should ask the following questions and perform a site-specific biological risk assessment.

- *What microorganism is being used? Is it a Risk Group 1 microorganism?*
- *Do the school facilities comply with the requirements of Physical Containment Level 1 laboratories?*
- *Does the school have the necessary equipment for sterilisation and decontamination procedures?*
- *Does the staff have training in microbiological skills?*
- *What manipulations are being performed with the microorganism? Are methods being used to eliminate or minimise exposure to potentially infectious material via aerosols, splashes, ingestion, absorption and accidental inoculation?*
- *Are any staff or students wishing to participate in microbiological activities immunocompromised or immunosuppressed (include those who are pregnant or may become pregnant, or are living with or caring for an immunocompromised individual)? These individuals are more prone to infections and they should consult a doctor to determine whether their participation is appropriate."*[1]

The Bio-Rad kit activity that you mentioned[2], involves advanced work in subculturing and manipulations of bacteria. This would be considered a Science ASSIST level 4 activity with medium to high risk and therefore staff should be highly trained in microbiology and the manipulations required.

There are a number of procedures used in this kit which are not recommended for schools

- Streaking plates from milk and yoghurt would be ok, but **agar plates should not be incubated at 37℃** as this increases the likelihood of growing human pathogens
- **Agar plates, which have been inoculated by students, should not be opened** as there is a high risk of contamination with unknown microorganisms and therefore a high risk of exposure to possible pathogens. The plates should remain sealed whilst being examined by students and then sterilised in an autoclave before disposal.
- This means that agar plates which have been inoculated by the students:
    - **Must not be opened in order to sample the culture to create a smear to view under the microscope**
    - **Must not be opened in order to subculture from this plate (to inoculate a further agar plate or broth)**
- The use of ampicillin could cause adverse reactions in anyone who may have an allergy

to penicillin

It is important to be aware of the safety issues and risks regarding the microbiological aspects of this and other microbiology kits and to confirm if the required techniques and procedures are allowed in your school jurisdiction. You could also consult with a Workplace Health and Safety Advisor in your jurisdiction for further advice.

We recommend that you consider an alternate activity. We have a range of activities which are suitable for use in schools in our GUIDELINES for best practice for microbiology in Australian schools

We have previously answered the following related questions, which can be viewed on our website:

Genetic modification of bacteria

Using *E. coli* bacteria in schools

Gene induction experiment?

Transformation of E.coli with pFluoroGreen

References and further reading

[1] Science ASSIST. 2017. *GUIDELINES for best practice for microbiology in Australian schools,* Science ASSIST website, https://assist.asta.edu.au/resource/4196/guidelines-best-practice-microbiology-australian-schools.•

[2] Bio-Rad Explorer. Nd. *Microbes and Health Kit: "What Causes Yogurtness?"*, Bio-Rad website, https://www.bio-rad.com/sites/default/files/webroot/web/pdf/lse/literature/1665031A.pdf (Accessed March 2019)

•

'Yogurt Production', Milk Facts website, http://www.milkfacts.info/Milk%20Processing/Yogurt%20Production.htm (Accessed March 2019)

'Yoghurt', Dairy Food Safety website, https://www.dairysafe.vic.gov.au/consumers/dairy-foods/yoghurt (Accessed March 2019)

Disposal of Agar plates

Posted by Anonymous on Tue, 2014-12-09 14:33

Disposal of Agar plates: After reading your procedure on making agar plates, I found that the procedure was unable to give me any specific information on the disposal of used plates with live cultures. This issue came up after a discussion with some of my colleagues on safe use and disposal of agar plates with live cultures, so we looked up the Science Assist website. This request is not urgent, as I have been able to get this information by talking to technicians in my state organisation, but it would be great to have some safe operating procedures for handling and disposal on the site.

Voting:•

☆
☆
☆
☆
☆

No votes yet

Laboratory Technicians:•
Laboratory Technicians

Showing 1-2 of 2 Responses

Disposal of Agar plates

Submitted by on 17 February 2020

Hi Anonymous i came across your question. The expert answer on following webpage available on ASSIST website might be helpful. https://assist.asta.edu.au/question/4146/autoclaving-disposable-petri-di... alternativley you can find the webspage by searching for "Autoclaving disposable Petri dishes:" in resources section of the ASSIST website. Thanks

Answer by barney41 on question Disposal of Agar paltes

Submitted by sat on 09 December 2014

Thank you for your feedback. Science ASSIST is a new science advisory service for school laboratory technicians and teachers. We are continuing to develop additional SOPs including further information on microbiological procedures. We anticipate that a SOP for the disposal of cultured microbiological plates will be available for the new school year.

Gene induction experiment?

Posted by Anonymous on Thu, 2016-09-22 13:35

Gene induction experiment?: A teacher has asked about the possibility of setting up an experiment to induce expression of ?-galactosidase in E. coli (http://www.nuffieldfoundation.org/practical-biology/gene-induction-%C3%9F-galactosidase-e-coli).

My concerns with this experiment are the cost of reagents (especially as this is untried, so we don't know how successful it will be) and the use of methylbenzene.

I was wondering if anyone has successfully performed this (or a similar) gene induction experiment in their school? It would be great to hear your feedback/suggestions...

Voting:

No votes yet

Year Level:
Senior Secondary
Laboratory Technicians:
Laboratory Technicians

Showing 1-1 of 1 Responses

Gene induction experiment?

Submitted by sat on 13 October 2016

In brief: This is a complex activity which involves a number of chemical hazards as well as microbiological hazards. We have not performed this activity, however we can make the following comments.

Risk Assessment: It is very wise of you to investigate this before proceeding with ordering chemicals and other resources. It is important to undertake a risk assessment of both the chemicals/substances used as well as the processes involved in an activity prior to ordering the chemicals and equipment. We have developed a Risk Assessment Template that you may find helpful.

Hazardous chemicals:

Toluene (methylbenzene): This is a hazardous chemical, which we have not to date included in our List of recommended chemicals for science in Australian schools.•However, we could consider it for inclusion where there is a curriculum requirement. •Toluene is highly flammable, produces harmful vapours and is suspected of damaging fertility and the unborn child. There is also evidence of health effects due to long term exposure and it is toxic to aquatic organisms. It requires storage separate from incompatible substances in a flammable liquids cabinet. It should be handled in a fume cupboard and waste should not be allowed to go down the sink, but collected for disposal via a waste contractor.• Controls to minimise the risk of exposure to this chemical include:

- using it in an operating fume cupboard;
- wearing Personal Protective Equipment (PPE) i.e. safety glasses, PVA gloves (such as viton or PVA. Note: if no PVA gloves are available, one can double glove with nitrile gloves, but remove the gloves if they become contaminated), laboratory coat or apron;
- using small quantities;
- restricting the use to Year 11 and 12 students and staff only.

?-galactosidase is an enzyme that catalyzes the breakdown of the substrate lactose (a disaccharide sugar) into two monosaccharide sugars: galactose and glucose. An initial search for this enzyme confirms your comment regarding the high cost of reagents(1).

Enzymes are biologically active proteins. All enzymes in powder form are considered hazardous, due to the potential inhalation of enzyme dust or aerosols, which can lead to sensitisation and allergic reactions. They are also irritating to the eyes, respiratory system and skin. Always use practices that do not generate dust or aerosols. However, in dilute aqueous solutions they are generally considered to be a low hazard. It is also important to understand that enzymes, when dissolved into solution, are much less stable than in powder form and lose their activity quickly. Therefore, it is best to prepare only what is required just before use, and recognise that the solution may need to be kept at a particular temperature during an activity. For more details see our previous question Enzyme preparation for experiments.

ONPG (2-Nitrophenyl ?-D-galactopyranoside) is a colourimetric substrate for the detection of ? galactosidase activity. Whilst not considered hazardous, it is still recommended not to generate any dust and wear appropriate PPE such as gloves, safety glasses and if required a dust mask.

Microbiology hazards:

The activity requires a high level of staff training in microbiology as well as extremely close supervision of students.

1. The activity involves the subculturing of a Risk Group 1 microorganism (*E. coli* K–12) and would require laboratory facilities that comply with Physical Containment Level 1. Subculturing is a specialised technique requiring sound knowledge and expertise to minimise the risks involved. It is a skill developed with much practice. This procedure is not permitted in some jurisdictions so your school would need to find out and comply with your school jurisdiction or governing body regarding this type of activity. When working with microorganisms, it is best to treat them all as potential pathogens[(2)]. The *E. coli* K–12 strain, which is a Risk Group 1 microorganism, is not considered pathogenic to healthy individuals, but may present a higher risk to people who may be immunosuppressed or immunocompromised.
2. The type of media used in schools should not select for pathogens such as selective or enriched agars. Nutrient broth or agar•are simple media which support the growth of a wide variety of bacteria and moulds and are suitable for use in school laboratories. In this activity, the addition of lactose to the growth medium provides an additional carbon source and induces the gene that produces ? galactosidase in the *E.coli*.
3. The recommended temperature for the incubation of microorganisms in schools is at room temperature or up to a maximum of 30° C to minimise the likelihood for growth of potential human pathogens that are adapted to human body temperature. The growth rate of *E.coli* will increase in response to an increase in temperature in the 25–37° C range, with 37° C being the optimum [(3,4)]. Whilst incubating *E.coli* at 37° C may be acceptable where good aseptic technique is used, it is difficult to guarantee good aseptic technique in a school setting, therefore we recommend incubating at 30° C, which will produce growth at a slower rate and reduce the risk of encouraging the growth of human pathogens.
4. The use of a pressure cooker or autoclave is required for the sterilisation of bacterial cultures before disposal.

Science ASSIST is in the process of developing guidelines for microbiology in Australian schools. The guidelines are due for release late 2016.

In the meantime, we recommend that before schools embark on working with microorganisms, they should ask the following questions and perform a site-specific biological risk assessment.

- What microorganism is being used? Is it a *Risk Group 1* microorganism?
- Do the school facilities comply with the requirements of Physical Containment Level 1 laboratories?
- Does the school have the necessary equipment for sterilisation and decontamination procedures?
- Do the staff have training in microbiological skills?
- What manipulations are being performed with the microorganism? Are methods being used to eliminate or minimize exposure to potentially infectious material via aerosols,

splashes, ingestion, absorption and accidental inoculation?
- Are any staff or students wishing to participate in microbiological activities immunocompromised or immunosuppressed (include those who are pregnant or may become pregnant, or are living with or caring for an immunocompromised individual)? These individuals are more prone to infections. If so, then they should consult a doctor to determine whether their participation is appropriate.

In addition, the answer to the following question also contains links to earlier questions and other resources:

Microbiology, 2016 draft of the new senior syllabus

Alternative activities:

The activity that you refer to cites another activity considering the enzyme ?-galactosidase(5). Depending upon the desired learning outcome, this activity could be a suitable alternative, which does not require the use of toluene or the culturing of a microorganism. However, it does still involve the significant cost of purchasing the enzyme.

Alternatively, other enzyme activities using less expensive enzymes could be conducted.

References:

(1) '?-Galactosidase from *Escherichia coli',* Sigma-Aldrich website,• https://www.sigmaaldrich.com/US/en/product/sigma/g5635•(Updated August 2019)

(2) University of Sydney. 2013. 'Microbiology', https://intranet.sydney.edu.au/services/safety-wellbeing/standards-guidelines.html••(Accessed September 2016)

(3) Farewell, A. and Neidhardt, F.C. 1998. *Effect of Temperature on In Vivo Protein Synthetic• Capacity in Escherichia coli*, Journal of Bacteriology, 180. 4704-4710. https://journals.asm.org/doi/pdf/10.1128/jb.180.17.4704-4710.1998

(4) 'B1 - Escherichia coli, K-12 strain, live broth' Southern Biological Website,• https://www.southernbiological.com/bacteria-e-coli-k-12-strain-live-broth/•(Updated May 2019)

(5) 'Investigating the effect of competitive and non-competitive inhibitors on the enzyme B-galactosidase' Science and Plants for Schools website, http://www.saps.org.uk/attachments/article/95/SAPS%20-%20Inhibitors%20on%20enzyme%20beta-galactosidase%20-%20Scottish%20Highers.pdf (Accessed September 2016)

'2-Nitrophenyl ?-D-galactopyranoside' Safety Data Sheet, Please find the latest version on the Sigma-Aldrich website: https://www.sigmaaldrich.com

'Aseptic techniques', Nuffield foundation website, https://practicalbiology.org/standard-techniques/aseptic-techniques (Accessed September 2016)

'Biology –Genetic control', BBC Higher Bitesize website, (Reference no longer available)

'Gene induction: ?-galactosidase in E. coli', Nuffield Foundation website, https://practicalbiology.org/genetics/controlling-gene-expression

'Maintaining and preparing cultures of bacteria and yeasts', Nuffield foundation website, https://practicalbiology.org/standard-techniques/maintaining-and-preparing-cultures-of-bacteria-and-yeasts (Accessed September 2016)

'Practical Biology Student Sheet: Gene induction: ?-galactosidase in E. coli', Nuffield Foundation website, https://web.archive.org/web/20181221085337/https://www.nuffieldfoundatio... (Original resource no longer exists, this archived copy provided by the Internet Archive January 2020)

‘Regulation of the Lactose System’ in Griffiths A.J.F., Gelbart W.M., Miller JH, et al. 1999. *Modern Genetic Analysis*, W.H. Freeman: New York. National Center for Biotechnology Information website,•https://www.ncbi.nlm.nih.gov/books/NBK21402/

'Standard Health and Safety guidance', Nuffield foundation website, https://www.nuffieldfoundation.org/standard-health-safety-guidance (Accessed September 2016)

'Toluene (methylbenzene)', Australian Government National Pollutant Inventory website, http://www.npi.gov.au/resource/toluene-methylbenzene (Accessed September 2016)

‘Toluene’ Safety Data Sheet, Chem Supply website, https://www.chemsupply.com.au/documents/TA0141CH75.pdf (August 2013)

Science ASSIST. 2018. Chemical Management Handbook for Australian Schools –Edition 3, Science ASSIST website, https://assist.asta.edu.au/resource/4193/chemical-management-handbook-au... (See Laboratory notes on•Enzymes)

Enzyme Technical Association (ETA). Nd. ‘Working Safely With Enzymes’, Enzyme Technical Association (ETA) website, https://www.enzymetechnicalassociation.org/wp-content/uploads/2017/11/Wo... (Accessed via https://www.enzymetechnicalassociation.org/documents/)

‘SAFETY - Working with enzymes’, National Centre for Biotechnology Education University of Reading website, http://www.ncbe.reading.ac.uk/SAFETY/enzymesafety.html (2017)

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Genetic modification of bacteria

Posted by Anonymous on Wed, 2019-03-13 17:34

Genetic modification of bacteria: I'd like to make transgenic bacteria by placing a jellyfish gene producing Green Fluorescent Protein (GFP) into *E. coli*. I know that genetic modification is quite tightly regulated, but I can't seem to find any information on whether this is allowed to be done in schools or not.

I understand that you can buy kits for it but can you tell me if this is an OK experiment to conduct at school?

Voting:
No votes yet

Year Level:
Senior Secondary
Laboratory Technicians:
Laboratory Technicians

Showing 1-1 of 1 Responses

Answer by labsupport on question Genetic modification of bacteria

Submitted by sat on 13 March 2019

Regulation

The Office of the Gene Technology Regulator website has the legal information regarding the regulation of genetically modified organisms, see https://www.ogtr.gov.au/resources/publications/gmos-schools A link to a **Fact Sheet - GMO kits in Schools** is provided on this site and contains the information that you require**.**

Suitability of this activity for schools

It is important to be aware of the risks and safety issues regarding the microbiological aspects of these kits and to confirm if the required techniques and procedures are allowed in your school jurisdiction.

If your school jurisdiction allows, then this activity is permissible provided that a site-specific biological risk assessment has been conducted and approved by your school. (See below). Detailed information for this activity has been provided in a previous Q&A Transformation of E.coli with pFluoroGreen, some of which is repeated below.

Subculturing – This activity requires *E.coli* cultures to be subcultured from both solid and liquid media. The specialised technique of subculturing requires sound knowledge and expertise to minimise risks involved. Many jurisdictions do not allow cultures to be opened for any manipulation due to the significant risks of contamination and growing unknown microorganisms.

Incubation temperature –This activity requires growth at 37 ^{0}C as the *E.coli* will not grow well at temperatures below this. School jurisdictions recommend incubation of microorganisms at room temperature up to a maximum of 30^{0}C and not at 37^{0}C to minimise the likelihood for growth of human pathogens.

Selective media –The use of simple media such as nutrient agar is recommended for use in schools. Selective or enriched media which encourages the growth of pathogens is not advised for use in schools.

Use of penicillin – This activity requires the addition of an antibiotic (ampicillin) to agar, which produces a selective medium for the growth of *E.coli* which contains the gene for ampicillin resistance. Ampicillin is also a member of the penicillin family of antibiotics and staff or students who may be allergic to penicillin should avoid all contact.

Sterilisation and decontamination –The genetically modified bacteria produced need to be killed and not released into the environment. The use of an autoclave is the method of choice to decontaminate microbial cultures and waste. This activity suggests using 10% bleach (a disinfectant) as an alternative if an autoclave is not available. Science ASSIST does not recommend the use of 10% bleach (chemical sterilisation) as it is an unsatisfactory alternative to autoclaving. It has a number of limitations and is less effective against spores.

Other microbiology considerations

There are many other aspects to conducting microbiology in schools that must be considered before proceeding.

Firstly, schools must ensure that they have the required facilities and equipment and the necessary staff training to be able to manage the risks of microbiological work.

Secondly, schools should choose the microorganism with the lowest level of risk that will meet the learning outcomes.

Thirdly, before, schools embark on working with microorganisms they should ask the following questions and perform a site-specific biological risk assessment.

- What microorganism is being used? Is it a Risk Group 1 microorganism?
- Do the school facilities comply with the requirements of Physical Containment Level 1 laboratories?
- Does the school have the necessary equipment for sterilisation and decontamination procedures?
- Do the staff have training in microbiological skills?
- What manipulations are being performed with the microorganism? Are methods being used to eliminate or minimise exposure to potentially infectious material via aerosols, splashes, ingestion, absorption and accidental inoculation?
- Are any staff or students wishing to participate in microbiological activities immunocompromised or immunosuppressed (include those who are pregnant or may become pregnant, or are living with or caring for an immunocompromised individual)? These individuals are more prone to infections and they should consult a doctor to determine whether their participation is appropriate.

Science ASSIST has produced GUIDELINES for best practice for microbiology in Australian schools. See https://assist.asta.edu.au/resource/4196/guidelines-best-practice-microbiology-australian-schools

We recommend that your school is familiar with the content of this guide before contemplating the delivery of practical activities in microbiology. In particular, see pp 12-13 for section 3.1 Risk assessment.

We have previously answered the following related questions, which can be viewed on our website:

Using E. coli bacteria in schools

Gene induction experiment?

Transformation of E.coli with pFluoroGreen

References and further reading:

‘Activity 4: Transformation of *E. coli* using green fluorescent protein’, The American Phytopathological Society website, https://www.apsnet.org/EDCENTER/K-12/TEACHERSGUIDE/PLANTBIOTECHNOLOGY/Pa... (Accessed March 2019)

‘Fact sheets’, Office of the Gene Technology Regulator website, https://www.ogtr.gov.au/resources/publications/gmos-schools (Link updated November 2021)

Science ASSIST. 2017. *GUIDELINES for best practice for microbiology in Australian schools*, Science ASSIST website, https://assist.asta.edu.au/resource/4196/guidelines-best-practice-microbiology-australian-schools

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Growing mould on bread

Posted by Anonymous on Mon, 2016-06-06 09:54

Growing mould on bread: Hi..I have some students wanting to grow mould on bread then inoculate agar plates with the mould from the bread then add different oils to see how they react to the mould..these are yr 12 students doing their eei..Would this be allowed?

Voting:•
Cancel rating
No votes yet
Rate
Year Level:•
Senior Secondary
Laboratory Technicians:•
Laboratory Technicians

Showing 1-1 of 1 Responses

Growing mould on bread

Submitted by sat on 17 June 2016

In brief:

A student experimental investigation studying the effect of oils on moulds is an interesting exercise. Essential oils are known to possess antiviral, antibacterial, antifungal and insecticide properties[1] and have become popular as a natural, non-toxic agent for cleaning and sanitising.

The method described does not align with all jurisdictional policies and safe procedures for microbiological work in schools. The main concerns are:

1. **Opening cultures**: The opening of zip-lock bags or Petri dishes containing mould growth by students will allow aerosols of fungal spores to be released into the environment with the risk of causing allergic reactions and /or asthmatic attacks. All plates and bags used for growing fungi and moulds **should be kept closed** immediately after inoculation and incubation **and never reopened** to prevent the dispersal of fungal spores. Growth should only be viewed in unopened containers in which they were grown.
2. **Unknown microorganisms:** The identity of mould and micro-organisms grown on the bread will be unknown and cannot be guaranteed to be classified as Risk Group 1 micro-organisms. The majority of school laboratories are classified as Physical Containment 1 (PC1) laboratories where only Risk Group 1 microbes are allowed. If the organisms are unknown, then the containers should not be opened and not subcultured.
3. **Subculturing:** The method requires students to perform subculturing. Subculturing of micro-organisms is where a new microbial culture is made by transferring some cells from a previous culture to a fresh growth medium. Subculturing is a specialised technique not allowed in some jurisdictions. Persons should have training in handling microorganisms to an appropriate level of microbiological understanding and technical expertise in order to manipulate microorganisms and apply correct aseptic techniques. Subculturing should only be conducted using known microorganisms, which are RG1. Students should not subculture from cultures that they have inoculated because of the risk of contamination of unknown micro-organisms.
4. **Waste disposal:** an autoclave or pressure cooker is required to sterilise agar plates before disposal.

Alternative Method:

Methods using commercially available pure non-pathogenic cultures are recommended. Paper discs saturated with essential oils may be placed on agar plates by students prior to mould inoculation by microbiologically trained teachers or technicians. See our list of School science suppliers for suppliers of suitable Risk Group 1 cultures, agar plates and paper discs.

Additional information:

Please refer to previous questions to ASSIST on growing bread moulds:

students investigating mould and bacterial growth on food items

Mould investigations extra questions

Most school laboratories are classified as Physical Containment Level 1 (PC1) if they conform to the requirements set out in Section 5 of Australian and New Zealand Standard AS/NZS 2243.3:2010 Safety in Laboratories. This means they are suitable for work with microorganisms where the hazard levels are low and require no special containment equipment, and is suitable for work with microorganisms from Risk Group 1[2]

Bread slices for mould growth should be placed in zip lock bags or Petri dishes that have been sealed with 4 pieces of sticky tape. These containers should never be re-opened. A closed container reduces the liberation of spores grown from moulds that cause contamination in the laboratory and are a hazard to human health. It is highly probable that unknown micro-organisms will grow in addition to the anticipated mould. Until further

classification and identification has taken place,

Science ASSIST recommends that before schools embark on working with microorganisms they should ask the following questions and perform a site specific biological risk assessment:

- Do the school facilities comply with the requirements of PC1 laboratories? Generally, Australian school science laboratories are classified as Physical Containment level 1 (PC1) and this is only **if** they conform to the requirements specified in Section 5 of AS/NZS 2243.3:2010 Safety in Laboratories –Microbiological safety and containment. At this level they are only suitable for work with microorganisms where the hazard levels are low, and where laboratory personnel can be adequately protected by standard laboratory practice[3]. Microorganisms that are classified as Risk Group 1 are the only group that should be handled in PC1 laboratories.
- Does the school have the necessary equipment for sterilisation and decontamination procedures?
- Does the staff have training in microbiological skills?
- What microorganism is being used? Is the strain of microorganism likely to harm human health?
- What manipulations are being performed with the microorganism? Are methods being used to eliminate or minimize exposure to potentially infectious material via aerosols, splashes, ingestion, absorption and accidental inoculation?
- Are any staff or students wishing to participate in microbiological activities immunocompromised or immunosuppressed (Include those who are pregnant or may become pregnant, or are living with or caring for an immunocompromised individual)? These individuals are more prone to infections. If so, it has been suggested that they should consult a doctor to determine whether their participation is appropriate[4].

Useful websites:

- 'Health effects of mould –What are the risks?', Mould assessment Australia website, http://mouldassessment.com.au/ (Accessed June 2016)
- Society for General Microbiology. 2006. *Basic Practical Microbiology: A Manual*, Microbiology Online website, http://www.microbiologyonline.org.uk/file/ca2189fba3b39d24c5a44c1285d008...
- Internet Journal of Microbiology

References

[1] Krisch J, Tserennadmid R, Vág gvölgyi C. 2011. 'Essential oils against yeasts and moulds causing food spoilage' in Mé ndez-Vilas, A (Ed.)*Science against microbial pathogens: communicating current research and technological advances*, Formatex website, https://web.archive.org/web/20171118151650/http://formatex.info/microbiology3/book/1135-1142.pdf•(Original resource no longer available February 2020. This copy provided by the Internet Archive).

[2] Australian Standards AS NZS 2243.3-2010. *Safety in Laboratories. Microbiology safety and containment.* Sydney.

[3] 'Microbiology', University of Sydney WHS website, https://intranet.sydney.edu.au/services/safety-wellbeing/standards-guidelines.html

(Accessed June 2016)

[4] American Society for Microbiology. 2012. *Guidelines for Biosafety in Teaching Laboratories*, Universitat Autònoma de Barcelona website, http://www.uab.cat/doc/teaching_lab_ASM

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Society for General Microbiology. 2006. *Basic Practical Microbiology: A Manual*, Microbiology Online website, http://www.microbiologyonline.org.uk/file/ca2189fba3b39d24c5a44c1285d008...

Handling cow manure in science labs

Posted by Anonymous on Fri, 2016-10-21 12:43

Handling cow manure in science labs: I was hoping someone might be able to help me with a request I have received from the Ag department here.

They want to us the science lab and equipment to carry out a prac examining cow manure. I want to check if there are regulations with regard to handling manure (only teachers will carry out the prac.)

Voting:•

No votes yet

Year Level:•

7
8
9
10
Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Handling cow manure in science labs

Submitted by sat on 01 November 2016

In brief: Science ASSIST does not recommend practical activities examining cow manure be performed in the school science laboratory.

School laboratories designated specifically for science practical activities are usually, but not always constructed to PC1 standard. School science laboratories do not have suitable containment facilities for examination of cow manure. Risks to students and staff include zoonotic diseases from unknown microorganisms (bacteria and viruses) and parasites[1].

Further information:

A Physical Containment Level 1 (PC1) laboratory is a classification given to laboratories with certain physical structures that enable the safe handling of material likely to contain microorganisms that are classified as Risk Group 1 microorganisms. *"Physical containment is the term used to describe procedures and structures designed to reduce or prevent the release of viable organisms into the outside environment."*[2]

Further, s4.3.2 states:

"The organisms used should generally be classified as Risk Group 1"[2]

Only risk group 1 microorganisms from a trusted source should be used in a PC1 laboratory. Cow manure should not be handled in the school science laboratory as the facilities are inadequate to safely handle the unknown and potentially pathogenic microorganisms.

Biological samples collected from cattle may contain zoonotic diseases. These are diseases that can be transmitted from animals and their environments to humans[3]. Zoonotic diseases can be spread by indirect contact with animal faeces and bodily fluids or aerosols.

The most notable zoonotic diseases from cattle manure is Q fever. Transmission is by inhalation of dust that can be contaminated with faeces[3] and cause flu-like symptoms that can be treated with antibiotics[4]. Q fever is a notifiable disease.

References:

[1] 'Pathogens and Potential Risks Related to Livestock or Poultry Manure'. eXtension Foundation website http://articles.extension.org/pages/8967/pathogens-and-potential-risks-related-to-livestock-or-poultry-manure (Accessed October 2016)

[2] This extract from AS/NSZ 2243.3:2005, *Safety in laboratories, Part 3: Microbiological safety and containment* is reproduced with permission from SAI Global Ltd under Licence 1407-c117

[3] S.A. Health. 2015. *Animal contact guidelines. Reducing the risk of illness associated with animal contact*, SA Health website, http://www.sahealth.sa.gov.au/wps/wcm/connect/e0947b00492e1a49ac0afd9006... (accessed October 2016)

[4] 'Health and Safety Fact Sheet Q fever in the School Environment', Qld Department of Education, https://education.qld.gov.au/initiativesstrategies/Documents/factsheet-q-fever.pdf#search=Health%20and%20Safety%20Fact%20Sheet%20Q%20fever%20in%20the%20Schoo

•(Link updated May 2019)

‘Animal health and diseases’,•Queensland Department of Agriculture and Fisheries website,• https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/land-management/health-pests-weeds-diseases/overview/animal-health•(Link updated May 2019)

‘Animal Industries’, Queensland Department of Agriculture and Fisheries website,• https://www.daf.qld.gov.au/business-priorities/agriculture/animals•(Accessed October 2016)

‘Health and Safety Fact Sheet Q fever in the School Environment’, Qld Department of Education,•https://education.qld.gov.au/initiativesstrategies/Documents/factsheet-q... (Link updated May 2019)

National Health and Medical Research Council. 2013.•*Australian code for the care and use• of animals for scientific purposes 8th•Edition’*, NHMRC website,• https://www.nhmrc.gov.au/about-us/publications/australian-code-care-and-use-animals-scientific-purposes/australian-code-care-and-use-animals-scientific-purposes-code•(Link Updated May 2019)

SA Health. 2015.•*Animal contact guidelines. Reducing the risk of illness associated with animal contact*, SA Health website, http://www.sahealth.sa.gov.au/wps/wcm/connect/e0947b00492e1a49ac0afd9006...

Inoculating agar plates and sealing them

Posted by Anonymous on Wed, 2015-05-27 09:58

Inoculating agar plates and sealing them: Could you advise the correct procedure for innoculating agar plates, and in particular, sealing them? I have always followed the "Microbiology - Safety Considerations" by Sheryl Hoffmann, with tape over the edge on three sides of the plate, not sealing around the entire plate. I have commenced at a new school this year and need help to convince and change from sealing the whole plate.

Voting:

No votes yet

Year Level:
Senior Secondary
Laboratory Technicians:
Laboratory Technicians

Showing 1-2 of 2 Responses

Inoculating agar plates and sealing them

Submitted by sat on 03 June 2015

Safety issues are a significant consideration in microbiology, as there is a potential for infectious hazards. It is the strict observance of correct procedures, which enables students and staff to work safely with microorganisms. When working with microorganisms, it is best to treat them all as potential pathogens [(1)].

Currently in Australia, some microbiological activities are permitted in some jurisdictions and not others. Therefore, you should check the activities permitted in your jurisdiction before proceeding. Science ASSIST is in the process of consulting authorities in order to make nationally consistent sensible and workable recommendations for best practice in school microbiology.

It is important to be aware of the possible hazards and risks before working with microorganisms. Therefore, Science ASSIST recommends that a risk assessment is carried out and appropriate control measures be put into place. Science ASSIST has developed a one page risk assessment template to help with this (see Risk Assessment Template).

Inoculation techniques commonly used in schools:

The following link contains good general information on practical microbiology including detailed procedures for the following inoculation techniques.

http://www.microbiologyonline.org.uk/file/ca2189fba3b39d24c5a44c1285d008...

Microorganisms can be inoculated onto agar plates in school science laboratories by various methods.

1) Inoculation of plates via air exposure (settle plates):

Petri dishes are left open to the air in various places in the laboratory for a period of time before lids are replaced, sealed with 4 pieces of sticky tape and incubated. Plates should not be left open in areas such as toilets.

2) Inoculation by direct contact.

Microorganisms are transferred directly to an agar plate by touching the surface of the agar with an item such as a coin. Touching the agar with your finger tip is not recommended, as this could allow for the growth of pathogens.

3) Inoculation of plates with sterile swabs from environmental samples:

A sterile swab is moistened in sterile broth or water and wiped over the area to be sampled. The swab is then moved over the surface of the agar plate in a zig-zag manner [(2)] to transfer any microorganisms. The swab can be disposed of into the rubbish as it has not been used to swab areas that contain any pathogens. As an added precaution, the swab could be placed into a freshly prepared disinfectant solution such as 0.25% sodium hypochlorite for 2 hours before disposal into the rubbish.

4) Inoculation of plates with bacteriological loops from food samples such as yoghurt or cheese:

A heat sterilised loop can be used to sample from a yoghurt or cheese specimen. The loop is used to smear the sample either in a zig-zag manner over the surface of the agar, as described above, or placed onto a section of the surface of an agar plate and then streaked out for single colonies as described below.

Note: The above cultures are considered "wild cultures" and should **not be opened or subcultured**. The agar plates should be sterilised before disposal. When observations are complete, the plates should be decontaminated by sterilising in an autoclave or pressure cooker before disposal into the waste bin. Agar plates must be placed into an autoclavable bag, such as an oven bag, for sterilisation at 110 kPa/15psi, 121° C for 15–20 minutes in an autoclave or pressure cooker before disposal.

Remember to label the base of the plate around the edge [3] rather than in the middle, where any growth could be obscured, and incubate the plate upside down to prevent any condensation that forms on the lid from dripping onto the agar affecting the colonies growing on the surface.

Sealing agar plates:

The complete sealing of Petri dishes during incubation should be avoided, as this may generate an anaerobic environment inhibiting the growth of aerobic microorganisms and promoting the growth of potentially anaerobic pathogens (See below for more information). Science ASSIST recommends that the lid and base of the Petri dish be taped with 4 pieces of sticky tape [2, 3] to allow for aerobic conditions and to prevent accidental opening of the plate during incubation. Plates can be sealed with sticky tape, or preferably Parafilm, completely around their circumference prior to allowing students to examine them. This will prevent any exposure to moisture or drips that may seep out of the Petri dish, which are potential sources of infection, as well as keeping the lid securely attached to the base. All observations must occur with the Petri dish taped. Parafilm is a laboratory sealing film with unique properties. It is a stretchy, waxy film that is very good at moulding around tops of test tubes, bottles, flasks and around petri dishes to provide a leakproof seal. It is much more effective than sticky tape.

Essential Background Information:

Facilities:

School science laboratories are classified as (PC1) Physical Containment level 1, if they comply with the requirements of AS/NSZ 2243.3-2010. Safety in laboratories. Part 3. Microbiology safety and containment. PC1 laboratories are suitable for work with risk group 1 microorganisms only. These are infectious microorganisms that are "*unlikely to cause human, plant or animal disease*" and "*where laboratory personnel can be adequately protected by Standard Laboratory practices*" [4].

Anaerobic microorganisms:

The growth of anaerobic microorganisms, those that cannot be grown in the presence of oxygen, should be avoided in school laboratories. Anaerobes are widely distributed in nature and are potentially pathogenic (capable of causing disease) when removed from their normal

environments [5]. Most anaerobes fall under Risk Group 2 or 3 microorganisms which are not to be handled in PC1 laboratories and are associated with many illnesses, for example, dental infections, abscesses, pneumonia and appendicitis. It is important that procedures and techniques that are used when dealing with microbes in the school laboratory do not produce anaerobic conditions that may select for the growth of pathogenic anaerobic organisms.

Procedures to prevent the growth of pathogens:

In addition to not completely sealing agar plates during incubation, there are other procedures that should be carried out in school laboratories in order to prevent the growth of pathogenic organisms.

- When handling microorganisms, it is important to use aseptic techniques at all times. A significant risk associated with microbiology is the generation of microbial aerosols, where fine droplets of water containing cells and/or spores are released into the air.
- Aseptic technique is a fundamental skill in microbiology:
    - to avoid the contamination of culture media with unwanted microbes,
    - to prevent contamination of personnel and work surfaces, and
    - to prevent microbes from being accidently released into the environment.
- The type of media used should not select for pathogens.
    - **Nutrient agar** is a simple media which supports the growth of a wide variety of bacteria and moulds and is suitable for use in school laboratories.
    - Media designed to select for more fastidious microorganisms and pathogens such as Blood and MacConkey Agar **should not** be used.
- When culturing from the environment, samples **should not** be taken from areas likely to contain organisms harmful to humans, for example: body surfaces, coughs, sneezes, animal sources such as bird cages and unsanitary environments such as drains and toilets.
- Cultures should be incubated at **temperatures of 30° C or below** to avoid the growth of potential human pathogens that are adapted to human body temperature.

Precautions when inoculating agar plates.

- Wash hands with soap and water before and after working with microorganisms.
- Cover any cuts with a waterproof dressing and consider wearing disposable gloves.
- Make sure work surfaces are decontaminated before and after working with microorganisms with 70% ethanol.
- Make sure inoculating instruments (loops, swabs, pipettes and spreaders) are sterilised prior and after use.
- Make sure that inoculating instruments containing microbiological samples are not allowed to touch any surface other than the agar that requires inoculation.
- Flame the mouth of all test tubes and bottles both when the cap is removed and before it is replaced.
- Plates should be open for a minimum amount of time to minimise the risk of introducing any contaminants from the air.
- Inoculation should be carried out as quickly as possible to minimise introducing any contaminants.
- Work close to the Bunsen flame, as it provides an updraught that carries air away from

the workspace, so reducing contamination from the air.
- Have a bacterial spills kit available (freshly prepared 1% sodium hypochlorite, bucket ,mop, plastic waste disposal bags, paper towel, disposable gloves, safety glasses, mask, plastic disposable apron).

Subculturing:

Science ASSIST is currently seeking advice regarding the following activites in schools. Currently they are permitted in some jurisdictions and not others. Teachers supervising students carrying out these activities should have microbiological training.

1. Streak-plate method:

The principle of this method is the gradual dilution of an inoculum of bacteria over the surface of an agar plate to produce single isolated pure colonies. A small amount of sample is placed onto a section of the surface of an agar plate with either a sterile swab or flamed inoculating loop. This is called the initial inoculum. The loop is sterilised and used to spread out the initial inoculum in one direction to make several streaks. This is referred to as the first set of streaks. The loop is sterilised again by flaming and the streaking process repeated 2–3 more times, each time going back into the previous set of streaks. Following incubation, single colonies should be seen in the final set of streaks. Each colony is produced from a single bacterial cell as it multiplies.

2. Inoculation of plates with pipettes and glass spreaders to produce lawn plates:

Sterile cotton-wool-plugged graduated or Pasteur pipettes can be used to deliver 2–3 drops of bacteria from nutrient broth cultures on to the surface of an agar plate. A sterile glass spreader is then used to spread the drops evenly over the surface of the agar. This technique is used to prepare a lawn or spread culture, where the entire surface of the plate is uniformly covered with bacteria. It is commonly used for testing antimicrobial substances such as antibiotics and disinfectants, or for performing colony counts. The pipette and spreader should be decontaminated by autoclaving or placing into a disinfectant solution immediately after use and before cleaning.

Glossary:

Anaerobic microorganisms:

Microorganisms that do not require oxygen for growth. Oxygen is not used to obtain energy and is toxic to these microorganisms. They are often called strict or obligate anaerobes.

Facultative anaerobic microorganisms:

Microorganisms that grow in either the absence or the presence of oxygen. They can metabolise energy aerobically or anaerobically. Oxygen is not toxic to these microorganisms.

Pathogen:

A microorganism that is capable of causing disease.

Subculture:

The aseptic transfer of a microorganism from one agar plate to another fresh agar plate to allow it to continually grow.

References:

(1) 'Microbiology' University of Sydney WHS website October 2013. https://intranet.sydney.edu.au/services/safety-wellbeing/standards-guidelines.html

(2)•'Guidelines for best practice for microbiology in Australian schools'. Science ASSIST website,•https://assist.asta.edu.au/resource/4196/guidelines-best-practice-microb... (Added October 2019)

(3) Society for General Microbiology UK. 2006. *Basic Practical Microbiology, A Manual* . Microbiology Online website: http://www.microbiologyonline.org.uk/file/ca2189fba3b39d24c5a44c1285d008...

(4) Standards Australia. 2010. AS/NZS 2243 *Safety in Laboratories, Part 3: 2010 Microbiological safety and containment*. Sydney, Australia.

(5) Hentges, David J. 'Anaerobes: General Characteristics' in Baron S, (Editor) 1996. *Medical Microbiology*. 4th edition. University of Texas Medical Branch: Galveston (TX). National Center for Biotechnology Information website https://www.ncbi.nlm.nih.gov/books/NBK7638/

NSW Department of Education and Communities 'Chemical Safety in Schools (CSIS)' resource package. NSW DEC website https://education.nsw.gov.au/ DEC Intranet, login required.

'Microbes all around us' Nuffield Foundation website https://practicalbiology.org/environment/what-lives-where (Accessed May 2015)

'Aseptic Techniques' Nuffield Foundation website https://practicalbiology.org/standard-techniques/aseptic-techniques (Accessed May 2015)

Inoculating agar plates and sealing them

Submitted by sat on 11 June 2015

For full details of Inoculating agar plates and sealing them, please see the answer posted on 03/06/2015

Further information on the gas permeability data for Parafilm M indicates that when used as a• **single layer**•**it will allow sufficient oxygen exchange**•to promote the growth of aerobic microorganisms and inhibit the growth of potential anaerobes. •Petri dishes should only be wrapped with a single layer and a small overlap of Parafilm during incubation to allow adequate gas exchange. Wrapping Parafilm around a Petri dish•**more than once should be avoided**•and will be sufficient to stop any gas exchange creating an undesirable anaerobic environment.•[1]

The product information sheet states the gas permeability (rates corrected to 760 mm pressure) to be:

- *Oxygen: 150 cc/m2 /24 hours*
- *Carbon dioxide: 400 cc/m2 /24 hours (both at about 22.8 ℃, 50% relative humidity (R.H.)*
- *Water vapour: 0.88 g/m2 /24 hours (37.8 ℃ and 90% R.H. vs desiccant).*[2]

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1. Tilbrook, Dr Peta. 2015. Technical Services Manager, Department of Environment and Agriculture, School of Science, Curtin University, WA. Personal communication.

[2]•Sigma-Aldrich,•*Product Information •–Parafilm®M,•* Sigma-Aldrich website• https://www.sigmaaldrich.com/deepweb/assets/sigmaaldrich/product/documents/421/110/p7543pis.pdf •(Accessed June 2015)

Laboratory Signage & Waste Disposal

Posted by Anonymous on Wed, 2016-01-27 20:44

Laboratory Signage & Waste Disposal: I would like to know if it's mandatory for school laboratories to have a biological sticker on the front door of a prep room and on a 30 degree incubator?

I have worked in research laboratories where Physical Containment Facilities Level 2 (PC2 labs) require a biological sticker because they use cell lines and bacteria to transform competent cells. I'm wondering what the term biological hazard refers to, all microorganisims such as mould, yeast, fungi and bacteria or only microorganisms that pose a threat to health, such as those generally cultured over 37 degrees? Do food industries also have to have biological hazard stickers on entrance doors, if they deal with microorganisms? For example, the cheese industry deals with moulds, the wine industry and bakeries with yeast.

My other question pertains to chemical waste management. Is it acceptable to place organic solvents and heavy metal liquid mixtures in a fume hood to evaporate the majority of liquid and dispose of the remaining sludge via landfill eg: general garbage?

Many thanks with your assistance.

Voting:

Average: 5 (1 vote)

Year Level:

7
8
9
10
Senior Secondary

Laboratory Technicians:

Laboratory Technicians

Showing 1-1 of 1 Responses

Laboratory Signage & Waste Disposal

Submitted by sat on 05 February 2016

Biological Hazards

Biological hazards or biohazards are organisms or products of those organisms that are harmful to human health and other living things. According to Safework Australia:

'Biological hazards are organic substances that pose a threat to the health of humans and other living organisms. Biological hazards include pathogenic micro-organisms, viruses, toxins (from biological sources), spores, fungi and bio-active substances. Biological hazards can also be considered to include biological vectors or transmitters of disease'[1]

'Exposure to biological hazards is therefore widespread and the risk of exposure is not always obvious'.[1]

Signage for Laboratories Using Microorganisms

Signs are used to inform personnel and visitors of potential hazards in the workplace.

The international biological hazard symbol is recognised worldwide as an indication of the presence of a biohazard. It is also used to identify rooms, equipment, containers etc., that either contain, or are contaminated with, a biological hazard.

The recommendation from the World Health Organisation (WHO) is that the international biohazard warning symbol be displayed prominently on doors to all laboratories and work areas where microorganisms of **Risk Group 2 or higher** are handled and/or stored.

Australian Requirements

The AS/NZS 2243.3:2010 Safety in Laboratories ~~-~~ Microbiological safety and containment states:

'5.2 REQUIREMENTS FOR PC1 LABORATORIES

5.2.1 General

A sign complying with Appendix D showing the level of containment, together with hazard symbols as appropriate and any access restrictions should be prominently displayed at the entrance."[2]

The biological hazard symbol according to Appendix D is a black symbol on a yellow background. General microbiology laboratories should also have the laboratory containment

level indicated on the sign in black letters as below.

Microbiological Laboratory Hazard Sign

Image not found
file:///var/www/vhosts/assist.asta.edu.au/httpdocs/sites/assist.asta.edu.au/files/Biohazard%20sign.jpg

School Science Laboratories

Generally, school science laboratories are classified as Physical Containment level 1 (PC1), **if** they conform to the requirements specified in Section 5 of AS/NZS 2243.3:2010 Safety in Laboratories - Microbiological safety and containment. If they conform to these requirements, then they are only suitable for work with microorganisms where the hazard levels are low, and where laboratory or facility personnel can be adequately protected by standard laboratory practice. This level of facility with its practices and equipment is usually suitable for secondary school teaching laboratories and undergraduate teaching laboratories.

Microorganisms that are classified as Risk Group 1, are the only ones that should be used in PC1 laboratories. Risk group 1 microorganisms are pathogens that present low individual and community risk - microorganisms that are unlikely to cause human, plant or animal disease. However, it should be understood that many of these microorganisms are capable of causing disease, given the appropriate circumstances. They are often referred to as opportunistic. People who are immunocompromised or immunosuppressed are more at risk. Higher levels of Physical Containment are required for handling microorganisms of Risk Groups 2-4.

Science ASSIST recommendations

Since microbiology activities are not conducted in every laboratory all year round, Science ASSIST recommends that a sign only be displayed at the entrance to the laboratory and/or preparation rooms whenever microbiological agents are being handled. The sign should be removed when biohazards are no longer present. This sign should include the biohazard symbol and laboratory containment level. Any access restrictions, plus contact information for responsible persons, should also be included.

A biohazard symbol should also be displayed on equipment such as incubators, fridges, freezers or containers when microorganisms are being stored. Again, this can be removed when the biohazard material has been removed.

There is no requirement to provide biohazard signage for food handling areas in the school environment.

Additional Information

As recommended by the World Health Organisation (WHO), Australian Standards have classified infectious microorganisms into four groups according to the degree of risk to humans, animals, plants and the environment. This classification system takes into account:

- the pathogenicity of the agent;
- the mode of transmission and the host range of the agent;
- the availability of effective preventative measures; and

- the availability of effective treatment.

Physical containment is the term used to describe facilities and procedures designed to reduce or prevent the release of viable organisms into the outside environment.• In Australia, laboratories are classified into four levels of Physical Containment (PC 1-4). The level of containment must be of at least the level appropriate for the risk group of the microorganisms being used in the laboratory. That is, PC1 for RG1; PC2 for RG2 etc.

Chemical waste management

Regarding the disposal of hazardous waste, in general, it would not be acceptable to place organic solvents and heavy metal liquid mixtures in a fume hood to evaporate the majority of liquid and dispose of the remaining sludge via landfill. The recommended procedure is to safely store the chemical waste in appropriately labelled chemically compatible bottles for collection by a licenced waste disposal contractor.

Disposal of organic solvents

It is best practice to store waste organic solvents in separate containers as either Halogenated Organic Waste or Non-halogenated Organic Waste for collection by a licensed waste contractor. **Halogenated organic wastes** are those which contain chlorine, bromine or iodine; in schools, the most commonly encountered halogenated organic waste would be dichloromethane, or products of bromination reactions, such as dibromocyclohexane.• **Non-halogenated organic waste** includes solvents such as cyclohexane, hexane, heptane, ethyl acetate, alkenes and alcohols. Mixtures of halogenated and non-halogenated waste should be treated as halogenated waste.

While it is not prohibited in Australia to evaporate volatile waste in a fume cupboard, it is not considered best practice, as this introduces untreated waste into the atmosphere (this method of waste disposal is prohibited in the USA).• However, a local risk assessment may find that it is safer to evaporate these solvents if your school generates small amounts and if your waste pickups are few and far between.

It is best practice to not dispose of organic solvents down the drain.• It is prohibited to dispose of a mixture containing a layer of solvent which floats on the surface of the water (i.e. is water-immiscible).

Some water authorities will accept solutions containing very small amounts of flammable solvents, such as ethanol or acetone, which are miscible with water.• Check with your local water authority for their trade waste acceptance limits.

Disposal of heavy metal waste

Solutions of heavy metal waste should not be poured down the drain. It is best to collect different heavy metal waste solutions in separate waste bottles. If you have a waste solution that only contains the one type of metal ion, it is best to treat or store this separately; i.e., don’t generate mixtures of different types of waste unnecessarily.

Evaporation of the water from a solution of a mixture of heavy metals in an operating fume

cupboard is an acceptable procedure. The sludge produced should be placed in a labelled bottle and stored for collection by a licenced waste contractor.

Other considerations when collecting and storing chemical waste for disposal

- Record on the bottle the substances which are added.• The list of contents must be updated whenever a new type of waste is added.
- Chemical waste should be segregated in accordance with chemical compatibility and Dangerous Goods class whilst waiting for collection.
- It is important to keep chemical waste to a minimum. The use of micro-techniques should be considered if practical.
- Waste management could be incorporated in the learning activity to demonstrate the chemical principles.

More information on containers and labelling can be found in our questions: Disposal of silver nitrate solid and Organic waste.

Information and contacts for local waste water regulators can be found in our question on organic chemistry.

Science ASSIST is developing detailed information on handling chemical waste, which will be available in the coming months.

References:

[1] Safe Work Australia. 2011. 'National Hazard Exposure Worker Surveillance: Exposure to Biological Hazards and the Provision of Controls against Biological Hazards in Australian Workplaces', Safe Work Australia• website http://www.safeworkaustralia.gov.au/sites/SWA/about/Publications/Documen...

[2] Australian Standards AS NZS 2243.3-2010. *Safety in Laboratories –Microbiological safety and containment.* Reproduced with permission from SAI Global Ltd under Licence 1407-c117

Centers for Disease Control and Prevention. 2009. *Biosafety in microbiological and biomedical laboratories (BMBL)* 5th Edition. Atlanta, USA. https://www.cdc.gov/biosafety/publications/bmbl5/

Kindler, Lee. n.d. *Signs and safety,* Safe-T1 website, http://www.safe-t1.net.au/assets/files/resource/Safety&signs.pdf (Accessed 1 February 2016)

'Microbiology', University of Sydney website,https://intranet.sydney.edu.au/services/safety-wellbeing/standards-guidelines.html••(Accessed October 2015)

'Warning sign –Biohazard authorised Personnel only', Brady Australia website,• https://www.bradyid.com.au/warning-sign-biohazard-authorised-personnel-o... (Link Updated November 2021)

World Health Organization. 2004. *Laboratory biosafety manual.* Third edition. World Health Organization. Geneva. https://www.who.int/csr/resources/publications/biosafety/Biosafety7.pdf

looking at decomposers -Micro biology experiment

Posted by Anonymous on Fri, 2016-06-03 08:35

looking at decomposers -Micro biology experiment: This micro biology experiment looks at fungi and bacteria on grass. With the Biological controls ACT and the concerns of late about cultivation unknowns bacteria on agar plates from swabbing surface in a PC1 LAB in a school environment I wondering if this decomposers experiment should be conducted?

I would be collecting samples from the school grounds and the possible fungi spore that would be in the grass samples are Stinkhorns, Cyanthus Striatus, Leratiomyces ceres and chlorophyllum molybdites these are very common fungi in the school grounds. But for the bacteria this is harder to say. Other than the common grass bacillus we have been know to have Melioidosis in the soil in Cairns BUT in saying this not to our knowledge in the school soil. Also we have cane fields close to the school i was wondering if I should be concerned about the possible of rat urine on the grass and therefore possibility of Lymphocytic choriomeningitis. it is common here from handling sugar cane during harvest time which it is now. The rats leave the field so the oval area could be affected

The experiment requires to wipe non sterilized grass cutting of agar plates and sterilized grass cutting over agar plates and incubate for 24hrs at 37C

So give this I am wondering if my concerns are justified. Could you please look into this and give me some safety guidelines please?

Voting:•

No votes yet

Year Level:•

7
8
9
10
Senior Secondary

Laboratory Technicians:•

Showing 1-1 of 1 Responses

looking at decomposers -Micro biology experiment

Submitted by sat on 14 June 2016

In brief:

School policies: Currently there are differences between the state/territory educational jurisdictional policies on whether certain microbiological activities can be carried out. Schools are advised to check what activities are permitted in their jurisdiction/school sector before proceeding to work with any microorganisms.

It is important to be aware of the possible hazards and risks, so that appropriate controls can be put into place before working with microorganisms.

Through further correspondence we have obtained further details of this activity. There are several concerns with this activity.

Collection of grass specimens: Precautions would be required for the collection of grass samples to reduce the risk of exposure to unknown microorganisms.

Unknown microorganisms: The activity you describe will produce 'wild cultures' which will not be identified and hence the possibility of isolating pathogens. The Petri dishes should be sealed and never opened after incubation and whilst conducting observations. Due to your tropical location you have indicated a number of potential microorganisms of concern.

Sterilising forceps: Sterilising forceps in a Bunsen flame for 1 minute will result in the forceps becoming extremely hot and the risk of severe burns. Forceps are safely sterilised by wrapping in foil and placing in an autoclave or pressure cooker at 15psi, 121^{o}C for 15minutes.• Several forceps can be sterilised for each group at a time. An alternative is to soak the forceps in 70% alcohol for 10min, air dry and wrap in aluminium foil avoiding touching the ends.

Paper bags in a hot oven for 15 minutes: The method does not specify the temperature of the oven for sterilising. A hot air oven needs to be run at 160^{o}C for 2-3 hours to sterilise[1]. The 15 minutes suggested will not be sufficient to sterilise and regular paper bags will not survive the high dry heat temperatures[2]. Special sterilisation paper bags are available for use in steam sterilisers.

Incubation temperature: The method specifies an incubation temperature at around 37^{o}C. The recommended incubation temperature for schools is at temperatures of 30^{o}C or below to avoid the growth of human pathogens.

Decontamination procedure: The method does not explain that the plates should be

sterilised in an autoclave or pressure cooker prior to disposal.

Science ASSIST recommends that before schools embark on working with microorganisms they should ask the following questions and perform a site specific biological risk assessment:

- Do the school facilities comply with the requirements of PC1 laboratories? Generally, Australian school science laboratories are classified as Physical Containment level 1 (PC1) and this is only **if**•they conform to the requirements specified in Section 5 of AS/NZS 2243.3:2010 Safety in Laboratories –Microbiological safety and containment.• At this level they are only suitable for work with microorganisms where the hazard levels are low, and where laboratory personnel can be adequately protected by standard laboratory practice [3]. Microorganisms that are classified as Risk Group 1 are the only group that should be handled in PC1 laboratories.
- Does the school have the necessary equipment for sterilisation and decontamination procedures?
- Do the staff have training in microbiological skills?
- What microorganism is being used?
- What manipulations are being performed with the microorganism? Are methods being used to eliminate or minimize exposure to potentially infectious material via aerosols, splashes, ingestion, absorption and accidental inoculation?
- Are any staff or students wishing to participate in microbiological activities immunocompromised or immunosuppressed (Include those who are pregnant or may become pregnant, or are living with or caring for an immunocompromised individual)? These individuals are more prone to infections. If so, it has been suggested that they should consult a doctor to determine whether their participation is appropriate [4].

Biological risk assessment: According to *Biosafety in microbiological and biomedical laboratories* (BMBL)[5], the following five steps should be considered:

1. Identify agent hazards and perform an initial assessment of risk.
2. Identify laboratory procedure hazards
3. Make a determination of the appropriate biosafety level and select additional precautions indicated by the risk assessment.
4. Evaluate the proficiencies of staff regarding safe practices and the integrity of safety equipment.
5. Review the risk assessment with a biosafety professional,

If after conducting a detailed risk assessment you have determined that your school can manage the risks, the following procedures are recommended to prevent the growth of any pathogenic microorganisms.

- When culturing from the environment, samples should **not** be taken from areas likely to contain human pathogens.
- The type of media used should not select for pathogens.
    - **Nutrient agar** is a simple media which supports the growth of a wide variety of bacteria and moulds and is recommended for use in school laboratories.
    - Selective media designed to select for more fastidious microorganisms and pathogens such as Blood and MacConkey Agar **should not** be used.

- The lid and base of the Petri dish should be taped with 4 pieces of sticky tape [6] to allow for aerobic conditions and to prevent accidental opening of the plate during incubation. Plates can be sealed with sticky tape or preferably Parafilm completely around their circumference prior to allowing students to examine them. This will prevent any exposure to moisture or drips that may seep out of the Petri dish which are potential sources of infection, as well as keeping the lid securely attached to the base. All observations of any 'wild cultures' must occur with the Petri dish taped. Wild cultures should never be subcultured in a school laboratory.
- When handling micro-organisms it is important to use aseptic techniques at all times. A significant risk associated with microbiology is the generation of microbial aerosols, where fine droplets of water containing cells and/or spores are released into the air.
- Aseptic technique is a fundamental skill in microbiology
    - to avoid the contamination of culture media with unwanted microbes,
    - to prevent contamination of personnel and work surfaces and
    - to prevent microbes from being accidently released into the environment.
- Cultures should be incubated at **temperatures of 30^0C or below** to avoid the growth of potential human pathogens that are adapted to human body temperature.
- •The agar plates should be sterilised before disposal. When observations are complete the plates should be decontaminated by sterilising in an autoclave or pressure cooker before disposal into the waste bin. Agar plates must be placed into an autoclavable bag, such as an oven bag, for sterilisation at 110kPa/15psi, 121^0•C for 15-20 minutes in an autoclave or pressure cooker before disposal.

Science ASSIST has previously answered several questions relating to microbiology, see:

Inoculating agar plates and sealing them

Bacteria

Additional information:

Microbiology of soils: Soils contain a diverse range of microorganisms which include bacteria, fungi, algae and protozoa which are involved in the decomposition of plant materials as well as being involved in maintaining soil fertility and recycling nutrients. The rhizosphere (the area closely associated with the roots) of plant material is where much of the microbiological activity takes place[7]. The soil microbial community is influenced by many factors such as temperature, moisture, acidity or alkalinity, oxygen levels, organic matter and soil porosity.

Bacteria and fungi are the most important microorganisms involved in the decomposition process of plant materials.

Bacteria are the most predominant microorganisms present and play an important role in the early stages of decomposition of organic material, some are nitrogen fixers, some are sulfur oxidisers and• others help develop humus in soils and contribute to the smell associated with high organic matter[8].• Some bacteria are very sensitive to changes in the soil environment, while others have features such as resistant spores that allow them to remain in the soil for long periods[8]. Some can cause disease in plants, animals and humans. Bacillus species, Pseudomonas species[8] and Clostridium species are some examples of bacteria found in the

soil environment. There is also the emergence of the soil bacterium Burkholderia pseudomallei which is implicated in the infectious disease of humans and animals in the tropics[9]. This organism is able to be cultivated on Nutrient agar[10].

Fungi have roles in plant disease, organic matter decomposition and specialized functions in the rhizosphere. They dominate in the later stages of decomposition.• Examples of fungi commonly isolated from soils include Penicillium, Aspergillus, Fusarium and Mucor species [11].

Other: There is also the possibility of microorganisms being introduced via animal excretions in the area. Lymphocytic Choriomeningitis (LCM) if present may be a consideration in your situation. LCMV infections can occur after exposure to fresh urine, droppings, saliva, or nesting materials from infected rodents[12].

References

[1]Society for General Microbiology. 2006. *Basic Practical Microbiology: A Manual*, Microbiology Online website, http://www.microbiologyonline.org.uk/file/ca2189fba3b39d24c5a44c1285d008...

[2] 'Sterilization –Packaging and storing', Centers for Disease Control and Prevention website,• https://www.cdc.gov/oralhealth/infectioncontrol/faqs/packaging-storing.html (Link Updated November 2021)

[3] 'Microbiology', University of Sydney WHS website, https://intranet.sydney.edu.au/services/safety-wellbeing/standards-guidelines.html (Accessed June 2016)

[4] American Society for microbiology. 2012. *Guidelines for Biosafety in Teaching Laboratories*, Universitat Autònoma de Barcelona website, http://www.uab.cat/doc/teaching_lab_ASM

[5] U.S. Department of Health and Human Services. 2009. *Biosafety in microbiological and biomedical laboratories (BMBL)* 5th Edition. 2009. Section II Biological risk assessment. Centers for Disease Control and Prevention website, https://www.cdc.gov/biosafety/publications/bmbl5/

[6] 'Guidelines for best practice for microbiology in Australian schools'. Science ASSIST website, https://assist.asta.edu.au/resource/4196/guidelines-best-practice-microb.... (added October 2019).

[7] 'Microbiology of turfgrass soils'. Grounds maintenance website,• https://web.archive.org/web/20180206231202/http://grounds-mag.com/mag/gr... (Broken link replaced with archived version on the Internet Archive, September 2021)

[8] Reid, Greg and Wong, Percy. 2005. *Soil Bacteria*, New South Wales Department of Primary Industries website, http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0017/41642/Soil_bacteria.pdf

[9] 'Melioidosis', Centers for Disease Control and Prevention website, https://www.cdc.gov/melioidosis/ (26 January 2012)

[10] Weigel, L.M and Morse, S.A. 2009. 'Implications of Antibiotic Resistance in Potential Agents of Bioterrorism', p 1329 in Mayers, Douglas (Ed.) *Antimicrobial Drug Resistance. Volume 2 Clinical and Epidemiological Aspects.* Humana Press: New York. Google Books website, https://books.google.com.au/books?id=dl_IbfXOqe4C&pg=PA1329&dq=can+Burkh...

[11] 'Soil Fungi', Biological Sciences, University of Sydney website, https://canvas.sydney.edu.au/courses/7114.html (2004)

[12] 'Lymphocytic Choriomeningitis (LCM)', Centers for Disease Control and Prevention website, https://www.cdc.gov/vhf/lcm/transmission/index.html (6 May 2014)

'Dry heat sterilization', Wikipedia website, https://en.wikipedia.org/wiki/Dry_heat_sterilization (Accessed June 2016)

Garg, Nisha and Garg, Amit. 2015. *Textbook of Operative Dentistry*, Jaypee Brothers Medical Publishers: New Dehli. p 180. Google Books website, https://books.google.com.au/books?id=n2TJDryohrMC&lpg=PP1&dq=Textbook%20... (Updated March, 2017)

Jenkins, Abigail. 2005. *Soil fungi*, NSW DPI website, http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0020/41645/Soil_fungi.pdf

Standards Australia. 2010. AS/NZS 2243•*Safety in Laboratories, Part 3: 2010 Microbiological safety and containment*. Sydney, Australia.

'Melioidosis', Wikipedia website, https://en.wikipedia.org/wiki/Melioidosis (Accessed June 2016)

'Microbiology of decomposition', Wikipedia website, https://en.wikipedia.org/wiki/Microbiology_of_decomposition• (Accessed June 2016)

NT Government, Centre for Disease Control. 2015. *Meliodosis*, Northern Territory Health Department website, http://health.nt.gov.au/library/scripts/objectifyMedia.aspx?file=pdf/43/46.pdf&siteID=1&str_title=Melioido (December 2015)

'Pathogenic fungus', Wikipedia website, https://en.wikipedia.org/wiki/Pathogenic_fungus (Accessed June 2016)

Microbiology (cultivating temperatures)

Posted by Anonymous on Mon, 2015-08-31 10:27

Microbiology (cultivating temperatures): Hi, We are interested in buying a genetic modifying kit from BioRad. Website: http://www.bio-rad.com/en-au/category/pglo-plasmid-gfp-kits

I understand this procedure is allowed in schools (please correct me if I'm wrong), but it requires the plates to be grown at 37° C. From my understanding I can't find it written, hence my query I thought plates were not allowed to be grown at 37° C because they could grow pathogenic organisms. What temperature are plates allowed to be grown at in a school environment?

Voting:

No votes yet

Year Level:
9
10
Senior Secondary

Laboratory Technicians:
Laboratory Technicians

Showing 1-1 of 1 Responses

Microbiology

Submitted by sat on 14 September 2015

Science ASSIST recommends a risk assessment be conducted prior to the purchase and use of all biological materials so that all hazards can be identified and appropriate control measures implemented. Science ASSIST has developed some resources to help in this process, see AIS: Risk Management and risk assessment Risk Assessment Template.

Regarding the temperature at which agar plates should be grown in a school environment:

You are correct that microorganisms should not be incubated at 37° C. ;The recommended temperature for the incubation of microorganisms in schools is at room temperature or **up to a maximum of 30 ℃** to minimise the likelihood for growth of potential human pathogens that are adapted to human body temperature.[i] Science ASSIST advises against the incubation of microorganisms at 37 ℃.

Regarding the use of the genetic modifying kit being used in schools:

Science ASSIST is seeking further clarification on various aspects of this activity and will provide a detailed response as soon as possible.

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[i] Society for General Microbiology (SGM). 2006. *Basic Practical Microbiology –A Manual* . Reading UK. http://www.microbiologyonline.org.uk/file/ca2189fba3b39d24c5a44c1285d008...

Microbiology during COVID-19

Posted by Anonymous on Fri, 2020-05-22 12:19

Microbiology during COVID-19: Are there any additional precautions that should be taken? Science ASSIST has received a few questions on this topic, so we are combining them into one Q&A:

Q1 Should we be getting our students to wear surgical masks, protective eyewear and gloves when using microscopes to view microbes? The microbes relate to the year 12 NESA syllabus for testing microbes in food and water.

Q2 Is it safe to grow bacteria on an agar plate under school laboratory condition in this Covid environment. Have you come across a statement saying that we shouldn't carry out this experiment in school laboratory condition? Is it still safe to carry out this experiment as long as we adhere to all the safety procedures? What will you suggest?

Q3 At the moment, in the current COVID-19 environment, is it okay for students to do pracs involving nutrient agar Petri dishes and inoculating them using swabs from the environment (hard surfaces like light switches, floors etc). Not swabs from the body of course. And I am aware that the Petri dishes would be sealed and would not be opened once incubated. I understand that viruses don't grow in agar, but can they start! if the Petri dish grows some bacteria?? Is this a safe prac do to at the moment?

Voting:

No votes yet

Year Level:
Senior Secondary
Laboratory Technicians:
Laboratory Technicians

Showing 1-2 of 2 Responses

Microbiology during covid19

Submitted by sat on 22 May 2020

Microbiology during COVID-19

A site specific biological risk assessment should be conducted for all microbiological work as recommended in the Science ASSIST GUIDELINES for best practice for microbiology in Australian schools.

Viruses and their cultivation in the laboratory

There is no risk of the coronavirus growing on agar plates as it will not grow on bacteria and will not be propagated on the agar.

Viruses are unable to be grown on agar plates or in microbiological broths as viruses require a living host cell such as plant or animal cells in order to replicate. Specific cell culture systems or the use of embryonated eggs would normally be required. The exception is Bacteriophages that infect bacteria. These can be grown with bacteria on special agar plates; however these are not used in schools.[1, 2, 3, 4]

Wearing masks

Masks are not required if you are well and working with standard microbiological procedures, see

- **'How to protect yourself and others from coronavirus (COVID-19)'**, Australian Government Department of Health website, https://www.health.gov.au/news/health-alerts/novel-coronavirus-2019-ncov... (Accessed May 2020) and the link to the fact sheet **'Information on the use of surgical masks'** https://www.health.gov.au/sites/default/files/documents/2020/03/coronavi...
- **'Does wearing a mask help reduce my risk of COVID-19?'** Health Direct website, https://www.healthdirect.gov.au/coronavirus-covid-19-how-to-avoid-infect... (Accessed May 2020)

General note: Staff and students should not be at school if they are unwell, so there is no need to wear masks. If disposable masks are used, they must not be reused and must be removed and disposed of properly to avoid increasing risks of infection.

Wearing safety glasses

Safety glasses should be used when conducting microbiological activities including preparing microscope slides to protect from biological splashes and aerosols. They are not required for viewing prepared slides under a microscope, as they may also introduce new risks such as additional face touching.

Shared safety glasses should be cleaned/disinfected between users, see the Science ASSIST Q&As on this topic: Should shared safety glasses be decontaminated after each use? And safety glasses and assessing risks

Wearing gloves

Gloves are not a substitute for frequent handwashing and can pose a higher risk of spreading disease if not used correctly. See https://www.safeworkaustralia.gov.au/covid-19-information-workplaces/ind...

They are not required for standard microbiological procedures unless a person has cuts or other skin problems such as dermatitis.

In the current COVID-19 situation we recommend that gloves are worn if your school chooses to conduct environmental sampling to further minimize risks of infection, see below the section on Environmental sampling.[4]

Note: gloves are not appropriate if using Bunsen burners.

Using microscopes during COVID-19

Microscopes should be cleaned and disinfected in between use. See our question dedicated to this topic at Disinfecting Microscopes

Isolating microbes from food, water samples and environmental surfaces

Standard microbiological precautions apply, such as those contained in the Science ASSIST GUIDELINES for best practice for microbiology in Australian schools, i.e.

- Sampling can occur with sterile swabs or microbiological loops from
    - various water samples such as tap water, pond water, or flower water from a vase onto nutrient agar.
    - various food samples such as cheeses, yoghurts, fruits or any rotting vegetables onto nutrient agar.
    - suitable environmental surfaces such as laboratory benches, window sills, taps, computer keyboards, light switches and pens or pencils.(See next heading 'Environmental sampling' below for more information)

Note that these agar plates should never be opened or subcultured as they will contain

unknown wild microorganisms some of which may be pathogenic.

- Sampling should never occur from:
  - raw meats, or surfaces used in the preparation of raw meat
  - toilets or unsanitary locations
  - human body fluids
  - skin areas,
  - animal sources
  - soil samples

Environmental sampling

Environmental sampling poses an additional risk during this pandemic, due to the possible presence of the coronavirus on surfaces that are being sampled. I.e. touching something that someone has touched who has the virus.

Therefore, we recommend that gloves be worn by staff/students who are sampling from different environmental surfaces[4] and the observation of strict safe procedures:

- Do not touch your face whilst wearing the gloves
- Remove gloves correctly without touching the outside of the glove
- Wash hands thoroughly with soap and water or use hand sanitiser afterwards (note washing with soap and water is the preferred method)

Note: Schools have increased their cleaning regime and there may not be many microbes present, however wearing gloves has the additional benefits of

- Providing an additional layer of protection if the current cleaning regime is reduced and we have a second wave of infection
- Providing an additional safeguard of excluding the swab takers microbes

For more information on this activity, see the ‘SOP: Microbes are everywhere’ contained in Attachment 1 in the GUIDELINES for best practice for microbiology in Australian schools.

Standard precautions apply as below.

The growth and subculture of pure cultures of microorganisms

Standard microbiological practice should be followed:

Aseptic techniques should be used to avoid generating microbial aerosols which can contaminate agar plates, students or staff, work surfaces and the environment These include:

- washing hands before and after work
- disinfecting benches before and after work,
- covering any cuts on the hands with a waterproof dressing or wearing gloves.

- wearing safety glasses to protect the eyes from any microbial aerosols.
- Using sterile swabs or bacteriological loops,
- working close to a Bunsen flame,
- flaming the mouth of all test tubes and bottles both when the cap is removed and before it is replaced
- opening plates for a minimum amount of time for inoculation
- sterilising all plates in a pressure cooker, or autoclave, at 15psi, 121℃ for 20-30 minutes before disposal.

Note: There must be no opening and no subculturing from plates or broths inoculated by students.

Other school requirements:

- Using only a general all- purpose medium such as nutrient agar which does not select for pathogens
- Taping agar plates closed with 4 pieces of sticky tape to prevent opening, but allowing air exchange to generate an aerobic environment.
- After incubation, the plates should **not be reopened** and should be sealed around the whole circumference to reduce the risk of students opening the plates before distribution to students for examination.
- Incubation of cultures between room temperature and 30℃ for 24-48hrs.

For more detailed information of microbiology practices, see GUIDELINES for best practice for microbiology in Australian schools.

Good hygiene during COVID-19

Good hygiene should be strictly observed such as is stated in the Australian Health Protection Principal Committee (AHPPC) statements, see https://www.health.gov.au/committees-and-groups/australian-health-protec...

As the information is being frequently updated it is good to check the latest advice. As of (24th April 2020) the latest advice for schools can be found at https://www.health.gov.au/news/australian-health-protection-principal-co...

In particular, see the sections on hygiene, routine care and environmental cleaning. The general hygiene advice is:

- Staff and students should stay away from school if unwell
- Everyone should practice good hygiene: wash hands regularly, cough into elbows, minimise touching face
- Clean and disinfect frequently used high touch surfaces and frequently used objects such as computers, photocopiers etc.

Safe Work Australia also has a wealth of good information related to the education and training sector, see https://www.safeworkaustralia.gov.au/covid-19-information-workplaces/ind...

References

[1] 'Isolation, Culture, and Identification of Viruses', Lumen Learning website, https://courses.lumenlearning.com/microbiology/chapter/isolation-culture... (Accessed 22 May 2020)

[2] 'Personal Study: Virus Culture', Simulab Lab Tech Training Website, http://simulab.ltt.com.au/4/laboratory/personalstudy/psVirusCulture.htm (Accessed 22 May 2020)

[3] 'Viral Cultivation and Physiology', Houghton Mifflin Harcourt website, https://www.cliffsnotes.com/study-guides/biology/microbiology/the-viruse... (Accessed 22 May 2020)

[4] Lloyd, Megan. 2020. Personal communication. Chair of the Education Special Interest Group of the Australian Society for Microbiology.

'Australian Health Protection Principal Committee (AHPPC)' Australian Government Department of Health website, https://www.health.gov.au/committees-and-groups/australian-health-protec... (Accessed 22 May 2020)

'Disinfecting Microscopes', Science ASSIST Q&A, Science ASSIST website, https://assist.asta.edu.au/question/4582/disinfecting-microscopes (21 May 2020)

'Does wearing a mask help reduce my risk of COVID-19?' Health Direct website, https://www.healthdirect.gov.au/coronavirus-covid-19-how-to-avoid-infect... (Accessed 22 May 2020)

'Education and training > General information'', Safe Work Australia website, https://www.safeworkaustralia.gov.au/covid-19-information-workplaces/ind... (29 April 2020) (Note: this page has several links to related information and state-based information and advice.)

'Good hygiene for coronavirus (COVID-19)', Australian Government Department of Health website, https://www.health.gov.au/news/health-alerts/novel-coronavirus-2019-ncov... (Accessed 22 May 2020)

'How to protect yourself and others from coronavirus (COVID-19)', Australian Government Department of Health website, https://www.health.gov.au/news/health-alerts/novel-coronavirus-2019-ncov... (Accessed 22 May 2020)

'Retail Gloves', Safe Work Australia website, https://www.safeworkaustralia.gov.au/covid-19-information-workplaces/ind... (29 Apr 2020)

‘Safety glasses and assessing risks’, Science ASSIST Q&A, Science ASSIST website, http://assist.asta.edu.au/question/3362/safety-glasses-and-assessing-risks (7 December 2015)

Science ASSIST. 2016. *GUIDELINES for best practice for microbiology in Australian schools*. Science ASSIST website, https://assist.asta.edu.au/resource/4196/guidelines-best-practice-microb...

‘Should shared safety glasses be decontaminated after each use?’ Science ASSIST Q&A, Science ASSIST website, https://assist.asta.edu.au/question/4552/should-shared-safety-glasses-be... (12 March 2020)

Microbiology during COVID-19

Submitted by on 26 May 2020

Great responses! Thank you.

Microbiology, 2016 draft of the new senior syllabus

Posted by Anonymous on Wed, 2016-08-31 09:11

Microbiology: 2016 draft of the new senior syllabus: In reference to the QLD Biology 2016 Draft Senior Syllabus: The Unit 2, Topic 2.2 Infectious Disease, (MANDATORY practical: Investigate the effect of an antimicrobial on the growth of a microbiological organism (via the measurement of zones of inhibition) AND Suggested practical: Investigate the efficiency of hand washing compared to alcohol-based antiseptic gels for reducing the bacterial load on hands using agar plates or other modelling activity).

Are there any regulations/guidance/training available for ALL staff involved ~~as~~ this unit, as it is, has potential for lots of "issues" for many schools.

I question growth of unknown bacteria from hands particularly.

Thanks.

Voting:•

No votes yet

Australian Curriculum:•
Biological Sciences
Year Level:•
Senior Secondary
Laboratory Technicians:•
Laboratory Technicians

Showing 1-1 of 1 Responses

Microbiology, 2016 draft of the new senior syllabus

Submitted by sat on 13 September 2016

In brief:

As at 7 March 2017, the Queensland Biology draft senior syllabus is undergoing further revision.[1]

School policies: Currently in Australia, there are differences between the state/territory educational jurisdictional policies on whether certain microbiological activities can be carried out. Schools are advised to check what activities are permitted in their jurisdiction/school sector before proceeding to work with any microorganisms. Schools should consider eliminating or substituting high-risk elements of activities that they are unable to mitigate.

Guidance: Science ASSIST has developed 'Guidelines for safe practice for microbiology in Australian schools'.•

Training: We are not aware of any current specific training programmes in microbiology for school science staff. It is essential that staff conducting activities in microbiology have received training in microbiology in order to be aware of and safely manage the risks.

Growth of unknown microorganisms: Regarding concerns about placing fingers directly on agar plates: the microbial growth on the agar from this activity will be microorganisms that are unknown and there is a risk that these may include human pathogens. The likelihood of this can be reduced by following safe procedures such as using only nutrient agar and incubating at < 30° C. Exposure to the growth of unknown microorganisms can be prevented by never opening the plates. Following incubation, plates should be sealed with Parafilm or similar to prevent students being able to open them.• The plates must be sterilised before disposal, as noted in the recommendations below.

Microbiology Risk Management

Science ASSIST recommends a site-specific biological risk assessment[2] be conducted where all hazards are identified and appropriate control methods implemented before commencing work on either of these activities.

Before schools embark on working with microorganisms, they should ask the following questions and perform a site-specific biological risk assessment similar to the following.

- **What microorganism is being used? Is it a *Risk Group 1* microorganism?** Microorganisms that are classified as Risk Group 1 are the only ones that should be used in PC1 laboratories, i.e. low risk ~~not~~ not associated with disease in healthy people. It should be noted that, even though the microorganisms are from RG1, some can still pose a low level of risk to the community as they can be capable of causing disease, if provided with appropriate conditions (referred to as opportunistic). People who are immunocompromised or immunosuppressed are at greater risk.
- **Do the school facilities comply with the requirements of Physical Containment Level 1 laboratories?**

School science laboratories are generally classified as Physical Containment level 1 (PC1), if they conform to the requirements specified in Section 5 of AS/NZS 2243.3:2010 Safety in Laboratories –Microbiological safety and containment [3]. If they do conform to these requirements, and there are many school labs that don't, then they are only suitable for work with microorganisms where the hazard levels are low, and where laboratory or facility personnel can be adequately protected by standard laboratory practice[4].

- **Does the school have the necessary equipment for sterilisation and decontamination procedures?** An autoclave or pressure cooker should be available for sterile preparation of agar/broth etc., and for decontamination[5].
- **Do staff have training in microbiological skills?** Staff should be trained in good microbiological technique, competency and confidence when performing procedures, interpretations and outcomes of activities, and competency in microbiological hazard awareness to maximise the student experience in microbiology.
- **What manipulations are being performed with the microorganism? Are methods being used to eliminate or minimize exposure to potentially infectious material via aerosols, splashes, ingestion, absorption and accidental inoculation?** Staff should have training in microbiological skills including: proficiency in aseptic technique to eliminate or minimize exposure to potentially infectious material via aerosols, splashes, ingestion, absorption and accidental inoculation; subculturing procedures; sterilisation; and decontamination procedures, and also have the ability to identify contamination of pure cultures. Suitable PPE should be provided, this includes lab coats and safety glasses. Cuts should be covered with a waterproof dressing and consideration should be given to the wearing of disposable gloves.
- **Are any staff or students wishing to participate in microbiological activities immunocompromised or immunosuppressed (include those who are pregnant or may become pregnant, or are living with or caring for an immunocompromised individual)?** These individuals are more prone to infections. If so, then they should consult a doctor to determine whether their participation is appropriate.

Additional information:

Activity: 'Investigate the effect of an antimicrobial on the growth of a microbiological organism"

Detailed instructions on the preparation of resources and running of this activity in class will be included in our forthcoming guidelines. Science ASSIST recommends the following.

- The activity should be conducted in suitable facilities by trained staff, with close supervision of students.
- Only low-risk microorganisms, such as RG1 microorganisms purchased from reputable biology suppliers, should be used in this activity. Refer to our science suppliers list.
- Schools should only use nutrient agar as a suitable growth medium for this activity.
- Appropriate PPE should be worn at all times. Cover any cuts with a waterproof dressing and consider wearing disposable gloves.
- Aseptic technique should be used by staff in the preparation of all material and by students when carrying out this activity.
- After inoculation and during the preparation for incubation, the plates should be kept

closed using either four pieces of tape or a single layer of Parafilm to allow for aerobic conditions. These plates should **never be reopened** after incubation.
- The incubation temperature recommended for schools is < 30° C. This temperature does not encourage the growth of pathogens potentially harmful to humans.
- Following incubation, plates should be sealed with Parafilm or similar to prevent students being able to open the plates when observing them.
- All cultures must be sterilised prior to disposal using an autoclave or pressure cooker.
- Wash hands with soap and water before and after working with microorganisms.

Antimicrobials suitable for this activity include:

- disinfectants such as household cleaners;
- antiseptics such as skin cleansers;
- antibiotics* –these are best purchased as discs pre-impregnated with a selected antibiotic.

*Safety Note: Antibiotics are commonly used in microbiology for antibiotic sensitivity testing. Caution with their use is required for several reasons: there are many people in the community who are sensitive or allergic to different classes of antibiotics, and their overuse or misuse can lead to the development of resistant microorganisms. Any antibiotic, including antibiotic discs, should not be handled if the person is allergic to that particular class of antibiotics. If antibiotic discs are used, they should be handled with clean forceps, which are then sterilised after use.

Activity: 'Investigate the efficiency of hand washing compared to alcohol-based antiseptic gels for reducing the bacterial load on hands using agar plates"

The current draft of the syllabus indicates this activity is a "suggested" activity. There have been concerns regarding placing fingers directly on agar plates. The resulting growth from this activity will be microorganisms that are unknown and there is a potential for human pathogens. Therefore, these plates should only be observed visually and never be opened. Science ASSIST recommends that, if schools opt to do this activity, the following safeguards be used.

- Only nutrient agar plates should be used as a suitable growth medium for this activity.
- After inoculation, and in preparation for incubation, the plates should be sealed using either four pieces of tape or a single layer of Parafilm to allow for aerobic conditions. These plates should **never be reopened** after incubation.
- The incubation temperature recommended for schools is < 30°C. This temperature does not encourage the growth of pathogens potentially harmful to humans.
- Following incubation, plates should be sealed with Parafilm or similar to prevent students being able to open the plates when observing them.
- Plates should be sterilised before disposal using an autoclave or pressure cooker.
- Wash hands with soap and water at the conclusion of the activity.

Further information:

The following is a useful document with some considerations for biological activities:

Queensland Department of Education. 2020. Queensland DoE website.• https://education.qld.gov.au/curriculum/stages-of-schooling/CARA/activity-guidelines/biological-activities•(Link updated May 2020)

Here are some Science ASSIST resources and previously answered questions referring to methods and considerations for microbiology activities:

SOP: Preparing agar plates

SOP: Operating a pressure cooker and autoclave

AIS: Sterilising agar

AIS: Links –Biological sciences safety

AIS: Links –Support for school science - links to training providers, manuals and publications

Use of antibiotics (Amoxycil) in experiments

Inoculating agar plates and sealing them

Agar plate experiments

Pressure cookers

Bacteria

Microbiology

use of tears in a school practical

Using human tears in an experiment

References

[1] 'Redeveloping and revising senior syllabuses', Queensland Curriculum and Assessment Authority website,•https://www.qcaa.qld.edu.au/senior/senior-subjects

[2] U.S. Department of Health and Human Services. 2009.•*Biosafety in microbiological and biomedical laboratories (BMBL)*•5th•Edition. 2009. Section II Biological risk assessment. Centers for Disease Control and Prevention website,• https://www.cdc.gov/biosafety/publications/bmbl5/•

[3] Standards Australia. 2010. AS *NZS 2243.3-2010. Safety in Laboratories –Microbiological safety and containment.* Sydney, Australia

[4] 'Microbiology', University of Sydney WHS website, https://intranet.sydney.edu.au/services/safety-wellbeing/standards-guidelines.html (October 2013)

[5] Science ASSIST. 2014. 'ASSIST Information Sheet: Sterilising agar', Science ASSIST website, https://assist.asta.edu.au/resource/648/ais-sterilising-agar

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Mould investigations extra questions

Posted by Anonymous on Thu, 2015-04-23 10:58

Mould investigations extra questions: I have some further questions regarding the mould investigations:

1. I prefer to double bag because we have had leaking bags in the past.

2. I find that 1-2 weeks is a bit too long. We are in Cairns, where it is mostly hot and humid, and I have found that even 1 week can be too long, the mould totally takes over. I usually put bags in the fridge once mould growth starts to get out of hand.

3. I asked about students dropping bread on various surfaces to see what grows on them, because we run a mythbuster elective. One group of students wanted to investigate the 3-second rule (that food is still okay to eat after it has been dropped on the floor for only 3 seconds). I found out afterwards that they dropped some slices on the floor in the toilets!

4. Would putting the bread in sealed ziplock bags encourage the growth of anaerobic organisms?

5. To avoid anaerobic growth on agar in petri dishes, is the correct advice to only tape them with 4 strips of sticky tape and not seal them completely?

Voting:•

Cancel rating

No votes yet

Rate

Australian Curriculum:•

The growth and survival of living things are affected by the physical conditions of their environment

Year Level:•

6

9

Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Mould investigations extra questions

Submitted by sat on 24 April 2015

Regarding your question about students investigating mould and bacterial growth on food items:

Q1. Regarding using double bags:

If you are happy to use double bags then that is quite acceptable, as it increases the containment of any aerosols, which is important and the reason why clear ziplock bags are used. However, using two bags may make it more difficult to observe the mould. If you were to use a single bag then sourcing and purchasing a good quality bag would be important, as there are different qualities of bags.

Q2. Regarding incubation times:

The incubation time for the mould cultures to grow will be dependent upon the growth conditions provided, as we know mould growth is dependent upon temperature and humidity. Consideration therefore needs to be given for the local climate and/or weather conditions. For example, moulds flourish in warm humid conditions and Northern Queensland fits this scenario during the summer months. In Tasmania, it can take up to two weeks for mould to grow even in summer.

Basically, there is no real set timeframe for incubation when controlled conditions are not in place. In this case, daily monitoring would need to be done to determine when mould growth is optimal. Placing the samples in a fridge ~~o~~ne that is designated for laboratory samples and does not contain food for human consumption ~~is~~ a good idea to slow down the growth of the mould. However, it must be understood that the mould will continue to grow under these low temperature conditions but at a slower rate. Perhaps conducting this experiment in the cooler non-humid winter months would be better, if possible. Although, even in your winter months you would expect reasonably fast mould growth.

Q3. Regarding dropping the bread on different surfaces:

As with all activities, a site-specific risk assessment should be conducted. As mentioned in the previous answer, sampling must not be taken from unhygienic environments such as drains, or areas exposed to body fluids such as toilets, or on surfaces on which meat has been handled, such as in the Home Economics Department. We understand that it is challenging when students are designing their own activities, but part of their process should also be to conduct their own site-specific risk assessment.

Q4. Regarding anaerobic organisms

Anaerobic bacteria, or anaerobes, are bacteria that do not need oxygen to live. In humans, these bacteria generally live in the gastrointestinal tract, but they may also be found in other places outside the body, including in the soil and water, in foods, and in animals. Some anaerobes are beneficial to humans, but others can cause illnesses, such as appendicitis, diverticulitis, and gingivitis.

Growth of anaerobic organisms:

Placing bread in ziplock bags should not encourage the growth of anaerobic organisms. Many microorganisms, in particular anaerobes, tend to be fastidious, (i.e., requiring specialized nutritional and growth conditions), which would not be provided by a slice of bread in a sealed plastic bag. Bread is not a suitable selective medium for isolating these organisms. Bread kept under these conditions goes mouldy because water, that evaporates from inside the bread, is trapped and makes the surface moist, providing good conditions for mould growth. Bread can occasionally spoil due to bacterial growth, either by the growth of bacilli from spores that survive baking, or by contamination with *Serratia marcescens* which turns the bread **red**. The presence of various inhibitory substances/preservatives in many types of bread keeps them from spoiling. This is an additional factor that would minimise the chances of microbes including anaerobes growing.

Provided the safety procedures are followed, the primary risk of growing mould on bread is the release of spore aerosols during the activity ~~h~~ence the control measure of using sealed containers or ziplocked bags.

If your risk assessment determines that there is concern that the students may open the bags, then the bread samples can be placed into petri dishes instead, which should be sealed with tape in 4 places. The use of petri dishes in this circumstance will provide a humid environment for the mould to grow but make it difficult for students to open and potentially release any spores.

Q5. Sealing Petri dishes with only 4 strips of sticky tape:

Not completely sealing petri dishes is a precaution required for school culture work using standard nutrient agar. This is a different activity from above with a different set of control measures and hazards as follows:

- The type of media used must not be designed to select for pathogens as does Blood and McConkey agar.
- Schools should only use risk group 1 microorganisms (as defined in AS2243.3) ~~t~~hose that pose low individual and community risk. Microorganisms that are unlikely to cause human, plant or animal disease.
- The incubation temperature should be restricted to an upper limit of 30° C to reduce the danger of isolating any pathogens adapted to human body temperature.
- A working knowledge of aseptic technique.

- Samples should not be taken from environments likely to contain organisms harmful to humans (e.g., body surfaces, coughs, sneezes and unsanitary environments such as drains and toilets).
- The agar plates are placed in an autoclavable bag, such as an oven bag, for sterilisation for 25 minutes (110kPa/15psi, 121° C) in an autoclave or pressure cooker before disposal.

Australian Standards AS NSZ 2243.3-2010. Safety in laboratories. Microbiology safety and containment.

Observing bread mould

Posted by Anonymous on Thu, 2019-05-09 13:59

Observing bread mould: Can we grow some mould on bread in a plastic bag and then open the bag to transfer some mould onto a glass slide, with glycerine and a coverslip to view under a microscope? Can we also transfer some onto an agar plate? We only have fume cupboards (no laminar flow cupboards) if that helps.

Voting:•
Cancel rating
No votes yet
Rate
Year Level:•
Senior Secondary
Laboratory Technicians:•
Laboratory Technicians

Showing 1-1 of 1 Responses

Answer by labsupport on question Observing bread mould

Submitted by sat on 09 May 2019

In brief:

It is permitted to grow and observe mould on bread in a sealed plastic bag or sealed Petri dish, however, it is not advisable to open the bag or Petri dish because of the hazards associated with the release of fungal spores.

Common household microorganisms associated with bread mould include *Rhizopus stolonifera, Penicillium sp., Aspergillus sp.* and *Cladosporium sp*. These are not considered

pathogens but are referred to as ‘opportunistic’. Opportunistic microorganisms are those able to cause disease if provided with appropriate conditions.

The intent to conduct activities beyond simple observation of bread mould in a sealed container requires a high level of staff training in microbiology and certain laboratory facilities.• Staff training includes knowledge and experience in aseptic techniques, sterilisation and decontamination procedures to recognise and control or manage the risk. •A minimum of PC1 facilities and equipment such as an autoclave or appropriate pressure cooker for sterile preparation and decontamination of waste are also required.

Fume cupboards, laminar flow cabinets and biological cabinets work differently for different purposes and differ in the level of protection provided to the user. We provide some further information below.

Science ASSIST recommends observing bread mould in sealed containers and providing alternate hands-on activities for students.

Opening a container with bread mould

The presence of fungal (dry) spores if kept in a sealed container such as a zip-locked bag or Petri dish, does not present a risk.

Opening a zip-lock bag or Petri dish containing mixed species of mould growing on bread to prepare a slide or subculture onto an agar plate introduces the risk of exposure to potentially hazardous fungal spores. A large amount of fungal spores too small to be seen with the naked eye would be released into the environment which will float in the air and disperse throughout the room increasing the normal load to about 2 orders of magnitude (M. Cole, personal communication, 12 April 2019).

- To healthy adults this may not present a problem, however if inhaled the opportunity exists for people with allergies, asthma, or those immunosuppressed to be adversely affected.
- The spores are likely to stay in the room for a long time, possibly for up to 4-5 weeks. (M. Cole, personal communication, 12 April 2019)
- Given that there are several different groups of teachers and students that may use the same science laboratory, the risks of adverse reactions extend beyond the staff and students who originally conducted the activity.
- Face masks as used in health care settings may not afford the level of protection required. Even if they did, one would need to consider the supply of these for everyone who would be subsequently working in that room, possibly for the next few weeks!
- Depending upon the presence and type of air-conditioning systems, these may spread the spores to rooms beyond the laboratory where the activity was conducted.

Therefore containers with bread mould should not be opened. The proposed activities would introduce further challenges and risks.

Preparing slides for microscope viewing

It is technically difficult to prepare slides of mycelium and spores for microscope viewing.

- It is most likely that students will create a slide with a mass of material on it which is tangled, and it will not be possible to discern any structures.
- Even experienced mycologists may have to prepare many slides before one is clear enough to identify the structures of a fungus.
- The manipulation of fungal cultures with forceps and needles also generates fungal spore aerosols adding to the load in the laboratory environment.

Subculturing mould from bread to an agar plate

The specialised technique of sub-culturing requires sound knowledge and expertise to minimise risks involved. Many jurisdictions do not allow cultures to be opened for any manipulation due to the significant risks of contamination and growing unknown microorganisms.

Fume cupboards and Biological Safety cabinets

Fume cupboards, laminar flow cabinets and biological cabinets work differently for different purposes and differ in the level of protection provided to the user.

- Fume cupboards are not designed for biological work.[1] They operate differently and are designed for use with chemical hazards, such as hazardous gases, vapours, fumes and dusts. They draw air away from you and protect you, the worker from chemical hazards.
- A Laminar flow cabinet directs air across the workspace and towards the user and the laboratory. It protects the specimen being used from contamination and offers no protection for the user or environment from any infectious materials/aerosols.
- A biological safety cabinet (BSC) depending on the class (I, II or III), can protect the user, the environment and the specimen being handled from contamination. Air is HEPA-filtered before release back into the environment.

The following document gives a brief comparison, see ‘Use of the Laboratory Fume-hood’. University of Wollongong website. https://smah.uow.edu.au/content/groups/public/@web/@sci/@chem/documents/doc/uow059174.pdf (May 2010)

Alternative activities

It is recommended that alternative practical activities are provided for students such as the use of:

- A **Dissecting microscope or magnifying glass** to view
  - bread mould through the lid of a sealed Petri dish or zip-lock bag. •
  - mould on other food items such as cheese, oranges or pumpkin by placing small pieces into a Petri dish, zip-lock bag or larger pieces into clear plastic containers with no holes (such as is used for supplying some products to the supermarket).
- A **Compound microscope** to view purchased prepared slides of the same or similar

moulds.
- A **BioViewer** to view photomicrographs of the same or similar moulds. A BioViewer is an instrument like a microscope which requires no power source, batteries or light source. Ambient light is utilised to magnify purchased photomicrographs.
- **Food based 'wet' microorganisms** for school microbiology activities, examples include yoghurt or wine or baking yeast in wet pack. If dry it will need rehydrating for 30mins prior to using.

Conducting microbiology activities in schools

Science ASSIST has produced "GUIDELINES for best practice for microbiology in Australian schools" see https://assist.asta.edu.au/resource/4196/guidelines-best-practice-microbiology-australian-schools.• We recommend that your school is familiar with the content of this guide before contemplating the delivery of practical activities in microbiology.

The school context is a highly variable environment, in particular the staff training in microbiology and science facilities.

When conducting a microbiology activity, it is important to consider what microorganism is being used and how it is being used. In particular, see chapter 3 and 4 regarding risk assessment; school work levels; staff training and microbiology rules. From page 13:

"Before schools embark on working with microorganisms they should ask the following questions and perform a site-specific biological risk assessment.

- *What microorganism is being used? Is it a Risk Group 1 microorganism?*
- *Do the school facilities comply with the requirements of Physical Containment Level 1 laboratories?*
- *Does the school have the necessary equipment for sterilisation and decontamination procedures?*
- *Does the staff have training in microbiological skills?*
- *What manipulations are being performed with the microorganism? Are methods being used to eliminate or minimise exposure to potentially infectious material via aerosols, splashes, ingestion, absorption and accidental inoculation?*
- *Are any staff or students wishing to participate in microbiological activities immunocompromised or immunosuppressed (include those who are pregnant or may become pregnant, or are living with or caring for an immunocompromised individual)? These individuals are more prone to infections and they should consult a doctor to determine whether their participation is appropriate."*

Science ASSIST has also produced a SOP: Growing fungi on bread[2].• This activity aligns with Science ASSIST'S **School Work Level 1**

School work level 1 is considered very low risk due to the type of microorganism used and the activity performed. Under this level, bread mould can be grown and observed in closed containers which are never opened.

Conditions of school work level 1 include:

- Limited to microorganisms used for food purposes and grown on substances on which they grow naturally.
- Growth conducted in closed containers at ambient room temperature.
- No agar plates used.
- No specialist training required for teacher or technician
- No special waste treatment required. Able to be placed into the regular waste or down the sink.

The higher school work levels require certain facilities and equipment and each one requires a higher level of staff training

We have also previously answered questions on similar topics

- https://assist.asta.edu.au/question/2690/students-investigating-mould-and-bacterial-growth-food-items
- https://assist.asta.edu.au/question/2782/mould-investigations-extra-questions
- https://assist.asta.edu.au/question/3865/growing-mould-bread

What the Australian Standards say:

The Australian Standards AS/NZS 2243.3-2010 *Safety in Laboratories Part 3 Microbiological safety and containment* states the following:

'Airborne fungal spores spread in a similar manner to aerosols. Cover or seal cultures of spore producing fungi to prevent dispersal' **5.2.3 Work Practices (PC1 Laboratories)**

'Fume cupboards and recirculating fume cabinets shall not be used when working with infectious materials' from AS/NZS 2243.3:2010 **Section 10.1 Chemicals**

'Microbiological work should be planned to limit the reliance on respiratory protective equipment (RPE). Most laboratory work with microorganisms transmissible to humans by the respiratory route is conducted in containment equipment such as a BSC' **10.2.5 Respiratory protection**

'The term 'face masks' is used to describe masks designed for use in health care, such as in operating rooms, medical and dental procedures. These types of masks are covered in AS 43 81. They are not for use where an additional degree of respiratory protection is required from the risk of airborne transmission of infection, and they do not meet the requirements for RPE specified in AS/NZS 1715' **10.2.5 Respiratory protection**[1]

References and further reading

[1] Standards Australia. 2010. AS/NZS 2243 *Safety in Laboratories, Part 3: 2010 Microbiological safety and containment*. Sydney, Australia. Reproduced with permission from SAI Global Ltd under Licence 1407-c117

[2] Science ASSIST. 2016. *GUIDELINES for best practice for microbiology in Australian schools* . Science ASSIST website, https://assist.asta.edu.au/resource/4196/guidelines-best-practice-microbiology-australian-schools (Page 84)

‘Bread Mold: How To Identify Types Of Mold’, Science Trends website, https://sciencetrends.com/bread-mold-how-to-identify-types-of-mold/ (26 July 2018)

Cole, Mary. 2019.• Personal communication. Agpath P/L; University of Melbourne.

‘Fungus is the next 'superbug' to threaten human health’, ABC News website, https://www.abc.net.au/news/2019-04-17/fungus-superbug-next-threat-to-human-health/11018652 (17 April 2019)

‘Molds On Food: Are They Dangerous?’, United States Department of Agriculture website,• https://www.fsis.usda.gov/wps/portal/fsis/topics/food-safety-education/get-answers/food-safety-fact-sheets/safe-food-handling/molds-on-food-are-they-dangerous_/ct_index (22 August 2013)

‘Mould’, NSW Government Department of Health website, https://www.health.nsw.gov.au/environment/factsheets/Pages/mould.aspx (22 May 2012)

‘Observing fungi in a petri dish’, Microbiology online website,• https://microbiologyonline.org/teachers/observing-microbes/observing-fungi-in-a-petri-dish (Accessed May 2019)

‘Potentially Hazardous Biological Agents’, The Society for Science & the Public website, •• https://www.societyforscience.org/isef/international-rules/potentially-hazardous-biological-agents/ (Accessed May 2019)

University of Wollongong. 2010. *Use of the Laboratory Fume-hood*, University of Wollongong website, https://smah.uow.edu.au/content/groups/public/@web/@sci/@chem/documents/doc/uow059174.pdf

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Observing growth on a slice of bread

Posted by Anonymous on Wed, 2020-04-08 09:23

Observing growth on a slice of bread: Is it OK for students to conduct a simple microbiological experiment at home using slices of bread which are rubbed on different surfaces and then incubated in a sandwich bag to encourage the growth of mould?

Voting:•

Cancel rating

No votes yet

Rate

Year Level:•

Foundation
1
2
3
4
5
6
7
8
9
10
Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Answer by labsupport on question Observing growth on a slice of bread

Submitted by sat on 08 April 2020

Science ASSIST strongly advises against any microbiological experiments being conducted at home.

There are risks associated with growing mould on slices of bread. These risks can be well controlled when conducted in the school science laboratory but cannot be guaranteed when conducted in the home environment.

The home environment has several limitations:

- adult supervision may be limited, if at all
- there may be younger (or disabled) siblings to consider
- students sometimes do unpredictable things, even if prompted by curiosity
- students and probably their at home supervisors don't have sufficient understanding of the risks associated with microbiological procedures; and the need to conduct a biological risk assessment.

What are the hazards?

Environmental sampling

Sampling environmental surfaces and incubating on bread (or agar plates, also referred to as Petri dishes) will lead to the growth of unknown microorganisms or 'wild' bacterial and fungal cultures, some of which may be pathogenic (a microorganism which can cause disease). Sampling should not be conducted from areas that are likely to contain pathogens such as toilet areas, human body fluids or skin and surfaces where raw meats are handled.[1]

With the current COVID-19 pandemic, we advise against conducting environmental sampling. Instead, we are being encouraged by the government, to routinely clean frequently touched hard surfaces with detergent/disinfectant solution/wipe.[2]

Growing mould on slices of bread

In a school setting this may be conducted using good quality zip lock bags.[1] However whilst the bread is placed in a sandwich bag for incubation, it is essential that bags are well sealed and **never opened.**

Release of mould spores:

- The opening of a bag or Petri dish containing any mould should not be permitted due to the release of fungal spores. These can spread like an aerosol increasing the normal load in the air which can remain in the environment for up to 4-5 weeks.
- Torn/leaking bags: This type of spill will also lead to spores being released and the need

to disinfect the contaminated surface.
- Many of the common bread moulds that are likely to grow are not considered pathogenic but are still regarded as opportunistic, meaning that given the appropriate conditions they are able to cause disease.
- The release of fungal spores is potentially hazardous for people who suffer with allergies, asthma or those who are more prone to infections. This includes people who are immunocompromised or immunosuppressed.

In a home environment: we have concerns that there is an increased likelihood that the bags may be opened releasing fungal spores and possibly aerosols of any other microorganism.

Biological risk assessment

When conducting a microbiology activity, it is important to consider what microorganisms are being used and how they are being used.

Before schools embark on working with microorganisms, they should ask the following questions and perform a site-specific biological risk assessment.

- What microorganism is being used? Is it a Risk Group 1 microorganism?
- Do the school facilities comply with the requirements of Physical Containment Level 1 laboratories?
- Does the school have the necessary equipment for sterilisation and decontamination procedures?
- Does the staff have training in microbiological skills?
- What manipulations are being performed with the microorganism? Are methods being used to eliminate or minimise exposure to potentially infectious material via aerosols, splashes, ingestion, absorption and accidental inoculation?
- Are any staff or students wishing to participate in microbiological activities immunocompromised or immunosuppressed (include those who are pregnant or may become pregnant, or are living with or caring for an immunocompromised individual)? These individuals are more prone to infections and they should consult a doctor to determine whether their participation is appropriate.[1]

Science ASSIST resources:

Science ASSIST has produced "GUIDELINES for best practice for microbiology in Australian schools" see https://assist.asta.edu.au/resource/4196/guidelines-best-practice-microb.... We recommend that your school is familiar with the content of this guide.

Note: In attachment 1, There is a SOP for 'Growing fungi on bread' and a SOP for environmental sampling titled 'Microbes are everywhere', both of which have detailed instructions and safety notes.

We have also previously answered questions on the use of bread mould. See:

- 'Students investigating mould and bacterial growth on food items', Science ASSIST website, https://assist.asta.edu.au/question/2690/students-investigating-mould-an... (11 March 2015)

- ‘Mould investigations extra questions’, Science ASSIST website, https://assist.asta.edu.au/question/2782/mould-investigations-extra-ques... (24 April 2015)
- ‘Growing mould on bread’, Science ASSIST website, https://assist.asta.edu.au/question/3865/growing-mould-bread (17 June 2016)
- ‘Observing bread mould’, Science ASSIST website, https://assist.asta.edu.au/question/4474/observing-bread-mould (5 May 2019)

References

[1] Science ASSIST. 2016. *GUIDELINES for best practice for microbiology in Australian schools*. Science ASSIST website, https://assist.asta.edu.au/resource/4196/guidelines-best-practice-microb...

[2] ‘Good hygiene for coronavirus (COVID-19)’, Australian Government Department of Health website, https://www.health.gov.au/news/health-alerts/novel-coronavirus-2019-ncov... (Accessed 8 April 2020)

Pressure cookers

Posted by Anonymous on Thu, 2015-11-19 17:50

Pressure cookers: I have read the SOP on preparing agar plates. Is it recommended to have the circular pressure gauge that has a series of numbers showing you the pressure as it goes up, or is it okay to use a good model Hawkins/Tefal etc. that has the ordinary pressure regulator on top. One of the models I have seen reaches 170° C.

I am looking to upgrade what is in stock at a school that only takes 100 ml conical flasks and looks like there is no pressure seal and cannot find a manual specific for the iSA pressure cooker.

Voting:•

No votes yet

Laboratory Technicians:•
Laboratory Technicians

Showing 1-1 of 1 Responses

Answer by barney41 on question Pressure cookers

Submitted by sat on 19 November 2015

In Brief

It is recommended that a pressure cooker used for the sterilisation of agar and microbiological waste be equipped with a pressure gauge that indicates the pressure and temperature within

the unit. The pressure cooker must be able to reach a pressure of 15 psi (103 kPa) and a temperature of 121°C to ensure items are sterilised.

Further, it is recommended that sterility verification strips be used to indicate that these conditions have been met, ensuring that sterility of the load has occurred.

When considering purchase of a pressure cooker, it should be kept in mind that many domestic pressure cookers do not meet these requirements. There are many pressure cookers available that are specifically designed for use in laboratories from various scientific suppliers. See the Science ASSIST School science suppliers list.

Additional Information

Effective sterilization is achieved when all viable organisms are eliminated[i]. The most effective and suitable method of sterilising agar is by using moist heat in the form of steam under pressure i.e. 121°C for 15 minutes at 15 psi (pounds per square inch). This method will denature & coagulate enzymes and other cell constituents in the bacterial cell including any spore formers. Sterilization can be guaranteed only when these parameters are reached. Sterilization of agar and plates is usually done in an autoclave or a commercially available pressure cooker with a gauge and the capacity to reach 15 psi. At a pressure of 15 psi inside the autoclave, the temperature is said to be 121°C. Exposure of articles at these parameters for 15 minutes sterilizes them. [ii]

A pressure cooker, (pressure steam steriliser) or an autoclave is commonly used in the laboratory to effectively sterilise microorganisms and agar. Pressure cookers and autoclaves reach the recommended temperature and pressure required to render most microorganisms and agar sterile.

To maintain sterilization at 121°C for 15–20 minutes at 15 psi (pounds per square inch), the following considerations must be given when purchasing a pressure cooker.

- Ensure the pressure cooker is an adequate size for the items to be sterilised. Space is required around items for steam to circulate.
- The pressure cooker must contain a pressure gauge and be able to reach a pressure of 15 psi (103 kPa) and a temperature of 121°C.

Note that some domestic pressure cookers do not meet these requirements.

For further information on the use of pressure cookers and sterilising see the following resource material developed by Science ASSIST.

AIS: Sterilising Agar: This ASSIST Information Sheet details how to sterilise agar. Microwave, pressure cooker or autoclave? Recommendations for best practice.

SOP: Operating a pressure cooker and autoclave: Standard Operating Procedure (SOP) and detailed method for operating a pressure cooker and autoclave.

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[i] http://textbookofbacteriology.net/control_2.html Control of Microbial Growth (page 1)

Kenneth Todar PhD

[ii] www.microrao.com/micronotes/sterilization.pdf Sridha Rao, Dept of Microbiology, JJMMC, Davangere

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students investigating mould and bacterial growth on food items

Posted by Anonymous on Wed, 2015-03-04 06:57

Students investigating mould and bacterial growth on food items: Are there any guidelines on how a prac investigating mould growth should be conducted? What safety measures and PPE have to be followed if students decide to grow mould on bread, cheese, fruit and vegetables? Is double bagging of food items enough? Are students allowed to drop bread on various surfaces, then bag the slice of bread to see what grows on it? How long are we allowed to let the bread sit in the bags for at room temperature? How should we dispose of the contaminated food items? There are so many questions regarding this prac, that seems so simple to start with.

Voting:•

Cancel rating

No votes yet

Rate

Australian Curriculum:•

The growth and survival of living things are affected by the physical conditions of their environment

Year Level:•

6

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

students investigating mould and bacterial growth on food items

Submitted by sat on 11 March 2015

Guidelines for investigating microorganisms in schools: There are many considerations regarding the use of microorganisms in school laboratories. Science ASSIST is currently consulting authorities in order to make nationally consistent sensible and workable recommendations for best practice in school microbiology. The activity you are describing has a low level of risk, provided safe operating procedures are followed, principally for containment of mould spores.

The Australian and New Zealand Standard AS/NZS 2243.3:2010 sets out requirements, responsibilities and general guidelines relating to safe handling and containment of microorganisms in laboratories.

Most school laboratories are classified as Physical Containment Level 1 (PC1), if they conform to the requirements set out in Section 5 of Australian and New Zealand Standard AS/NZS 2243.3:2010 Safety in Laboratories. This means they are suitable for work with microorganisms where the hazard levels are low and require no special containment equipment, and is suitable for work with microorganisms from Risk Group1[i]. Work at this level might, for example, include investigations with brewer's or baker's yeast and certain algae, protozoa or moulds.

The basic approach to working with microorganisms is to regard them all as potential pathogens [i]. It is the strict observance of correct procedures which enables students and staff to work safely with microorganisms. Aseptic technique is a fundamental skill in microbiology to maintain pure cultures whilst subculturing, to prevent microbes from being accidently released into the environment and infecting others in the laboratory.

Safe work practices: Behavioural management processes in science laboratories and practical work areas should ensure that staff and students are aware of any potential hazards for the particular activity to be undertaken.

Making sure safety issues are addressed and adjustments are made to meet the learning needs and maturity of students with adequate precautions in place will minimise any hazards.

It is important to conduct a site-specific risk assessment prior to the activity. Science Assist has developed a one-page risk assessment template that may be useful. See Risk Assessment Template.

Potential hazards: The release of Aerosols is the main hazard to consider during this activity. Aerosols are fine suspended particles of liquid containing microbial cells or spores, which can easily contaminate the laboratory. They are carried by air currents and increase the risk of infection by inhalation. Aerosols can be generated by spills.

Although the risks are very low for this activity, individuals who suffer from asthma, allergies or are immunosuppressed, may be more sensitive to exposure to spores and aerosols.

Here is a link to a fact sheet on moulds and health concerns:
http://www.health.nsw.gov.au/environment/factsheets/Pages/mould.aspx

What safety measures and PPE have to be followed for this activity?

- Awareness of students suffering from asthma, allergies or who are immunosuppressed is an important consideration.
- Studies of mould grown on bread, cheese, vegetables and fruit that are exposed to the air and allowed to go mouldy should be carried out in closed containers, such as sealed petri dishes or single plastic zip-lock bags.
- Samples must be sealed and never opened by students to minimise the spread of spores into the air, which could cause allergy or asthma attacks.
- Wear personal protective equipment, such as safety glasses. Consideration should be given to the wearing of aprons and face masks for high-risk individuals, in the unlikely event of a spill when examining the samples during spoilage, to provide protection from aerosols.
- No hand-to-mouth operations should occur (e.g. chewing pencils, licking labels).
- All exposed cuts and abrasions must be protected with suitable waterproof dressings before starting practical work.
- There should be no eating or drinking in the science laboratory. Food for human consumption must not be kept in refrigerators in which material for science activities is stored.
- Teachers, technicians and pupils should thoroughly wash their hands with soap and water after the activity and before leaving the laboratory. Facilities for this should be available within the laboratory.

Is double bagging of food items enough?

- Microorganisms with little or known risk such as moulds and yeasts can be studied in sealed containers that the students should not open.
- Using single zip-lock plastic bags is sufficient for reducing the possible risk of any spores being inhaled causing allergy or asthma.
- Double bagging would make it more difficult to see the mould growing due to condensation generated in the bags.

Are students allowed to drop bread on various surfaces, then bag the slice of bread and see what grows on it?

- There is no need to drop the bread onto various surfaces. Simply placing the bread or other items of food into a zip-lock bag with a little moisture and incubating in a warm location should be sufficient to allow for the growth of moulds.
- Fruit and vegetables are all safe to use along with dairy products (cheese, milk and yoghurt), and vinegar, brewer's and baker’s yeast.
- Moulds grown from most foods or ‘food-based mediums’ are allowed, but substances which pose a health risk are advised against (see below).
- Food spoilage should not be studied using meat or meat products because organisms, which cause food poisoning, may be present (e.g., poultry has a high risk of salmonella contamination).

- Particular care should be taken with surfaces on which meat has been handled such as in the Home Economics Department.
- Sampling must not be taken from unhygienic environments such as drains, or areas exposed to body fluids such as toilets.

How long should the bread be allowed to spoil in the bag at room temperature?

- Moulds grow best in warm, dark and moist conditions.
- Ensure sample bags are placed in a secure area away from student access.
- 1 to 2 weeks experiment time is required.

How to dispose of the contaminated food in the bags?

- When food is allowed to spoil in zip-lock bags, the bags must be sealed securely, double bagged and may be disposed of in the bin, as normal household waste.

Clean up procedure

- Use hot soapy water to clean laboratory benches and all used equipment (such as knives and chopping boards), dry well and then put away.
- If a spill occurs during the experiment (bags leaking or tearing), students must report this to their teacher immediately. Care should be taken if any aerosols or spores are released during a spill. If this occurs, it may be advisable to exit any students from the laboratory that may be at risk due to asthma, allergy or immunosuppression. If the spill is large, disinfecting the surface may be necessary. Benches should be wiped with a suitable disinfectant (e.g.,1% solution of sodium hypochlorite, or 70% alcohol). Both have good activity on mould. Wear disposable gloves and mask to decontaminate the area.

Information for growing mould on bread and other foods can be found in the links below:

https://www.education.com/science-fair/article/environment-affects-food-mold-spoil/

https://www.infoplease.com/cig/science-fair-projects/foods-do-molds-love-best.html

http://www.ciec.org.uk/pdfs/resources/medicines-from-microbes.pdf

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[i] Australian Standards AS NZS 2243.3-2010. Safety in Laboratories. Microbiology safety and containment

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Transformation of E.coli with pFluoroGreen

Posted by Anonymous on Tue, 2016-06-07 12:05

Transformation of E.coli with pFluoroGreen: What risks are to staff setting this prac up? We are only a basic PC1 school. Could you please send us a reply with information regarding any concerns?

Voting:•

No votes yet

Year Level:•
Senior Secondary
Laboratory Technicians:•
Laboratory Technicians

Showing 1-1 of 1 Responses

Transformation of E.coli with pFluoroGreen

Submitted by sat on 17 June 2016

In brief:

This activity has a number of different safety and legal aspects to consider prior to purchasing and conducting.

- **Legal requirements:** This activity demonstrates a procedure known as genetic transformation. All genetic modifications are regulated by the Office of the Gene

Technology Regulator (OGTR) to ensure that the required facilities are used and procedures are followed[1]. Whilst this activity may be considered an exempt dealing, there are still requirements for facilities to be the equivalent of a PC1 laboratory and the genetically modified organisms (GMOs) not to be released into the environment[2].

- **Staff training:** staff should be highly trained in good microbiological laboratory practice and have a good understanding of the gene technology involved in this activity. They should have a good understanding of responsible and safe handling of microorganisms, able to recognize biological hazards, recognize if a culture has become contaminated and give a high level of supervision to student activities to ensure correct procedures are implemented. Non- specialist teachers should not carry out this work.
- **Subculturing:** This activity requires subculturing in the form of transferring *E.coli* from tubes and plates by streaking and pipetting. Subculturing is a specialised technique requiring sound knowledge and expertise to minimise the risks involved. It is a skill developed with much practice. Many jurisdictions do not allow microorganisms to be subcultured. Once students have prepared a culture it is not recommended that these plates are opened for any manipulation due to the risk of contamination and growing unknown microorganisms.
- **Incubation temperature:** The recommended temperature for the incubation of microorganisms in schools is at room temperature or up to a maximum of 30℃ and **NOT 37℃** to minimise the likelihood for growth of potential human pathogens that are adapted to human body temperature.[3] This activity requires growth at 37^{o}C as the *E.coli* will not grow well at temperatures below this.
- **Choice of microorganism:** this should be a strain of *E. coli*, which is classified as a Risk Group 1 micro-organism which is unlikely to harm human health in healthy individuals. However this may be a risk to people who are immunocompromised or immunosuppressed. Ensure that the host bacteria *E.coli* is a RG1 micro-organism which is a non-pathogenic strain.
- **Selective media:** The type of media used in schools should not be selective or enriched agars which may encourage the growth of pathogens[3]. Nutrient agar is a simple media which supports the growth of a wide variety of bacteria and moulds and is suitable for use in school laboratories. In this activity the addition of ampicillin to the agar generates a selective medium which is required to allow the bacteria containing the gene for ampicillin resistance to grow. Any additional chemicals added to the agar should have a risk assessment conducted regarding their suitability for use in schools.
- **Penicillin allergies:** Ampicillin which is added to the agar is a member of the penicillin family of antibiotics. **Staff and students who may be allergic to penicillin should avoid all contact.**
- **Sterilisation and decontamination:** The antibiotic resistant, genetically modified bacteria produced need to be destroyed and not released into the environment. The method suggests using 10% bleach as an alternative if an autoclave is not available. Science ASSIST recommends the use of a pressure cooker or autoclave for sterilising rather than chemical sterilisation, which has risks and limitations. For information regarding sterilising agar see AIS: Sterilising Agar.

Additional information:

Licencing Requirements: In Australia the Gene Technology Act 2000 and the Gene Technology Regulations 2001, along with state laws have been developed to protect the

health and safety of people and the environment through regulating certain dealings and activities with genetically modified organisms (GMOs).

The Australian Government has within the Department of Health established the Office of the Gene Technology Regulator (OGTR) which has legislative power to enforce requirements under the Gene Technology Act 2000 where work involving certain dealings with gene technology is being undertaken. All dealings with genetically modified organisms (GMOs) must be licensed, notified or exempt by law.

Updated: 28 June 2018

For information on activities regarding GMOs in schools, see the "GM kits in Schools" fact sheet available on the following webpage:
http://www.ogtr.gov.au/internet/ogtr/publishing.nsf/Content/factsheets

This information replaced an existing document titled "Regulation of gene technology in Australian schools" that was removed in June 2018. The document can still be viewed through the Internet Archive's Wayback Machine at the URL:
https://web.archive.org/web/20180318031422/http://www.ogtr.gov.au/intern...$FILE/fact-gmos-in-schools.pdf This fact sheet has further links to more information including guidance notes for the containment of exempt dealings, which specifies the required facilities and procedures required. The viability of these links cannot be guaranteed by Science ASSIST.

End Update

Science ASSIST recommends that before schools embark on working with microorganisms they should ask the following questions and perform a site specific biological risk assessment:

- Do the school facilities comply with the requirements of PC1 laboratories? Generally, Australian school science laboratories are classified as Physical Containment level 1 (PC1) and this is only **if** they conform to the requirements specified in Section 5 of AS/NZS 2243.3:2010 Safety in Laboratories –Microbiological safety and containment. At this level they are only suitable for work with microorganisms where the hazard levels are low, and where laboratory personnel can be adequately protected by standard laboratory practice[3]. Microorganisms that are classified as Risk Group 1 are the only group that should be handled in PC1 laboratories.
- Does the school have the necessary equipment for sterilisation and decontamination procedures?
- Do the staff have training in microbiological skills?
- What microorganism is being used? Is the strain of microorganism likely to harm human health?
- What manipulations are being performed with the microorganism? Are methods being used to eliminate or minimize exposure to potentially infectious material via aerosols, splashes, ingestion, absorption and accidental inoculation?
- Are any staff or students wishing to participate in microbiological activities immunocompromised or immunosuppressed (Include those who are pregnant or may become pregnant, or are living with or caring for an immunocompromised individual)? These individuals are more prone to infections. If so, it has been suggested that they should consult a doctor to determine whether their participation is appropriate[4].

References:

[1] Regulation of Gene Technology in Australian Schools, Fact Sheet, January 2014. Australian Government, Department of Health, Office of the Gene Technology Regulator. http://www.ogtr.gov.au/internet/ogtr/publishing.nsf/Content/factsheets (Updated June 2018)

[2] 'What Are Exempt Dealings?' Australian Government, Department of Health, Office of the Gene Technology Regulator.• http://www.ogtr.gov.au/internet/ogtr/publishing.nsf/Content/exemptdealcl... (Link updated and made more general March 2021)

[3]Society for General Microbiology. 2006. *Basic Practical Microbiology: A Manual*, Microbiology Online website, http://www.microbiologyonline.org.uk/file/ca2189fba3b39d24c5a44c1285d008...

[4] American Society for microbiology. 2012. *Guidelines for Biosafety in Teaching Laboratories*, Universitat Autònoma de Barcelona website, http://www.uab.cat/doc/teaching_lab_ASM

Bio-Rad Biotechnology Explorer™ pGLO Bacterial Transformation Kit™ –Instructor's Guide, Student Manual and Appendices https://www.bio-rad.com/sites/default/files/webroot/web/pdf/lse/literature/Bulletin_1660033EDU.pdf

Edvotek. Transformation of *E. coli* with Green and Blue Fluorescent Protein Plasmids. Edvotek website. https://www.edvotek.com/222.100121.pdf (2003)

'Microbiology', University of Sydney WHS website, https://intranet.sydney.edu.au/services/safety-wellbeing/standards-guidelines.html (Accessed June 2016)

Standards Australia. AS/NZS 2243.3-2010. Safety in Laboratories. Microbiology safety and containment. 2010. Sydney Australia.

Use of antibiotics (amoxycil) in experiments

Posted by Anonymous on Wed, 2016-02-10 11:41

Use of antibiotics (amoxycil) in experiments: Our Year 12 Biology classes do an EEI (Extended Experimental Investigation) looking at the effect of antimicrobials on bacteria. We have had a student request to use amoxycil in her experiment. Are their any rules for the use of antibiotics?

Voting:•

No votes yet

Year Level:•
Senior Secondary
Laboratory Technicians:•
Laboratory Technicians

Showing 1-1 of 1 Responses

Use of antibiotics (Amoxycil) in experiments

Submitted by sat on 16 February 2016

In Brief

Use of antibiotics in microbiology

Antibiotics are generally used in microbiology for antimicrobial sensitivity testing using a variety of methods, or they may be incorporated into media for use as a selective agent.

Caution with their use is required for several reasons. There are many people in the community who are sensitive or allergic to various antibiotics and their overuse or misuse can lead to the development of resistant microorganisms[1].

Amoxicillin

Amoxicillin belongs to the class of antibiotics called penicillins, which are commonly used for treating bacterial infections. Penicillins are common antibiotics that can generate an allergic response. It is recommended that people who are allergic to any member of the penicillin family should avoid all contact with amoxicillin. Contact with amoxicillin can also cause irritation of the eyes, respiratory system and skin in certain individuals.

Additional issues for school science laboratories

Activities requiring the use of antibiotics require certain manipulations of microorganisms, which are not permitted in some jurisdictions. Also, the use of selective media is not allowed in most jurisdictions.

1. Antibiotic sensitivity testing generally requires either lawn or broth cultures to be produced. This requires subculturing, which is a specialised technique requiring sound knowledge and expertise to minimise the risks involved. It is a skill developed with much practice. Some jurisdictions do not allow microorganisms to be subcultured.
2. The type of media used should **not** select for pathogens (e.g., selective or enriched agars). Nutrient agar is a simple medium which supports the growth of a wide variety of bacteria and moulds and is suitable for use in school laboratories. If the activity requires the addition of amoxicillin into the agar, then this produces a medium which will select for amoxicillin resistant microorganisms.
3. Antibiotic resistant bacteria need to be destroyed at 121 $^{\circ}$C, 15 psi for 15–20 minutes using an autoclave or pressure cooker.

Science ASSIST recommendations

- Prior to carrying out any microbiological activity, a site-specific biological risk assessment [2] should be conducted to identify, assess and control any risks.
- Schools need to ensure that they have the required facilities and equipment and the necessary staff training to be able to manage the risks. If schools do not meet this criteria, then they should not undertake this level of activity safely.
- Any antibiotic, including antibiotic discs, should not be handled if the person is allergic to that particular antibiotic or class of antibiotics.
- If it is deemed appropriate to use antibiotics, then there are a wide variety of antibiotics and concentrations, including amoxicillin, available in disc form from various scientific suppliers.These are safer than an antibiotic in solution and can be readily handled wearing appropriate PPE with sterile forceps to avoid any skin contact.
- Safety data sheets should always be consulted when using any chemicals.

Currently in Australia there are differences between the state/territory educational jurisdictional policies on whether certain microbiological activities can be carried out. Schools are advised to check what activities are permitted in their jurisdiction/school sector before proceeding to work with any microorganisms.

The level of microbiological activity that involves using antibiotics should only be undertaken in schools if the following conditions apply.

- Proper facilities are in place. PC1 facilities are required. School science laboratories are generally classified as Physical Containment level 1 (PC1), if they conform to the requirements specified in Section 5 of AS/NZS 2243.3:2010 Safety in Laboratories – Microbiological safety and containment [(3)]. If they do conform to these requirements, and there are many school labs that don't, then they are only suitable for work with microorganisms where the hazard levels are low, and where laboratory or facility personnel can be adequately protected by standard laboratory practice[(4)].
- Microorganisms that are classified as Risk Group 1 are the only ones that should be used in PC1 laboratories, i.e. low risk ~~-~~not associated with disease in healthy people. It should be noted that, even though some microorganisms are from RG1, some can still pose a low level of risk to the community, as they can be capable of causing disease if provided with appropriate conditions (referred to as opportunistic). People who are immunocompromised or immunosuppressed are at greater risk.
- Staff have training in microbiological skills including proficiency in aseptic technique to eliminate or minimize exposure to potentially infectious material via aerosols, splashes, ingestion, absorption and accidental inoculation, subculturing procedures, sterilisation and decontamination procedures and have the ability to identify contamination of pure cultures.
- Staff are able to demonstrate good microbiological technique, competency and confidence when performing procedures, interpretations and outcomes of activities, and competency in microbiological hazard awareness to maximise the student experience in microbiology.
- Suitable PPE is provided, this includes a lab coat and safety glasses. Cuts are covered with a waterproof dressing and consideration is given to the wearing of disposable gloves.
- An autoclave or pressure cooker is available for sterile preparation of agar/broth etc. and for decontamination.

Additional Information

Action of antibiotics

Antibiotics kill or inhibit certain microorganisms. Many common antibiotics inhibit bacterial growth by inhibiting protein synthesis. Amoxicillin acts on cell wall synthesis by inhibiting the formation of the peptidoglycan cross-link, a major component in gram-positive bacteria. The cell wall is weakened and ultimately ruptures.

Antibiotic sensitivity testing

The sensitivity of microorganisms to antibiotics is a common and important technique in

microbiology laboratories. Common antibiotic sensitivity methods include dilution methods, disc diffusion methods, E-testing and some automated testing systems. The results from antibiotic testing are used for selecting the correct antibiotic for therapy against an infecting organism.

For further information on this subject take a look at Science ASSIST's 'Guidelines for best practice for Microbiology in Australian Schools' document: https://assist.asta.edu.au/resource/4196/guidelines-best-practice-microb...

References

(1) 'Antibiotics' Microbiology online website, http://www.microbiologyonline.org.uk/about-microbiology/microbes-and-the... (Accessed 15 February 2016)

(2) US Department of Health and Human Services. 2009. 'Section II–Biological Risk Assessment' in *Biosafety in microbiological and biomedical laboratories (BMBL),* 5th Edition, pp 9–21, Centers for Disease and Control Prevention website, https://www.cdc.gov/labs/pdf/CDC-BiosafetyMicrobiologicalBiomedicalLabor... (Link updated January 2019)

(3) Standards Australia. 2010. AS *NZS 2243.3-2010. Safety in Laboratories –Microbiological safety and containment.* Sydney, Australia

(4) 'Microbiology', October 2013, University of Sydney WHS website, https://intranet.sydney.edu.au/services/safety-wellbeing/standards-guidelines.html

'Agar diffusion test', Wikipedia website, https://en.wikipedia.org/wiki/Agar_diffusion_test (February 2016)

'Allergic reactions to antibiotics', healthdirect Australia website, https://www.healthdirect.gov.au/allergic-reactions-to-antibiotics (October 2014)

'Amoxicillin', US National Library of Medicine website, https://medlineplus.gov/druginfo/meds/a685001.html (January 2010)

'Amoxicillin' Safety Data Sheet Version 5.3, Sigma-Aldrich website http://www.sigmaaldrich.com/MSDS/MSDS/DisplayMSDSPage.do?country=AU&lang... (December 2015)

'Antibiotic allergy clinical update', Australian society of clinical immunology and allergy website, https://allergy.org.au/hp/papers/allergic-reactions-to-antibiotics/ (May 2015)

See the 'Susceptibility testing of antiseptics and disinfectants' Standard Operating Procedure in Science ASSIST's 'Guidelines for best practice for microbiology in Australian Schools'. (Added October 2019).

'Antibiotic susceptibility discs and ejector packs' Southern Biological website, 'Mastring antibiotic sets', Southern Biological website, https://www.southernbiological.com/mastring-antibiotic-sets/•(Updated October 2019).

Australian Government, Department of Health and Department of Agriculture. 2015. *Responding to the threat of antimicrobial resistance. Australia's First National Antimicrobial Resistance Strategy 2015–2019* , Australian Government, Department of Health website. To download this document, click here.

Bio-Rad. 2011. *'Disks for antibiotic susceptibility testing'* Bio-Rad website. https://commerce.bio-rad.com/webroot/web/pdf/inserts/CDG/en/Literature/inserts/66098_01_2011_GB.pdf

'Growth medium', Wikipedia website, https://en.wikipedia.org/wiki/Growth_medium (February 2016)

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use of tears in a school practical

Posted by Anonymous on Tue, 2015-01-20 16:12

Use of tears in a school practical: Hi I am asking if it is OK to use tears in a school prac? The tears are generated by a student holding an onion near their eye. As the tears run down the face, the person blots them with a small piece of filter paper ~~m~~made using a hole punch. The paper can then be placed on a bacterial lawn that has been spread across agar in a petri dish. Lysozyme in the tears kills the bacteria creating a clear area on the plate's surface. Only one person touches the paper and the tears ~~th~~he person who generates them. It has been suggested that this is not allowed as it uses bodily fluids, but we have done it for years in SA. I would like to know its status in all states and territories in Australia, please.

Voting:•

☆
☆
☆
☆
☆

No votes yet

Year Level:•
Senior Secondary
Laboratory Technicians:•
Laboratory Technicians

Showing 1-1 of 1 Responses

Answer by labsupport on question Answer by labsupport on question Answer by labsupport on question Answer by labsupport on question Answer by labsupport on question use of tears in a school practical

Submitted by sat on 23 January 2015

The situation regarding what is permitted for many different aspects of supporting the science curriculum in different states and territories in Australia is quite complex. There are many different layers of governance. There are:

1. National bodies, who develop model legislation, codes of practice and safety guides, such as Safe Work Australia and other policy makers;
2. State and territory regulators who enforce compliance with the Act and Regulations adopted by that region;
3. Educational jurisdictions in each state and territory, who establish additional policies for their own government school sector; and
4. Educational sectors outside the government schools systems who also establish their own policies.

There is currently no consistency across the educational jurisdictions and sectors concerning the use of body fluids. There appears to be no consistent definition of what constitutes a body fluid nor regarding which microbiological procedures are permitted throughout Australia.

To the best of our knowledge, this is the current status of what is permitted/prohibited in the state jurisdictions regarding the use of body tissues and fluids. Non-government schools may be able to choose whether or not to follow those policies in their region.

State/Territory	Use of human body tissue and fluids
ACT	Experiments involving the use of fresh human tissues or body fluids, e.g. cheek cell smears, blood typing, blood smears & urine samples are prohibited.
NSW	Experiments using fresh human blood products, urine and fresh human tissue, e.g. cheek cell smears should not be used. A student using their own saliva is permitted.
NT	A risk assessment must be conducted prior to the use of biological materials and all appropriate control measures must be implemented.
Qld	Subject to a Risk Assessment. Students must only use their own cheek cells.
SA	Subject to a Risk Assessment. Students must only use their own cheek cells.

State/Territory	Use of human body tissue and fluids
Tas	Testing of body fluids, i.e. blood, vomit, urine and faeces, must not be conducted in schools by staff or students. Experiments that involve saliva or cheek cells may be undertaken, but appropriate risk management and disposal procedures need to be in place, including consideration of whether blood is visible in the saliva.
Vic	Any uses of body fluids/cells are subject to individual school risk assessment. Taking of blood is banned.
WA	Experiments on any human body fluid or tissue including cheek cell and skin scrapings are banned.

Regarding the use of tears in an activity, we are reluctant to recommend the use of tears in a school science activity until we receive authoritative advice otherwise, particularly considering the recent study which confirmed that tears can transmit the hepatitis B virus (HBV).[i]• It is important to remember that schools may not be aware of potential infectious diseases that staff or students may have and whilst these situations may be rare, there may also be other people in the vicinity who are immuno-suppressed that are at greater risk of acquiring infections.

We recommend that schools considering the use of human body fluids, tissues or microbiological organisms carefully evaluate all of the risks. We recommend reading the following general information about biological materials, hepatitis and HIV viruses as well as infection control guidelines developed by Sydney University:

- http://www.safeworkaustralia.gov.au/sites/SWA/about/Publications/Documen... •

In particular see page 21 "*Poor understanding of biological hazards leads to poor risk assessments in workplaces"*

- http://www.safeworkaustralia.gov.au/sites/SWA/about/Publications/Documen...

In particular, see Sections 2.3 Activities and occupations where a hazard may exist, Section 4.2 Safe working procedures, 4.3 Standard Precautions, Section 4.4 Risk control strategies for certain occupations and Appendix E Principles of Standard Precautions.

Schools have been identified as places where people could be exposed to diseases such as Hep B and HIV. (pp. 6-7) All body fluids/substances should be treated as infectious and risk control strategies should be implemented. (p19).

INFECTION CONTROL PROCEDURES - University of Sydney

It is vital that a risk assessment for every activity is conducted by a person with appropriate knowledge and who considers all the possible risks and implements the appropriate control measures to not expose others to potential hazards. All schools should conduct a site-specific risk assessment prior to performing any of these procedures.

Science ASSIST aims to provide advice that promotes good practice to support the Australian Curriculum: Science. A procedure cannot be safe in one region and not in another. It is also

aware of a great diversity in science facilities as well as in staff training in the area of microbiology and knowledge of infectious diseases. As a result of all of these different factors, Science ASSIST is currently seeking advice concerning the development of detailed safety guidelines regarding the use of body tissue and fluids as well as microbiology.

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[i] Komatsu, H., Inui A, Sogo T, Tateno A, Shimokawa R, Fujisawa T. 2012. Tears from children with chronic hepatitis B virus (HBV) infection are infectious vehicles of HBV transmission: experimental transmission of HBV by tears, using mice with chimeric human livers. *J Infect Dis*. 2012 Aug 15; 206(4):478-85. doi: 10.1093/infdis/jis293. Epub 2012 Apr 16.

[ii] Safe Work Australia. 2011. National Hazard Exposure Worker Surveillance: Exposure to Biological Hazards and the Provision of Controls against Biological Hazards in Australian Workplaces. http://www.safeworkaustralia.gov.au/sites/SWA/about/Publications/Documen...

Using E. coli bacteria in schools

Posted by Anonymous on Thu, 2019-02-21 09:54

Using *E. coli* bacteria in schools: A student is planning an experiment and would like to grow *E. coli* pili 1 strain and test antibotics on it. Can this strain of *E. coli* be used in NSW schools?

Voting:•

No votes yet

Australian Curriculum:•
Planning and conducting
Year Level:•
7
8
9
10
Senior Secondary
Laboratory Technicians:•
Laboratory Technicians

Showing 1-1 of 1 Responses

Using E. coli bacteria in schools

Submitted by sat on 21 February 2019

In brief: The bacteria you describe is a human pathogen and would be considered a Risk Group 2 microorganism and therefore would not be permitted in NSW schools[1]. The only

strain of *E. coli* suitable for use in schools is the *E. coli* K-12 strain which is a Risk Group 1 microorganism.

Science ASSIST has produced GUIDELINES for best practice for microbiology in Australian schools.• See p15 for section 3.3 Choice of microorganism.

We recommend that your school is familiar with the content of this guide before contemplating the delivery of practical activities in microbiology.

Escherichia coli

Escherichia coli (E. coli) is a type of bacteria, that lives in the intestines of people and animals. Whilst many strains may be considered harmless, there are several different strains, some of which can cause illness and severe disease in humans and animals.[2] These strains are referred to as pathogens. A characteristic of pathogenic strains is the presence of virulence attributes, which enable them to infect and damage a host and cause disease.[3,4]

E.coli **pili 1,** which you have referred to, has a virulent attribute known as an adhesive organelle called type 1 pili that has been associated with urinary tract and even kidney infections[5]. This places it in the category of a Risk Group 2 microorganism. As such it is not permitted in NSW Schools and is not suitable for use in any schools.

E. coli **K-12** is a non-pathogenic strain of *E. coli*. It has no virulent attributes. For example, it has no toxins, no adhesion factors and no invasion factors[6]. It is classified as a Risk Group 1 microorganism, which means that it is unlikely to cause disease in a healthy person. This is the only strain of *E. coli* that is suitable for use in schools, along with safe procedures and a site-specific risk assessment. It should be sourced from a scientific supplier. See the Science ASSIST list of School science suppliers.

Microbiology

There are many aspects to conducting microbiology that must be considered before proceeding.

Firstly, schools must ensure that they have the required facilities and equipment and the necessary staff training to be able to manage the risks of microbiological work.

Secondly, schools should choose the microorganism with the lowest level of risk that will meet the learning outcomes.

Thirdly, before, schools embark on working with microorganisms they should ask the following questions and perform a site-specific biological risk assessment.

- What microorganism is being used? Is it a Risk Group 1 microorganism?
- Do the school facilities comply with the requirements of Physical Containment Level 1 laboratories?
- Does the school have the necessary equipment for sterilisation and decontamination procedures?
- Do the staff have training in microbiological skills?

- What manipulations are being performed with the microorganism? Are methods being used to eliminate or minimise exposure to potentially infectious material via aerosols, splashes, ingestion, absorption and accidental inoculation?
- Are any staff or students wishing to participate in microbiological activities immunocompromised or immunosuppressed (include those who are pregnant or may become pregnant, or are living with or caring for an immunocompromised individual)? These individuals are more prone to infections and they should consult a doctor to determine whether their participation is appropriate.

References and further reading

[1] NSW Department of Education, 'Chemical Safety in Schools (CSIS)' resource package. NSW DoE website, http://www.dec.nsw.gov.au/• DoE Intranet, login required.

[2] '*E. coli (Escherichia coli)* Questions and Answers', Centers for Disease Control and Prevention website, https://www.cdc.gov/ecoli/general/index.html (Accessed February 2019)

[3] 'Medical Definition of Virulence', MedicineNet website, https://www.medicinenet.com/script/main/art.asp?articlekey=6911 (December 2018)

[4] 'Virulence', Wikipedia website, https://en.wikipedia.org/wiki/Virulence (Accessed February 2019)

[5] Joel D. Schilling, Matthew A. Mulvey, Scott J. Hultgren, 'Structure and Function of *Escherichia coli* Type 1 Pili: New Insight into the Pathogenesis of Urinary Tract Infections', *The Journal of Infectious Diseases*, Volume 183, Issue Supplement_1, 1 March 2001, Pages S36–S40, https://doi.org/10.1086/318855 or https://academic.oup.com/jid/article/183/Supplement_1/S36/2191070

[6] Kuhnert, Peter and Frey, Joachim. 1996. '*Tools for Safety Assessment Identification and monitoring of Escherichia coli K-12 safety strains'*, Centre for Biosafety and Sustainability website, http://www.bats.ch/bats/publikationen/1996-1_e.coli/96-1_e-coli_k12.php

Science ASSIST. 2017. GUIDELINES for best practice for microbiology in Australian schools, Science ASSIST website, https://assist.asta.edu.au/resource/4196/guidelines-best-practice-microb....

Using human tears in an experiment

Posted by Anonymous on Mon, 2014-12-22 13:00

Using human tears in an experiment: Can human tears be used in an experiment in a classroom? The experiment involves collecting the tears on filter paper after exposing the students to onions to make them cry?

Voting:

No votes yet

Year Level:

7
8
9
10
Senior Secondary

Laboratory Technicians:

Laboratory Technicians

Showing 1-1 of 1 Responses

Answer by labsupport on question Using human tears in an experiment

Submitted by sat on 19 January 2015

It is not recommended to use human blood or body fluids in activities in school science laboratories. In fact, most schools in government jurisdictions prohibit the use of fresh human tissues or body fluids. Human tears, along with other body fluids, have the potential to

transmit infectious diseases. A recent study confirmed that tears can transmit the hepatitis B virus (HBV).[i]• A Physical Containment level 2 (PC2) laboratory is required to work with human blood and body fluids. [ii]• Generally, school science laboratories are classified as Physical Containment level 1 (PC1) **if** they conform to the requirements specified in Section 5 of AS/NZS 2243.3:2010 Safety in Laboratories –Microbiological safety and containment.• If they conform to these requirements, then they are only suitable for work with microorganisms where the hazard levels are low, and where laboratory or facility personnel can be adequately protected by standard laboratory practice.[iii] Microorganisms that are classified as Risk Group 1 are the only ones that should be used in PC1 laboratories. Higher levels of Physical Containment are required for handling fresh human tissues or body fluids and microorganisms of Risk Groups 2-4 [iv]. [i] Komatsu, H., Inui, A., Sogo, T., Tateno, A., Shimokawa, R., Fujisawa, T. (2012). Tears from children with chronic hepatitis B virus (HBV) infection are infectious vehicles of HBV transmission: experimental transmission of HBV by tears, using mice with chimeric human livers. *J Infect Dis*. 2012 Aug 15; 206(4):478-85. doi: 10.1093/infdis/jis293. Epub 2012 Apr 16. [ii] CCH 2011. *Physical Containment Level 1 laboratories 35–190* (accessed April 2014) [iii] University of Sydney. 2013. Biological Safety – Microbiology• https://intranet.sydney.edu.au/services/safety-wellbeing/standards-guidelines.html •(accessed July 2014) [iv] Australian Standards AS NZS 2243.3-2010. Safety in Laboratories –Microbiological safety and containment

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Animal skeleton

Posted by Anonymous on Tue, 2016-10-18 14:25

Animal skeleton: One of our teachers can get a sheep skeleton from someone. The sheep died in a field and the bones are now devoid of any flesh. The teacher wants to know if there is a way in which the skeleton can be cleaned/sterilised so it can be used in the classroom to show the structure of the long bones and the spine etc. I know that we are not allowed to use anything not sourced from a reputable supplier (because of possible disease, fungus and pathogens it may be carrying) but the teacher would like to know if there is something that can be done so she can use it.

Voting:

No votes yet

Year Level:
6
7
8
9
10
Senior Secondary

Laboratory Technicians:
Laboratory Technicians

Showing 1-1 of 1 Responses

Animal skeleton

Submitted by sat on 26 October 2016

In Brief:

Source of animal:

We recommend you check with your school jurisdiction for regulations regarding the use of dead animals or animal body parts that may not be sourced from a certified abattoir, butcher or science supply company. More information can be found on the Science ASSIST website link: Dissection materials

Zoonotic diseases:

There is a risk of contracting a zoonotic disease from handling living or dead animals. Zoonotic diseases are any diseases or infections that can be transmitted between animals and humans generally caused by bacteria, parasites, fungi and viruses. However, by following the safety procedures outlined below you will reduce any risk to quite a low level. Sheep do potentially carry a number of diseases and pathogens transmissible to humans however the risks associated with old skeletal remains would be less than those associated with handling a fresh carcass. The following link gives a good overview of potential hazards in this area. https://agriculture.vic.gov.au/biosecurity/animal-diseases (Link Updated July 2020)

Science ASSIST recommendations:

It is important to follow the safety precautions outlined below:

- Conduct a site specific risk assessment to assess and control any biological and chemical risks. Refer to the specific SDS for any chemicals being used. We have developed a Risk Assessment template for schools to use, see Risk Assessment Template.
- Work in a fume cupboard or well ventilated area when handling the hydrogen peroxide.
- Wear appropriate PPE (i.e. safety glasses, nitrile gloves, laboratory coat or preferable in this case disposable coveralls and face mask suitable for biological hazards).
- Use plastic, glass or ceramic containers with loose fitting lids only. Do not use metal containers.
- Good hygiene practices should be observed at all times: Keep hands away from the mouth, nose, eyes and face.
- Disinfect work surfaces and equipment with hospital grade disinfectant, diluted

according to the manufacturer's instructions.

- Wash hands thoroughly

Recommended procedure for cleaning and sterilising dry animal bones

The Tasmanian Museum[1] recommends the following method for cleaning and sterilising dry animal bones for collections.

Pre-treatment

- Freeze the bones for a week before handling and cleaning to slow down the growth of pathogens and therefore reduce the risk even more.

Cleaning

- Rinse bones in running water to remove any organic matter.
- Place the bones in a plastic tub or bucket and soak them in biological washing powder dissolved in warm to hot water (use according to manufactures instructions). The biological washing powder (which is available from supermarkets) contains enzymes which degrease the bone by breaking down any remaining fat and soft tissue that may still be present.
- Make sure the bones are fully immersed and leave for a few days to soak. Label the container accordingly.
- Remove the bones and rinsewell with running water (otherwise the enzymes will continue to break down the bone)[2]

Sterilising and whitening

- In a fume cupboard or well ventilated area place the bones in 3% hydrogen peroxide solution (made with 1 part 35% hydrogen peroxide and 11 parts water). Hydrogen peroxide is a powerful oxidiser. Use a loose lidded plastic container to reduce pressure build up and evaporation. Label appropriately and leave in a well ventilated, cool dark place for 3 to 5 days depending on how white you want the bones to appear[2,3].
- Remove the bones from the peroxide using tongs and rinse well in running water
-

Pour the peroxide into a suitable, labelled container for waste disposal. Dispose according to safety data sheet instructions.

- Lay the bones out to dry in the sun on absorbent towels or dry inside using a fan.
- When bones are completely dry, label and store under conditions to prevent any deterioration i.e. a cool dry place in low light levels and out of direct sunlight.

Additional information:

Alternatives**:**

For examining skeletal and muscle systems you could also consider using the following:

- Animal bones from the supermarket, pet meat supplier, butcher or abattoir.
- Whole dead chickens, purchased from the supermarket, or butcher.
- Prepared specimens such as animal skeletons and plastic models sourced from Biological supply companies.

Small animals and animal parts can also be purchased through biological supply companies. See the Science ASSIST School science suppliers list.

References:

[1]Gordon, Tammy. 2016. Natural Science Collections Officer, Tasmanian Queen Victoria Museum, Launceston. Personal communication

[2]How to clean animal bones –the complete guide: Jake's Bones

www.jakes-**bones**.com/p/how-to-**clean**-**animal**-**bones**.html (Accessed October 2016)

[3]Using hydrogen peroxide for bleaching skulls and animal bones

https://www.using-hydrogen-peroxide.com/peroxide-bleaching-skulls.html (Accessed October 2016)

Chem-Supply Pty Ltd. *Safety Data Sheet: 35% Hydrogen peroxide*

https://www.chemsupply.com.au/documents/HL0011CH35.pdf (Accessed October 2016)

Chem-Supply Pty Ltd. *Safety Data Sheet: 3% Hydrogen peroxide.*

https://www.chemsupply.com.au/documents/HL0041CHIF.pdf (Accessed October 2016)

Chem-Supply Pty Ltd. *Safety Data Sheet: Sodium hypochlorite (Hospital grade disinfectant)*

https://www.chemsupply.com.au/documents/ST0441CH6G.pdf (Accessed October 2016)

'List of recommended chemicals for science in Australian schools', Science ASSIST website /resource/3052/list-recommended-chemicals-science-australian-schools?search-id=34587a4 (October 2016)

'National Code of Practice for the Control of Work-related Exposure to Hepatitis and HIV (Blood-borne) Viruses [NOHSC: 2010(2003)]', Safe Work Australia website http://www.safeworkaustralia.gov.au/sites/swa/about/publications/pages/c... (1 January 1993)

Zoonoses –Animal diseases that may also affect humans. (29 July 2015), Agriculture Victoria website: https://agriculture.vic.gov.au/biosecurity/animal-diseases (Link Updated July 2020).

Biological preserved specimens

Posted by Anonymous on Fri, 2020-02-28 16:11

Biological preserved specimens: What are the rules for storing and/or disposing of biological preserved specimens?

Science ASSIST has received the following 4 questions, which all relate to this topic.

Q1 We have specimens that have been preserved in Formaldehyde. These specimens are used for demonstration purposes only. What are the legal requirements for these specimens? Is it legal for us to still have them on campus? How should they be stored?

Q2 We have many jars of biology specimens (beetles, frogs etc) with a liquid in them. Some of the liquid has evaporated. My teacher is worried that it is in the environment in her classroom. Is this dangerous? Can we top up with Formaldehyde?

Q3 I've read the question and response about dealing with preserved specimens (https://assist.asta.edu.au/question/2651/preserved-specimens) that are intended to be kept, however how can specimens in an unknown solution be safely and legally disposed of?

Q4 There seems to be a collection of half-empty specimen jars in my Lab classroom. 1. We are not sure of the liquid used to "preserve" the specimens 2. We would rather dispose of them entirely. What is the process of disposing of these jars?

Voting:

No votes yet

Laboratory Technicians:

Laboratory Technicians

Showing 1-1 of 1 Responses

Answer by labsupport on question Biological preserved specimens

Submitted by sat on 28 February 2020

Storage of preserved biological specimens

Traditionally, solutions of formaldehyde were used for preserving biological specimens. •Many old existing preserved biological specimens in schools contain formaldehyde and or other hazardous solutions. Schools are not prohibited from having biological specimens in formaldehyde, unless it is banned by their school jurisdiction or sector. •It should however be understood that there are risks associated with exposure to formaldehyde. •If your school has specimens in formaldehyde, it is important to be aware of the hazards and ensure that suitable controls are in place to reduce your risk of exposure. If the specimens in formaldehyde are in well-sealed jars the risk of exposure is very low. Preserved biological specimens may now be purchased in less hazardous solutions.

Storage advice for preserved biological specimens:

- Store specimens in screw capped containers that are non-reactive to the storage fluid. The seal should prevent evaporation of the storage solution, and metal lids should be avoided as they may corrode and eventually leak.
- Use Parafilm to provide an additional seal.
- Affix a label indicating the storage solution that the specimen is in.
- Check the condition of all containers and using safe procedures (referring to specific SDSs, wearing appropriate PPE and working in a fume cupboard or well ventilated area), either replace compromised lids or place the contents in another container for storage or waste disposal.
- Regularly monitor for fluid levels, compromised containers and defective lids etc.
- Store under conditions to prevent deterioration of the specimen (and solution) i.e. a cool dry place with good ventilation, low-light levels and out of direct sunlight.

Evaporation of the storage solution may indicate that the seal on the jars is not adequate. If the specimens are stored in the classroom and the teacher is in the classroom all day every day, then they are more at risk of exposure to hazardous fumes than students who would probably only be in the classroom for a few lessons per week. The only way to determine if workplace exposure standards have been exceeded is to undertake air monitoring for formaldehyde. The most effective control to reduce the risk of exposure is to remove or eliminate the hazardous chemical.

If your specimens are in good condition: you may wish to keep them. A range of strategies could be used to minimise that risk of exposure such as:

- Move them to another location, which is well ventilated.
- Transfer them (using safe procedures) to suitable jars which have an air-tight seal
- Transfer them (using safe procedures and a stepped process to avoid osmotic issues) into a less hazardous (and known) storage solution.
- Seek further help from a local museum, which may have expertise in this area•

If your specimens are in poor condition: then it may be best to arrange for disposal of the specimen and the solution, by a licenced chemical waste contractor. Consideration could be given to finding an alternative, such as specimens embedded in resin, which are very resilient to student handling.

If you do not know what the storage solution is: then you should not top up the jars, as you may be combining incompatible chemicals resulting in the generation of new substances that have unknown properties and unknown hazards, creating a potentially violent chemical reaction or damage to the specimen.

Note: Science ASSIST strongly advises against formaldehyde (methanal) being used in a school science setting. It is a Category 1 (known) human carcinogen, has acute toxicity, and is a Category 2 drug precursor. See references for further information. Formaldehyde is not included in the Science ASSIST List of recommended chemicals because of its acute health hazards, and because it is not regarded as essential or important to the science curriculum.•

Disposal of biological preserved specimens

The best way to dispose of biological preserved specimens is to arrange for disposal 'as is' from a licenced chemical waste contractor.

- If the specimens are in unknown liquids, sometimes these may even be in old food jars, it is not worth the risk or the time and effort to try to combine them into larger jars. We recommend leaving the specimens in the jars that they are in.
- Specimens in unknown liquids should be labelled as being in an unknown solution.
- Store the specimens in an appropriate well-ventilated area, until such time as they are disposed of.

It is a good idea to combine a disposal of these with any other chemicals that need disposal. Science ASSIST recommends that you:

- audit your chemical store for any unwanted chemicals
- check on the integrity of the chemical containers and the condition of the chemicals to see if any have deteriorated/ been degraded
- see if your disposal can be combined with a whole school waste disposal or with schools in your geographical area.

Previous Q&As

We refer you to some of our previous Q&As, that provide further information:

preserved specimens which contains detailed information about

- Handling unknown chemical solutions
- Replacing the old preserving solution
- Fixation & preservation methods
- Alternative preservation solutions

Preserving sheep brains without formalin which contain detailed information about

- Chemical Methods and safe methods for preparing preservative solutions
- Alternative options and preservation methods
- Labels for preserved specimens

Calf Foetus which contain detailed information about

- Recommended preservative solutions
- Stepped procedure for replacing old preservative solutions
- Detailed method for replacing methylated spirits with new preservative solution
- Safety when working with preserved specimens

References and further reading

Bocaege, E., Cooke, M., & S. J. M. M. Alberti, 2013. Endangered specimens, endangered skills: a museum conservation initiative.•*Papers on Anthropology*,•*22*, 303-308. https://doi.org/10.12697/poa.2013.22.31

'Formaldehyde - technical fact sheet', SafeWork NSW website, https://www.safework.nsw.gov.au/resource-library/hazardous-chemicals/formaldehyde-fact-sheets/formaldehyde-technical-fact-sheet •(Accessed February 2020) (See Health effects and Exposure Standards and air monitoring)

'Formaldehyde in laboratories', National Industrial Chemicals Notification and Assessment Scheme (NICNAS) website, https://www.nicnas.gov.au/chemical-information/factsheets/chemical-name/formaldehyde-in-laboratories •(Accessed February 2020) (See 'Recommendations' and 'Occupational exposure standard')

Blood Typing - Use of Animal Blood

Posted by Anonymous on Tue, 2015-12-01 16:19

Blood Typing -Use of Animal Blood: Hi, I know that if we use human blood for blood typing it has to be screened. A teacher attended a PD session and they used blood from the bottom of a bag of meat that was bought from the shops for human consumption. I'd like to know if it is OK to use this blood in a school laboratory?

Voting:•

No votes yet

Year Level:•
Senior Secondary
Laboratory Technicians:•
Laboratory Technicians

Showing 1-2 of 2 Responses

Blood Typing - Use of Animal Blood

Submitted by sat on 12 December 2015

In Brief

Use of human blood

Science ASSIST does not recommend the use of human tissue or body•fluids such as blood in school science practical classes due to the risk of disease transmission.

Human body fluids such as blood and other tissues have the potential to transmit diseases. There is a risk of exposure to pathogens such as Human Immunodeficiency Virus (HIV), Hepatitis B (Hep. B) and Hepatitis C (Hep. C). Even screened blood samples cannot be guaranteed to be free from infectious agents. The World Health Organisation (WHO) states[i]:

'*It should be recognized, however, that all blood screening programmes have limitations and that absolute safety, in terms of freedom from infection risk, cannot be guaranteed.*'

Currently there is no consistency throughout Australia concerning the use of human tissue and body fluids in school science activities. Most schools in government jurisdictions prohibit the use of human tissues or body fluids, whilst educational sectors outside government school systems establish their own policies based upon legislation, Australian Standards and their own risk assessments.

Laboratory facilities

The handling of human body fluids or tissues should occur in laboratories classified as Physical Containment level 2(PC2)•[ii].

Generally, school science laboratories are classified as Physical Containment level 1 (PC1),•**if**• they conform to the requirements specified in Section 5 of AS/NZS 2243.3:2010 Safety in Laboratories –Microbiological safety and containment.• If they conform to these requirements, then they are only suitable for work with microorganisms and other biological material where the hazard levels are low, and where laboratory or facility personnel can be adequately protected by standard laboratory practice[iii].

When handling human blood, blood products, body fluids and associated material it is generally advised to regard them as potentially infectious.•**Human body fluids or tissues should not be handled in a PC1 laboratory[iv].**

Science ASSIST is aware of the diversity in science facilities as well as in staff training and knowledge of infectious diseases. As a result of all of these different factors,•**Science ASSIST does not recommend the use of human tissue or body•fluids such as blood in school science practical classes due to the risk of disease transmission.**

Use of animal blood

We provide some guidelines below for the safe handling of blood from meat purchased from butchers. Schools should conduct a site-specific risk assessment prior to handling any raw meat products to identify any hazards and to determine control measures to eliminate or minimise the hazards.

If the raw meat sample has not been transported or stored at appropriate temperatures, then there is the risk of the growth of pathogenic microorganisms capable of causing food poisoning, e.g. salmonella and campylobacter spp. Therefore, Science ASSIST recommends

the following.

- Persons handling this material in a laboratory situation should have an understanding of microbiology and cross infection.
- Persons handling the raw meat should have an understanding of food safety and food hygiene.
- Good personal hygiene practices are required.
- The blood sample would only be suitable for short term storage at 4°C, as it would not contain any preservatives.
- Any water contamination of the blood would lyse the red blood cells (burst the cells releasing the haemoglobin), this would render it useless for any blood-typing experiments.
- Any meat products that have been frozen during the transport process result in red blood cells that are lysed

Alternatives

As a completely safe alternative, simulated blood-typing kits are available from various scientific suppliers. They contain both synthetic blood and synthetic antisera, which produce realistic blood-typing results. There is no danger of disease transmission from these kits as they contain no blood, blood products, or other material of biological origin. For example see: https://www.carolina.com/blood-typing/carolina-abo-rh-typing-with-synthetic-blood-kit/700101.pr

For Australian suppliers see our list of School science suppliers.

Additional information

Science ASSIST is currently developing detailed safety guidelines regarding the use of body tissue and fluids.

References

[i] World Health Organization. 2010. *Screening donated blood for transfusion-transmissible infections.* https://www.who.int/bloodsafety/ScreeningDonatedBloodforTransfusion.pdf

[ii] Standards Australia. 2010. AS/NZS 2243 *Safety in Laboratories, Part 3: 2010 Microbiological safety and containment*. Sydney, Australia.

[iii] 'Infection Control Procedures', University of Sydney website, https://intranet.sydney.edu.au/services/safety-wellbeing/standards-guidelines.html (accessed December 2015)

[iv] CCH 2011. *Physical Containment Level 1 laboratories 35-190* (accessed December 2015)

'Safety of Blood Products' National Blood Authority Australia website. http://www.blood.gov.au/safety-blood-products (accessed December 2015)

Food Standards Australia. 2001.•*Standard 3.2.2 Food Safety Practices and General Requirements.*•https://www.foodstandards.gov.au/publications/documents/3_2_2.pdf

Blood Typing - Use of Animal Blood

Submitted by on 03 December 2015

Hi, I have used this type of blood but when I used it, it had been mixed with water and was useless. I now buy blood from Southern Biological or an abattoir for student pracs. The blood you get from Southern biological should already be screened. I hope this helps.

Calf Foetus

Posted by Anonymous on Tue, 2015-12-01 10:37

Calf Foetus: A student has brought in a calf foetus stored in methylated spirits. Can you suggest what to transfer it into for preservation? Thank you.

Voting:

No votes yet

Laboratory Technicians:
Laboratory Technicians

Showing 1-2 of 2 Responses

Calf Foetus

Submitted by sat on 11 December 2015

In Brief

Source of animal

We recommend you check with your school jurisdiction for regulations regarding the use of dead animals or animal body parts that may not have been sourced from a certified abattoir, butcher or science supply company. More information on this can be found on the Science ASSIST website link: Dissection materials.

Preservative solutions for foetal tissue

Foetal tissue is very delicate and is usually preserved in a weak formalin solution (5%), or 75% to 80% ethanol containing 25% glycerol to maintain colour and softness of specimens. Normally preparation includes injection of preservative into the flesh in several places and into the body cavities to avoid decay of the internal structures.

Recommended Solutions:

The following are recommended as suitable and safe long-term preservative solutions. Depending on the size of the foetus, it may require the use of a needle and syringe. We recommend you check with your school jurisdiction for any regulations on the use of needles.

Note: These preservative solutions should not be handled by students.

- 25% glycerol in 80% v/v ethanol (The Tasmanian Museum[1] uses this method for preservation of its soft-bodied animal specimens.)
- 75% v/v Ethanol Solution
- 2-phenoxyethanol

Detailed methods for all three solutions are provided below, as well as instructions for transferring from one preservative to another.

Replacement of the old preservative solution

When transferring any specimen from one preservative to another, it is recommended to go through a stepped procedure which includes:

- decanting the existing preservative solution;
- rinsing the specimen several times with water to remove the old preservative (This is important to avoid the possibility of combining incompatible chemicals, which may create a hazardous chemical reaction or new substance that may damage the specimen.);
- replacement with a new preservative solution (Depending on the solution, it may require putting the specimen through several increasing concentrations to avoid any osmotic issues.)

Additional information

Fixation and preservation

Specimens are generally fixed to prevent tissue breakdown and to render them firm. For long-term storage, they are kept in preservative solutions. The chemicals used to fix and preserve specimens can be hazardous and dangerous. Traditionally 10% formalin and 70% ethanol have been the chemicals of choice and are still in use today.

Formalin[2] is toxic, carcinogenic, highly irritating and acts as a potent sensitizer. Formalin is usually used as a 10% solution made by combining 1 part formalin with 9 parts water. This is still the best fixative in use today. Formalin may be used in instances where colour is important since alcohol dissolves most colours almost immediately. Formalin needs to be

handled with great care in a fume cupboard or well-ventilated area. Science ASSIST does not recommend formalin for use in schools [i]

Ethanol[3] (Ethyl alcohol) usually comes in the 95% concentrated form. For long-term preservation and storage, it is usually diluted with distilled water to 70–75% strength. This is the lowest concentration at which preservation will be maintained. Alcohol is highly flammable, usually safe to handle, but can cause irritation to the skin in cases of prolonged contact.

Detailed method for replacing the methylated spirits with new preservative solution

There is not a lot of difference between methylated spirits[4] and ethanol, except that it makes the specimen quite brittle and it may have rendered the skin of the foetus transparent, since alcohol destroys most colours almost immediately.

Before transferring the calf foetus to a new preservative solution, it is recommended that the work be done in a fume cupboard with appropriate PPE. You should also not pour any preservative chemicals down the sink and at all times care must be taken to avoid damaging the specimen in the process.

1. In the fume cupboard or well-ventilated area, decant the methylated spirit solution into a glass container, which can be properly sealed to avoid evaporative loss. Label as 'Caution Flammable liquid - Do Not Use -' for disposal via a chemical waste contractor. Whilst waiting for pick up, store and segregate the waste chemicals safely in approved store rooms or chemical storage cabinets.
2. Wash the calf foetus several times by soaking for 30 minutes in tap water to remove the old methylated spirits solution.
3. Place the foetus into the final preservative solution in a clean glass container that has a tight-fitting lid to prevent any evaporation. Use either 25% glycerol in 80% v/v ethanol or one of the alternatives, see methods below. The use of Parafilm or some silicone sealant can be used to provide a good seal.
4. Label the container to state type of specimen, type and date of preservative. Most museums put the jar label inside the jar, not on the outside or on the lid. This will lessen the likelihood of the specimen and label being separated. It is important to use paper intended for long-term preservation in fluids. There are a several papers that will do. The Australian Museum[5] currently uses Resistall paper, which they source from the US, but other types of papers have been used in the past, including laundry tag paper: https://www.universityproducts.com/cart.php?m=product_list&c=241 . Soft lead pencil can be used to write on the paper and there are certain inks or ink pens that can be used as well. Any inks used should be of archival quality, resistant to fading and smearing, and be insoluble in the preservative solution. Suitable inks and ink pens can be found in some art or office supply stores and museum supply companies. It is recommended to allow the ink to completely dry before placing the label into the storage solution. Ordinary ballpoint pens should not be used for labelling as they generally dissolve in most preservative solutions. See the Science ASSIST School science suppliers list for local museum supply companies for similar products.
5. Store under conditions to prevent any deterioration i.e. a cool dry place in low-light levels and out of direct sunlight.

You will need to take precautions to avoid chemical exposure by contact with skin and eyes, inhalation, and ingestion. It is recommended to work in a fume cupboard and wear appropriate PPE. At all times care must be taken to avoid damaging the specimen in the process. Care is also required if needles are used. Never re-sheath a needle and dispose of used syringe needles in an approved sharps container

Science ASSIST recommends you refer to the specific SDS for any chemicals being used and conduct a site-specific risk assessment to assess and control any risks. We have developed a Risk Assessment template for schools to use, see Risk Assessment Template. You will need to make sure that any fixatives, preservatives and the use of needles are approved for use in your jurisdiction and educational sector and are disposed of appropriately following local guidelines.

Methods for suitable preservative solutions

(Note: % v/v is used for concentrations of solutions of liquids and is calculated as [(volume solute)/(volume of final solution)] x 100%. For example, 80% v/v means that 100 mL of solution contains 80 mL of the solute.)

Method 1: 25% glycerol in 80% v/v ethanol

1. First prepare an 80% v/v ethanol solution: for 100 mL, measure 84 mL ethanol (95%) and make up to 100 mL with distilled water.
2. For 100 mL glycerol/ethanol solution, measure 25 mL glycerol and make up to 100 mL with the 80% ethanol solution, (or combine 1 part glycerol with 3 parts ethanol (80%)).
3. Using a 10 mL syringe and 21g x 38mm needle inject the solution into the body cavity and also into the leg muscles (depending on the size of the foetus). This helps penetrate the inner tissues before immersion in the preservative solution.
4. Immerse the foetus in the solution for storage in a clean glass container that has a tight-fitting lid to prevent any evaporation. The use of Parafilm or some silicone sealant can be used to provide a good seal.
5. Store under conditions to prevent any deterioration i.e. a cool dry place in low-light levels and out of direct sunlight. As the solution is flammable it should be stored in the flammable liquids cabinet.
6. Leave for 2-3 days to fix the tissue.
7. After 3 days pour off the solution and refresh with a new batch.
8. Leave for at least one month before use as a display specimen.
9. Collect any waste solution into a glass waste container, which can be properly sealed to avoid evaporative loss. Label appropriately and dispose via a chemical waste contractor.

It is beneficial to use at least 2-3 fresh changes of the solution. The more changes the better for fixing (retaining colour) and rendering the tissue firm for display.

Using the ratio of 25% glycerol in 80% ethanol has the benefit of no real shrinkage; the glycerol makes the tissue pliable and it is relatively safe to use. Glycerol[6] has low toxicity and helps in preserving and reviving color.

Method 2: 75%v/v Ethanol Solution

1. For 100 mL of solution: measure 80 mL of ethanol (95%) and make up to 100 mL with distilled water, (or combine 4 parts ethanol (95%) with 1 part distilled water). Note: do not use denatured alcohol as a preservative. Some denaturants can have adverse effects on specimens[7].
2. Using a 10 mL syringe and 21g x 38mm needle, carefully inject the ethanol solution into the body cavity and leg muscles.
3. Immerse the foetus in the ethanol solution for storage in a clean glass container that has a tight-fitting lid to prevent any evaporation. The use of Parafilm or some silicone sealant can be used to provide a good seal.
4. Leave for 2–3 days to fix the tissue.
5. After 3 days, pour off the solution and refresh with a new batch.
6. Leave for at least one month before use for dissection or as a display specimen.
7. Store under conditions to prevent any deterioration i.e. a cool dry place in low-light levels and out of direct sunlight. Store in a flammable liquids cabinet.
8. Collect any waste solution into a glass waste container, which can be properly sealed to avoid evaporative loss. Label appropriately and dispose via a chemical waste contractor.

This is a good fixative and preservative that will not overly dehydrate the tissue. Concentrations higher than this are not recommended as they can excessively dehydrate the tissue.

Note: whilst waiting for pick up, store and segregate waste chemicals safely in approved store rooms or chemical storage cabinets.

Method 3: 2-phenoxyethanol

Another alternative is 2-phenoxyethanol (synonyms: phenoxetol, phenoxytol) which is non-flammable compared with 70% ethanol, is less volatile and of lower toxicity when compared with formaldehyde. See the following article which discusses the relative hazards of 2-phenoxyethanol compared with formaldehyde and ethanol: http://www.academia.edu/9751098/Phenoxetol_as_a_formaldehyde-removing_ag... . See the following link for a recipe: https://web.archive.org/web/20170219043724/http://www.rtg.wa.edu.au/solu... (link changed to an archived copy on the Internet Archive's Wayback Machine July 2017). Note that this is a storage solution only and was introduced because it is non-flammable. This removed the requirement in WA to store specimens that were preserved in 70% ethanol in a flammable liquids cabinet[8].

Safety when working with preserved specimens

- Refer to the specific SDS for the all chemicals being used and prepare a site-specific risk assessment.
- Wear appropriate PPE (i.e. safety glasses, gloves, laboratory coat, closed-in shoes).
- Work in a fume cupboard or well-ventilated area.
- Store all flammable preserving solutions in a flammable liquids cabinet.
- Dispose of all waste solutions via a waste contractor.

- Attach and dispose of syringe safely. Attach sheathed needles only to the syringe and never re-sheath needles, as this is how most needle-stick injuries occur.

Dispose of used syringe needles in an approved sharps container positioned at the point of use. Seal and dispose of a full sharps container at a sharps collection facility, sharps disposal bin via a State Health recommended facility or a facility recommended by your local council. More information on sharps and disposal can be found on the Science ASSIST website Sharps container disposal, and at the following website:

Safe Work Australia National Code of Practice for the Control of Work-related Exposure to Hepatitis and HIV (Blood-borne) Viruses [NOHSC: 2010(2003)]
http://www.safeworkaustralia.gov.au/sites/swa/about/publications/Documen...

Links to further information

See the Science ASSIST School science suppliers list for local museum supply companies for suitable labels, storage containers and other similar products.

More information on fixation and preservation can be found on the Science ASSIST website links: Preserving sheep brains without formalin

Preserved specimens

The following links have more information on fixation and preservation of wet collections.

http://conservation.myspecies.info/node/33

Fluid Preservation: A Comprehensive Reference

References:

[1] Gordon, Tammy. 2015. Natural Science Collections Officer, Tasmanian Queen Victoria Museum, Launceston. Personal communication

[2] Chemwatch Gold 2013 *Safety Data Sheet: 10%* formalin.
https://jr.chemwatch.net/chemwatch.web/ (Subscription required) (Accessed December 2015)

[3] Chemwatch Gold 2013 *Safety Data Sheet: Ethyl Alcohol.*
https://jr.chemwatch.net/chemwatch.web/ (Subscription required) (Accessed December 2015)

[4] Chemwatch Gold 2013 *Safety Data Sheet: Methylated spirits.*
https://jr.chemwatch.net/chemwatch.web/ (Subscription required) (Accessed December 2015)

[5] McGrouther, Mark. 2015. Fish Collection Manager, Australian Museum Research Institute, Australian Museum, Sydney. Personal communication

[6] Chemwatch Gold 2013 *Safety Data Sheet: Glycerol.*
https://jr.chemwatch.net/chemwatch.web/ (Subscription required) (Accessed December 2015)

[7]''Standards in the care of wet collections', NHM Conservation Centre website, http://conservation.myspecies.info/node/33 (July 2014)

[8] Kempton, Ruth. 2014. Team Leader, Regional Laboratory Technicians, WA Department of Education. Personal communication

Dungey, Barbara. 2006. *The Laboratory: a science reference and preparation manual for schools* (Rev. ed), National Library of Australia: Traralgon, Vic.

'National Code of Practice for the Control of Work-related Exposure to Hepatitis and HIV (Blood-borne) Viruses [NOHSC: 2010(2003)]', Safe Work Australia website http://www.safeworkaustralia.gov.au/sites/swa/about/publications/pages/c... (1 January 1993)

Simmons, John E. 2014. *Fluid Preservation: A Comprehensive Reference*. Rowman & Littlefield. https://books.google.com.au/books?id=_WqYAwAAQBAJ&pg=PA47&lpg=PA47&dq=sa...

Tandon, A; Bhatnagar, R; Pokhrel, Rishi and Solanke, Kirti. 2014. 'Phenoxetol as a formaldehyde-removing agent for long-term preservation:out experience' *Eur. J. Anat* 18 (4) : 267-272. Academia.edu website, https://www.academia.edu/9751098/Phenoxetol_as_a_formaldehyde-removing_agent_for_long-term_preservation_our_experience (Click on 'Read paper' at the base of the screen to open article)

[i] 'List of recommended chemicals for science in Australian schools', Science ASSIST website /resource/3052/list-recommended-chemicals-science-australian-schools (December 2015)

Calf Foetus

Submitted by on 03 December 2015

I use pure Ethanol. Methylated spirits ends up cloudy and formalin is not something I would suggest for use in schools.

Cheek Cells

Posted by Anonymous on Thu, 2016-05-26 11:59

Cheek Cells: Are students able to do the cheek cell practical using their own cheek cells?

Voting:•
No votes yet

Year Level:•
8
9
10
Senior Secondary
Laboratory Technicians:•
Laboratory Technicians

Showing 1-1 of 1 Responses

Cheek Cells

Submitted by sat on 03 June 2016

The answer to this question depends upon your school policy and a risk assessment.

Some school jurisdictions have considered the risks unacceptable and have established policies prohibiting this. Therefore, schools should first find out what their jurisdiction's policy is on this and then follow this policy for their school.

If your school permits using cheek cells for a science activity, schools should carefully evaluate their facilities, the level of staff training, student behaviour management and all the risks associated with handling human tissue. Science ASSIST previously answered this question see Using body fluids in science.

Science ASSIST is aware of the great diversity in science facilities, as well as in staff training in the areas of microbiology and knowledge of infectious diseases. As a result of all of these different factors, **Science ASSIST does not recommend the use of human tissue or body fluids in school science practical classes due to the risk of disease transmission.**

Science ASSIST recommends the use of alternative activities such as:

- using commercially prepared microscope slides of cheek cells;
- using Biosets (photomicrographs) of cells with Bioviewers that are available from various scientific suppliers: See the list of School science suppliers;
- preparing slides of animal cells from dissection material such as sheep kidneys.

In addition to the previous question, we provide some additional references for consideration.

'8. Biology Laboratory Safety Specifications C. Bloodborne pathogens' Connecticut State Department of Education website.•https://portal.ct.gov/SDE/Publications/Connecticut-High-School-Science-Safety/Biology-Laboratory-Safety-Specifications•(Link Updated July 2019)

'The Use of Human Body Fluids and Tissue Products in Biology Teaching.' (US) National Association of Biology Teachers website.•http://www.nabt.org/Position-Statements-The-Use-of-Human-Body-Fluids-and... (Updated May 2017)

Cremated skeleton

Posted by Anonymous on Thu, 2016-03-10 14:42

Cremated skeleton: I would like to know if anyone has had to dispose of a cremated skeleton from a school. The one here has been here for 8 years approx. and I would like to know if there is any departmental protocol or ethics involved as well as what should be done with it.

Voting:•

No votes yet

Year Level:•

7
8
9
10
Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Answer by labsupport on question Cremated skeleton

Submitted by sat on 23 March 2016

It was quite common years ago for schools and universities to have human skeletons for their studies, which were sourced through scientific suppliers. We are not aware of each school system's policies for dealing with the ethical disposal of human skeletal remains, however,

there does need to be legal and ethical consideration given when disposing of these and they should be treated with respect. Each state/territory has legislation regarding the use and disposal of human tissue and remains.

The human anatomy departments of universities, particularly those which have schools of medicine, are sometimes willing to accept donations of human skeletal remains from other teaching institutions, including schools. They are familiar with and governed by the state/territory legislation that applies in their jurisdiction. Other options include contacting medical waste disposal specialist companies who will dispose of human skeletal remains as medical waste.

However as your remains are now ashes, it may be helpful to contact your local government crematorium services for local advice. It appears that there is no legislation concerning these. They can be buried in a cemetery, kept in an urn or container or scattered on land or water. Please be aware that if you choose to spread the ashes, you may require permission from the land owners, or authorities, e.g. such as the local council, responsible for that land or water.

Here are some links to some interesting related articles:

‘All About Cremation Ashes’, Cremation solutions Inc. website, https://www.cremationsolutions.com/information/scattering-ashes/all-about-cremation-ashes/ (Accessed March 2016)

Australian National University, *Policy: Collection, storage and disposal of human tissue in research, ANU Policy Library website,* https://policies.anu.edu.au/cs/groups/confidential/@rs/documents/edrms/dxbf/mdaw/~edisp/anup_00039 (Accessed March 2016)

‘Cremation ashes’, Fact sheet, NSW Government Health website, http://www.health.nsw.gov.au/environment/factsheets/Pages/cremation-ashes.aspx (April 2013)

Tasmanian Association for Hospice and Palliative Care. 2015. *Our Final footprint: Dying simply and sustainably in Tasmania https://www.google.com.au/url?sa=t&rct=j&q=&esrc=s&source=web&cd=4&cad=r...* (Accessed March 2016)

UK Department for Culture, Media and Sport. 2005. *Guidance for the Care of Human Remains in Museums.* https://www.britishmuseum.org/sites/default/files/2019-11/DCMS-Guide_0.pdf (Updated December 2019).

Disinfecting microscopes

Posted by Anonymous on Thu, 2020-05-21 11:28

Disinfecting Microscopes: I am looking for information to create a SOP (or something that Science assist can do for us?) for cleaning and disinfecting microscopes - what is the best and safest agent to use and how to keep a record of this within the prep room. I am in particular wanting something that will be effective against enveloped viruses such as coronavirus.

Voting:•

No votes yet

Laboratory Technicians:•
Laboratory Technicians

Showing 1-1 of 1 Responses

Disinfecting microscopes

Submitted by sat on 21 May 2020

Using microscopes during COVID-19

Shared equipment such as microscopes should be cleaned and disinfected between each use. If it is possible to allocate each student their own microscope in a lesson this will avoid the need for disinfecting during a lesson. Note that the use of safety glasses is not recommended, as they are not needed when using a microscope and they may introduce new

risks such as additional face touching.

Here are some general guidelines formulated from the microscope manufacturer references noted below:

General:

- Disinfection will not destroy all microorganisms as it is not a sterilisation process. Disinfection will eliminate many microorganisms on inanimate surfaces and often requires certain exposure times. Common disinfectants are 70% ethanol, 0.5-1% bleach and 3% hydrogen peroxide[1]. It appears that most of the major microscope manufacturers recommend 70% ethanol to clean and disinfect their microscopes. Correlations with similar enveloped viruses to the emerging coronavirus indicates that 70% ethanol is effective.[2]
- Caution is required as to the type of cleaning and disinfecting agent used as not all components of all microscope brands are able to withstand all disinfectants. There is the possibility of damage to the lenses and the cement used to hold them together. Generally, it is advised to use minimal cleaning or disinfecting solution. and never saturate the lens cleaning tissue. We recommend checking with the microscope manufacturer or user manual for the recommended disinfectant for your brand of microscope.
- To avoid scratching the lenses do not use regular tissues, paper towel or cotton swabs for cleaning. Always use specific lens cleaning tissue.
- It is recommended to wear gloves when cleaning and disinfecting the microscope. The gloves can be discarded into the regular bin after cleaning and hands should be washed with soap and water or sanitiser.

Body of microscope:

- High touch areas of a microscope e.g. nosepiece, stage and slide holders and focus knobs should be wiped over with a soft cloth and mild detergent followed by a disinfectant.

Eyepiece (oculars) plus rubber eyepiece shades and objectives - cleaning and disinfecting.

- It is recommended to initially blow any dust off with a blower brush. This is then followed by gentle cleaning and then disinfecting with 70% ethanol using lens tissue.
- Remember to never saturate the lenses with cleaning or disinfecting solution, just lightly blot the surface then allow to air dry.

Note: It is not recommended to clean the internal surfaces of lenses.

Alternatives:

An eyepiece microscope camera can be used to view images projected from the microscope onto a smart board. or computer screen.

Record Keeping

This is not mandated, however it is a good idea to keep records in a microscope maintenance log to demonstrate that disinfection has taken place. We don't have a proforma for you to use, but you could make one up to suit your school circumstances, which would include as a minimum the date; microscope identification, •and which class (or student) used the microscope. It could also be used to identify where there is another issue with a specific microscope such as needing a replacement part (e.g. globe) or servicing (e.g. poor focusing or dirty lenses).

Good hygiene during COVID-19

Good hygiene should be strictly observed such as is stated in the Australian Health Protection Principal Committee (AHPPC) statements, see https://www.health.gov.au/committees-and-groups/australian-health-protec...

As the information is being frequently updated it is good to check the latest advice. As of (24th April 2020) the latest advice for schools can be found at https://www.health.gov.au/news/australian-health-protection-principal-co...

In particular, see the sections on hygiene, routine care and environmental cleaning. The general hygiene advice is•

- Staff and students should stay away from school if unwell
- Everyone should practice good hygiene: wash hands regularly, cough into elbows, minimise touching face
- Clean and disinfect frequently used high touch surfaces and frequently used objects such as computers, photocopiers etc.

Manufacturer information for cleaning and disinfecting microscopes

Leica: 'How to Sanitize a Microscope', https://www.leica-microsystems.com/science-lab/how-to-sanitize-a-microsc...

Nikon: 'Handling and Disinfecting Procedures for Nikon Microscope Products', https://www.microscope.healthcare.nikon.com/en_AOM/recommended-handling-...

Olympus: 'How to Clean and Sterilize Your Microscope', •https://www.olympus-lifescience.com/en/discovery/how-to-clean-and-steril... (Link Updated August 2021)

Zeiss: 'Recommendations for Disinfection of Microscope Components and Objectives', https://www.zeiss.com/content/dam/Microscopy/us/img/2019-Template/litera...

References and further reading

[1] ‘How to Sanitize a Microscope’, Leica Microsystems website, https://www.leica-microsystems.com/science-lab/how-to-sanitize-a-microsc... (03 April 2020)

[2] South Australian Health. March 2020. *Fact Sheet for health professionals Coronavirus disease (COVID-19): environmental management,* South Australia Health website, https://www.sahealth.sa.gov.au/wps/wcm/connect/58acb674-262e-4300-ac22-0... (Accessed via Coronavirus Disease 2019 (COVID-19) resources and links for health professionals, South Australia Health website, https://www.sahealth.sa.gov.au/wps/wcm/connect/public+content/sa+health+...)

‘Australian Health Protection Principal Committee (AHPPC)’ Australian Government Department of Health website, https://www.health.gov.au/committees-and-groups/australian-health-protec... (Accessed May 2020)

Science ASSIST. 2015. *SOP: Use and care of the compound light microscope,* Science ASSIST website, http://assist.asta.edu.au/resource/2879/sop-use-and-care-compound-light-...

Dissecting cane toads in WA

Posted by Anonymous on Fri, 2015-03-06 11:43

Dissecting cane toads in WA: Could you please advise on the status of importing cane toads into WA as preserved specimens. There has been a recommendation recently for Lab Techs to dissect cane toads imported from Queensland instead of other frogs or toads. My understanding is that, as they are a declared pest, a permit must be obtained for every import from Dept Agriculture and Dept Parks and Wildlife.

Can you comment on disposal issues- any pet, wild animal or bird that gets into a bin or land fill and eats a toad will die a horrible death.

By purchasing cane toads, are you actually paying someone to breed cane toads? Surely supporting breeding native or non-toxic frogs or toads for specimens is a better choice.

Voting:•

No votes yet

Year Level:•
Senior Secondary
Laboratory Technicians:•
Laboratory Technicians

Showing 1-1 of 1 Responses

Dissecting cane toads in WA

Submitted by sat on 06 March 2015

Thank you for your multiple questions regarding cane toads. I will answer them separately below.

Cane toads

Cane toads, *Rhinella marina,* were introduced into Queensland in 1935 to control scarab beetles, which were pests to sugar cane. The cane toad is tough and adaptable as well as being poisonous throughout its life cycle. It has few predators in Australia, which is bad news for competing native amphibians, and it may be responsible for the population decline of the few snakes and other species that do prey on it[1].

Cane toads have been very successful as an invasive species, expanding their range through Queensland, northern New South Wales, the Northern Territory and the north of Western Australia.[2] For more information see:

https://www.awe.gov.au/biosecurity-trade/invasive-species/feral-animals-australia/cane-toads and https://nt.gov.au/leisure/parks-reserves

Status of importing dead cane toads into WA

Under the WA Biosecurity and Agriculture Management Act 2007 cane toads are a declared pest. For **live** toads, an import and keeping permit is required from the Department of Agriculture and Food in WA, where strict conditions must be met in order for the application to be approved. There is no current policy prohibiting importing dead cane toads to WA. We have consulted with the Department of Agriculture and Food in WA and have been advised of the following: it is necessary for the Department of Agriculture and Food in WA to write a policy statement regarding allowing the importation of dead cane toads into WA.[3] This will then provide the opportunity for schools to use dead cane toads for dissection purposes in science. They have indicated that it could take at least a calendar month to arrange this, so this may be available by April 2015. We will update this post when we have been advised that this has been approved.

Dissection of cane toads

Science ASSIST is not aware of any breeders of cane toads. •

A cane toad dissection allows the teacher to cover many aspects of body systems in amphibians including: skeleton, musculature, heart and arterial, venous, digestive and respiratory, urogenital and nervous systems in a series of practicals using the same specimen [4].

Sourcing of cane toads should be from an authorised supplier, who has humanely euthanized them. Two sources of cane toads that comply with this are:

- Dissection Connection https://dissectionconnection.com.au/ supply cane toads frozen. The toads are sourced in Queensland and are euthanized following procedures set out by Sharp et al “Methods for the field euthanasia of cane toads”[5].
- Southern Biological https://www.southernbiological.com/ supply Queensland Cane

Toads, *Rhinella marina*. They are supplied by a licensed collector (based in Queensland) under a process approved by the Victorian Dept of Environment and Primary Industries.[6]

Note: Details of these suppliers have been compiled by Science ASSIST team members who, in the course of their laboratory employment, have found these businesses to provide merchandise which is suitable for school laboratories.•

When handling, students should wear PPE (laboratory coat/apron, safety goggles, nitrile or rubber gloves), and demonstrate good hygiene by not touching their face or eyes and paying particular attention to hand washing after the dissection. A site-specific risk assessment should be carried out prior to handling cane toads. This risk assessment should address the maturity of students carrying out the dissection with regard to the toxins that are contained within the parotoid gland behind the eyes of the toad.

An excellent source of information regarding the handling and disposal of cane toads is contained in the following document: https://education.qld.gov.au/curriculums/Documents/sop-cane-toad.pdf•(Link updated July 2019)

Cane toads are also dissected as part of the education program by the WA Department of Parks And Wildlife.[7] There is useful information on their website:• https://www.dpaw.wa.gov.au/management/pests-diseases/cane-toads (Link updated November 2017).

Disposal of cane toads

As with all dissection material, toads that have been dissected should be securely wrapped in several sheets of newspaper and double bagged before disposal in general refuse for deep burial in landfill sites.[8],[9] Secure wrapping and double bagging will generally deter animals from eating dissected toads in garbage bins, in preference for more easily attained food sources.

Alternative dissection materials

Sourcing alternative dissection materials is an option to consider. Science ASSIST recommends you consult with your jurisdictional education department and animal ethics committee, suppliers, the head of science and teachers at your school, whilst examining standard operating procedures and risk assessments before making a decision on the dissection specimen that best suits the learning area.

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1 Australian Museum 2014 *Cane Toad* https://australianmuseum.net.au/cane-toad (accessed February 2015)

[2] Australian government. Department of the Environment. 2009. *Australian Government policy on cane toads.* https://www.awe.gov.au/biosecurity-trade/invasive-species/feral-animals-australia/cane-toads (accessed February 2015)

[3] Kirkpatrick, Win. 2015. Department of Agriculture and Food in WA. Personal communication.

[4] Dissection Connection *Cane Toads come to Dissection Connection* https://dissectionconnection.com.au/new-cane-toads-come-to-dissection-connection/ (accessed February 2015)

[5] Dissection Connection *Cane Toads come to Dissection Connection* https://dissectionconnection.com.au/new-cane-toads-come-to-dissection-connection/ (accessed February 2015)

[6] Ball, Peter. Southern Biological. 2015. Personal Communication.

[7] Everitt, Corrin. 2015. WA Department of Parks and Wildlife. Personal Communication.

[8] Kempton, Ruth. 2015. Team Leader, Regional Laboratory Technicians, WA Department of Education. Personal Communication.

[9] Queensland Schools Animal Ethics Committee. 2014. Cane Toads Standard Operating Procedure.•https://education.qld.gov.au/curriculums/Documents/sop-cane-toad.pdf•(Link updated July 2019)

Enzyme preparation for experiments.

Posted by Anonymous on Thu, 2015-05-07 12:08

Enzyme preparation for experiments: I would like the correct preparation of these enzyme solutions: pepsin, trypsin and amylase.

Voting:

No votes yet

Year Level:
Senior Secondary
Laboratory Technicians:
Laboratory Technicians

Showing 1-1 of 1 Responses

Enzyme preparation for experiments.

Submitted by sat on 12 May 2015

Firstly, please read and be familiar with the "General Safety Precautions when using Enzymes" below prior to preparing enzyme solutions. Enzymes in powder form are considered hazardous substances[1,2,3]. However, in dilute aqueous concentrations, they are considered to be a low hazard.

It is important to understand that enzymes, when dissolved into solution, are much less stable than in powder form and lose their activity quickly. Therefore, it is best to prepare only what is required, and only just before use. Enzymes in powder form should be stored in the fridge (4°

C) unless otherwise specified. Diluted solutions can be stored in the fridge, but should be used within of an hour or two of preparation and be kept on ice during an experiment.

Enzymes are usually made up as a percentage concentration. A 0.5% to 1% w/v solution is generally suitable for enzyme digestion practicals carried out in schools. It is always best to use the lowest concentration and smallest amount possible. The optimum reaction conditions can be different for each enzyme. It should also be noted that both trypsin and amylase work optimally around a neutral pH, whilst pepsin requires a pH of 1.5–2 to be active. The protocol for the procedure that you are following should indicate the type and amount of acid required to acidify a reaction using pepsin. It may mean that an acid, in many cases hydrochloric acid, is added to the reaction, or that pepsin is made up in a dilute acidic solution instead of water.

Here is a recipe that is suitable to prepare 100 mL of a 0.5% w/v solution of trypsin, pepsin or amylase using distilled water.

Wear PPE: safety glasses, gloves, laboratory coat, face mask or work in a fume cupboard that is not turned on to minimise exposure to dust or aerosols. If working outside a fume cupboard, make sure you are in a draft-free area.

- Weigh out 0.5g of the enzyme.
- Add to 80mL of distilled water at room temperature in a beaker.
- Stir gently to dissolve.
- Adjust to a final volume of 100ml.
- Store at 4°C (fridge) for a short period of time or on ice during use.
- Do not heat or allow the solution to froth, as this will denature the enzyme.

Working with Enzymes:

Enzymes are proteins that are catalysts of chemical reactions. Catalysts increase the speed of the chemical reaction but do not form part of the final product. Enzymes act on substrates to make products in a chemical reaction and they are highly specific to the reactions they catalyse (the lock and key model).

It is always advisable to check the enzyme reaction is working as required and make adjustments to the conditions and concentrations if needed before any practical class. Enzyme activity is affected by concentration, temperature, pH, substrate concentration and can be affected by the age of the reagents.

Digestive Enzymes:

Amylase is found in saliva in the mouth (salivary amylase) and in the pancreatic juice in the pancreas (pancreatic amylase). It is an enzyme that breaks down starch into sugar. Amylase operates optimally at a pH of 6.7 to 7.0 and at 37°C.

Pepsin is the main gastric enzyme that digests proteins into their component peptides and amino acids. Pepsin is secreted in the stomach and operates optimally in an acidic environment around pH 1.5–2.

Trypsin, which is secreted in the small intestine, digests proteins into their component

peptides and amino acids. Trypsin operates optimally at a neutral or slightly alkaline environment of pH 7-9.

General Safety Precautions when using Enzymes:

Safe handling of enzyme preparations can be accomplished through proper work practices, engineering controls, and use of personal protective equipment.

Note:•Enzymes are biologically active proteins.•It is advised to avoid inhalation of enzyme dust or aerosols, which can lead to sensitisation and allergic reactions. Enzymes may cause asthma and are irritating to the eyes, respiratory system, mucous membranes and skin. Always wear safety glasses and gloves. When working with powdered enzymes, wear a dust mask or work in a fume cupboard, that is not turned on, to minimise exposure to any dust. Always use practices that do not generate dust or aerosols.

Enzymes in powder form are hazardous substances[1,2,3]. However, in dilute aqueous concentrations, they are considered to be a low hazard.

Minor spills should be cleaned up immediately, without generating dust. Place waste into a labelled container for disposal via a waste contractor.• Do not discharge waste into the sewer or waterways.

Science ASSIST recommends you conduct a site-specific risk assessment to assess and control the risks. You will need to determine how to safely prepare, handle and dispose of the solution. We have developed a Risk Assessment template for schools to use, see•Risk Assessment Template.

References

Science ASSIST. 2018. Chemical Management Handbook for Australian Schools –Edition 3, Science ASSIST website, https://assist.asta.edu.au/resource/4193/chemical-management-handbook-au... (See Laboratory notes on•Enzymes)

Enzyme Technical Association (ETA). Nd. 'Working Safely With Enzymes', Enzyme Technical Association (ETA) website, https://www.enzymetechnicalassociation.org/wp-content/uploads/2017/11/Wo... (Accessed via https://www.enzymetechnicalassociation.org/documents/)

'SAFETY - Working with enzymes', National Centre for Biotechnology Education University of Reading website, http://www.ncbe.reading.ac.uk/SAFETY/enzymesafety.html (2017)

'Enzymes' Royal Society of Chemistry website https://www.rsb.org.uk/education/teaching-resources/secondary-schools/chemistry-for-biologists (Accessed May 2015)

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[1] Chemwatch, November 2011.Material Safety Data Sheet: Trypsin

[2] Chemwatch, May 2013.Material Safety Data Sheet: Pepsin

[3] Chemwatch, April 2011.Material Safety Data Sheet: Amylase

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Enzymes

Posted by Anonymous on Tue, 2015-03-03 18:08

Enzymes: Hi, do you have a recipe to mix trypsin 1:250 powder into a solution suitable for an enzyme digestion prac.

No concentration was stipulated in the activity.

Voting:•

No votes yet

Year Level:•
Senior Secondary
Laboratory Technicians:•
Laboratory Technicians

Showing 1-1 of 1 Responses

Enzymes

Submitted by sat on 05 March 2015

A 0.5% to 1% w/v trypsin solution is generally suitable for enzyme digestion practicals. Here is a recipe to prepare 100mL of a 0.5% w/v solution.

Wear PPE: safety glasses, gloves, laboratory coat, face mask or work in a fume cupboard that is not turned on to minimise exposure to dust or aerosols. If working outside a fume cupboard make sure you are in a draft free area.

Weigh out 0.5g of trypsin

Add to 80mL of distilled water at room temperature in a beaker.

Stir gently to dissolve.

Adjust to a final volume of 100ml.

Store at 4^0C (fridge) for a short period of time or on ice during use.

Do not heat or allow the solution to froth as this will denature the enzyme.

Trypsin solutions are best freshly made.

Trypsin is a pancreatic enzyme which digests proteins into peptides and amino acids.

Chemical Formula Arrow

Protein + trypsin → amino acids

Image not found: file:///var/www/vhosts/assist.asta.edu.au/httpdocs/sites/assist.asta.edu.au/files/Long%20Arrow.jpg

Trypsin in powder form is a hazardous substance[1], however in low aqueous concentrations is considered to be a low hazard.

Working with Enzymes

Enzymes are proteins that are catalysts of chemical reactions. Catalysts increase the speed of the chemical reaction but do not form part of the final product. Enzymes act on substrates to make products in a chemical reaction and they are highly specific to the reactions they catalyse (the lock and key model).

Enzyme activity is affected by concentration, temperature, pH, substrate concentration and can be affected by the age of the reagents. It is always advisable to check the enzyme reaction is working as required and make adjustments to the conditions and concentrations if needed before any practical class.

It is important to keep enzymes stable and prevent them from denaturing. It is best to use the lowest concentration and smallest amount possible.

General Safety Precautions when using Enzymes

Safe handling of enzyme preparations can be accomplished through proper work practices, engineering controls, and use of personal protective equipment.

Note: Enzymes are biologically active proteins. It is advised to avoid inhalation of enzyme dust or aerosols which can lead to sensitisation and allergic reactions. Enzymes may cause

asthma and are irritating to the eyes, respiratory system, mucous membranes and skin. Always wear safety glasses and gloves. When working with powdered enzymes wear a dust mask or work in a fume cupboard that is not turned on to minimise exposure to any dust. Always use practices that do not generate dust or aerosols.

Minor spills should be cleaned up immediately without generating dust. Place waste into a labelled container for disposal via a waste contractor.• Do not discharge waste into the sewer or waterways.

Science ASSIST recommends you conduct a site specific risk assessment to assess and control the risks. You will need to determine how to safely prepare, handle and dispose of the solution. We have developed a Risk Assessment template for schools to use, see Risk Assessment Template.

References

Science ASSIST. 2018. Chemical Management Handbook for Australian Schools –Edition 3, Science ASSIST website, https://assist.asta.edu.au/resource/4193/chemical-management-handbook-au... (See Laboratory notes on•Enzymes)

Enzyme Technical Association (ETA). Nd. 'Working Safely With Enzymes', Enzyme Technical Association (ETA) website, https://www.enzymetechnicalassociation.org/wp-content/uploads/2017/11/Wo... (Accessed via https://www.enzymetechnicalassociation.org/documents/)

'SAFETY - Working with enzymes', National Centre for Biotechnology Education University of Reading website, http://www.ncbe.reading.ac.uk/SAFETY/enzymesafety.html (2017)

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https://www.rsb.org.uk/education/teaching-resources/secondary-schools/chemistry-for-biologists

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[1] Chemwatch, November 2011.Material Safety Data Sheet: Trypsin

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fainting during dissections

Posted by Anonymous on Fri, 2015-06-05 11:55

Fainting during dissections: I have read your SOPs on dissections. Could you include fainting as one of the hazards of the activity? How should students be prepared for what they are going to do? What signs of imminent fainting should students and teacher watch out for?

Voting:

No votes yet

Australian Curriculum:
Cells are the basic units of living things and have specialised structures and functions
Biological Sciences
Year Level:
8
9
10
Senior Secondary
Laboratory Technicians:
Laboratory Technicians

Showing 1-1 of 1 Responses

fainting during dissections

Submitted by sat on 09 June 2015

Before a dissection:

When planning a class dissection activity, it is best to discuss beforehand, the type of dissection to be undertaken (i.e., heart, lung, kidney rat etc.) and warn of the possibility there may be some blood present during the dissection.

Let students know they don't have to participate in the dissection and can be excused from the class.

Alternative arrangements can be made for students who don't wish to participate through giving them worksheets to complete and relocating them to a private study area.

Demonstrating the dissection to students before they begin is helpful, not only for correct procedure, but it allows them to adjust to the appearance of the material, and any blood that may be present after dissection material has been washed.

Always ensure adequate room ventilation by opening windows and doors or using mechanical ventilation.

Fainting

'Fainting is a brief episode of unconsciousness caused by a sudden drop in blood pressure. Common causes include heat, pain or distress. If you feel faint, lie down and elevate your feet. You can get up slowly after ten minutes. If a person doesn't recover quickly, always seek urgent medical attention. The collapse could have been triggered by a more serious event such as a cerebral haemorrhage (stroke)'.[i]

Signs and symptoms:

- Dizziness
- Light-headedness
- A pale face
- Perspiration
- Heightened anxiety and restlessness
- Nausea
- Collapse
- Unconsciousness, for a few seconds
- Full recovery after a few minutes[i]

If fainting occurs: If students start to feel faint, dizzy or nauseous during the dissection, lie them down, if possible, and elevate their feet. Sending them outside for some fresh air can also help.

'*Note: Do not sit the patient on a chair with head between knees*'[ii]

Refer to school first aid officer and seek medical attention if symptoms persist.

More information on fainting can be found in the latest copy of ‘Australian First Aid’ St John Ambulance Australia, and at the website below.

Better Health Channel State Government of Victoria: https://www.betterhealth.vic.gov.au/health/conditionsandtreatments/fainting (Link updated October 2017)

Better Health Channel State Government of Victoria: [ii] https://www.betterhealth.vic.gov.au/health/conditionsandtreatments/fainting (Link updated October 2017)

[ii] St John Ambulance Australia. (2011). *Australian First Aid.* Barton, ACT

Human skeletons

Posted by Anonymous on Tue, 2016-05-03 12:41

Human skeletons: We have been offered a human skeleton that has, up until now, been used for medical purposes. Are there any laws or special responsibilities we would have to comply with if we accepted this donation? Is it legal for us to have a human skeleton? I have read through the "Transplantation and Anatomy Act 1978" (ACT), but this was not helpful.

Voting:•

No votes yet

Year Level:•

7
8
9
10
Senior Secondary

Laboratory Technicians:•

Laboratory Technicians

Showing 1-1 of 1 Responses

Human skeletons

Submitted by sat on 25 May 2016

These are very difficult questions to answer, and at present we cannot answer your questions. We have sought clarification on the relevant Act and have also approached a number of other

places such as anatomy departments, mortuaries and museums for advice. The possession of human skeletons by schools appears to be a grey area with no clear guidelines. Most of the relevant legislation covers human tissue material obtained through autopsies and by patient consent after surgical procedures and we are therefore continuing with our research regarding the legality of acquisition and possession of human skeletons in schools. We previously answered a question on the disposal of a human skeleton see Cremated skeleton, which contains some related information and links that may be helpful.

We will update this post when we have some further information.

Is it illegal to grow Hydrilla in WA?

Posted by Anonymous on Tue, 2015-01-06 17:46

Is it illegal to grow *Hydrilla verticillata* in Western Australia? I know Elodea was banned years ago. Can we grow them in school environment for biology experiments?

Voting:

No votes yet

Year Level:
7
Senior Secondary
Laboratory Technicians:
Laboratory Technicians

Showing 1-1 of 1 Responses

Is it illegal to grow Hydrilla in WA?

Submitted by sat on 02 February 2015

Thank you for your great question. The short answer is that, according to the Western Australian Department of Agriculture and Food, you can legally grow Hydrilla in WA, and use it in biological experiments and investigations. See *https://www.agric.wa.gov.au/organisms/126995*

However, this does not apply to all states and territories. According to the Australian Government Department of Environment, it is noted as a declared weed in Western Australia

and Tasmania. Its use is permitted in WA but in Tasmania, where it does not occur naturally, it may not be sold or used. See:

- *http://www.environment.gov.au/cgi-bin/biodiversity/invasive/weeds/weeddetails.pl?taxon_id=9576# (see management tab)*
- http://dpipwe.tas.gov.au/invasive-species/weeds/weeds-index/declared-wee...

For general information regarding the importation of other plants or organisms into WA, see https://www.agric.wa.gov.au/bam/legislation-importing-western-australia. The status of a particular organism can be checked on the Western Australian Organism List (WAOL) see https://www.agric.wa.gov.au/organisms. Unlisted organisms require a permit for importation.

As often happens, your query opens up a number of associated questions. This is also an opportunity to address some of these.

About Hydrilla

Hydrilla (H verticillata) is an aquatic plant native to parts of Asia and Northern Australia (NT and Qld) where it grows in waterways, lagoons and estuaries. It now occurs naturally in all states and territories except the ACT and Tasmania. It is very similar to a number of other aquatic plants including Elodea.

Hydrilla is extremely robust and able to thrive in a wide range of temperature, light and salinity conditions. With the potential to create severe environmental plant blooms and waterway obstruction, this is not usually a problem in Australia. However, it is a major problem in North America.

See *http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0007/329308/041209-DPI-RWW-PLANT-GUIDE.pdf.*

About Elodea

Elodea (E Canadensis), is a similar aquatic plant that is native to North America, introduced through its use in aquaria. It can also create severe blooms and clog waterways, and is regarded as a greater environmental problem in Australia. For this reason, it is banned from sale in most of Australia, with the exception of Victoria. See https://www.southernbiological.com/living-specimens/plants-and-physarum/l2-15-elodea-anacharis-live-victoria-and-queensland-only/ (Updated May 2019)

Availability of Hydrilla

Hydrilla is not widely commercially available as live plants, however, we have located one possible source. See *http://www.watergardenparadise.com.au/submergedplants.php*.

Alternatively, as Hydrilla occurs naturally in many waterways, you may be able to collect it yourself. Responsible management of it would include destroying any remaining plant material at the end of the activity to ensure that it is not allowed to enter any waterways where it does not already exist.

The context of this question, and a request for help

We understand that the intended use is to allow the plants to photosynthesise under water and to observe and capture the oxygen bubbles that are generated in an inverted test tube. In the past, Elodea has been used in such activities. However, because of its declared pest status, this is no longer permitted, except in Victoria. The possible use of Hydrilla is being considered for this activity.

Although we have not field tested it, we think that under favourable conditions Hydrilla produces oxygen at a rate suitable for the above activity. Given the precautions listed above, there would seem to be no reason not to use this plant in those parts of Australia where it already occurs naturally. However, there remain significant parts of Australia where this is not appropriate, especially Tasmania and the ACT.

Science ASSIST would welcome any suggestions of other more environmentally friendly aquatic plants that may suit this activity.

Lung Dissection

Posted by Anonymous on Tue, 2015-06-02 15:18

Lung Dissection: Has an SOP been written for a lung dissection?

Voting:•
No votes yet

Australian Curriculum:•
Biological Sciences
Year Level:•
Senior Secondary
Laboratory Technicians:•
Laboratory Technicians

Showing 1-1 of 1 Responses

Lung Dissection

Submitted by sat on 04 June 2015

Update 17 October 2016: A SOP for a lung dissection is now available on the site: see SOP: Performing a lung dissection.

We have not written an SOP for a lung dissection, but we can add it to our list of SOPs to do.

In the meantime, the following information and suggestions may help.

- Make sure that you source dissection material from a butcher or an abattoir, so that appropriate health department checks have been conducted.
- See the following SOPs for other dissections as a comparison. They have good guidance for dissections in general:

SOP: Performing an eye dissection

SOP: Performing a kidney dissection.

SOP: Performing a heart dissection

- Consider suggesting that the students look at prepared slides of stained lung tissue showing alveoli.
- See a video resource linked to from the Science ASSIST site Biology lung dissection.

If considering conducting a lung dissection, d**o take note of these specific safety notes:** Blowing by mouth via a piece of rubber tubing into the lungs is not a recommended procedure due to the possibility of inhaling aerosols from the lungs as the air is expelled from the lungs. It is best practice to use a bicycle pump. In addition, it is good practice to wear safety glasses in all dissections.

Oil immersion lenses

Posted by Anonymous on Mon, 2015-11-16 17:56

Oil Immersion lenses: Hi, We have just purchased microscopes that have oil immersion lenses and a small sample of oil. What is the best way to clean the oil from the lenses after use? What is the best oil to purchase?

Voting:

No votes yet

Year Level:
8
9
10
Senior Secondary

Laboratory Technicians:
Laboratory Technicians

Showing 1-1 of 1 Responses

Oil Immersion

Submitted by sat on 20 November 2015

In Brief:

Immersion oil and which one to use?

Immersion oil is utilised to increase the optical resolving power of the microscope. It is used by placing a small amount between the coverslip of a specimen and the front lens of an oil immersion objective. There are many different types of immersion oils, all with different properties and it is generally best to use the immersion oil recommended by the manufacturer of the objective. •Immersion oil properties are usually matched to the objective lens properties to give optimal image quality. The refractive index of the immersion oil is an important parameter and it is typically 1.515 at 23°C [1], close to that of glass to obtain optimal results. As the refractive index is similar to that of glass, light rays leaving the microscope slide and passing into the oil continue unrefracted, or are refracted less than if they are passed from glass to air. Using immersion oil increases the resolution so that smaller objects can be seen.

As basic light microscopy is routinely used in school science laboratories, the difference in image quality will not be evident, so any manufacturer's immersion oil will be suitable as long as the refractive index is correct. Immersion oil is available from many scientific suppliers, see the Science ASSIST School science suppliers list.

Other fluids such as glycerine, and also mineral and vegetable oils work, but their refractive indices and dispersive powers vary somewhat from that of glass, and hence cannot be expected to elicit the best imagery from the specimen[2].

Immersion oil should only be used sparingly with an oil immersion objective lens. It should **Never** be used with any of the other dry objectives, as it will damage them. Immersion oil is best stored at room temperature.

Cleaning microscope objectives

It is best to consult the manufacturer's guidelines as to the best cleaning method and fluid for your particular microscope.

Generally, the choice of cleaning method and fluid depends on the optical surface that requires cleaning and the substance to be removed. The surface of the optics of a microscope are easily damaged and therefore require extra care in their maintenance. Any cleaning fluid used should not damage any part of the microscope, including the lenses, and it should not leave any residue.

Image quality is dependent on having clean, damage-free optics. Immersion oil should be removed immediately after use and not be allowed to remain on the objective lens. The risk of leaving immersion oil on an objective lens can result in the contamination of other parts of the microscope and the possibility of the oil moving into the objective itself causing irreversible damage[3].

Steps for the removal of immersion oil from the external surface of the oil immersion lens.

- The oil should be removed immediately after use.
- Use clean, lint-free, lens cleaning tissue to gently blot the oil from the lens surface.
- Gently wipe the lens surface with fresh lens cleaning tissue until no oil residue is evident. This will require several changes of lens cleaning tissue.

- Any final traces of immersion oil can be removed using a small amount of lens cleaning fluid. Commercial glass cleaners such as Windex®can be used sparingly but they may have an effect on some coatings used on lens surfaces [(4)].
- Never use abrasive materials such as dry cotton swabs or facial tissues, as they are likely to scratch the lens.

Additional information

Immersion Oil

The choice of immersion oil for many years was Cedar Wood Oil, until the manufacture of synthetic alternatives in the 1940s. Cedar Wood oil is still available, but has many disadvantages: it goes yellow with age, and if not cleaned up properly, will penetrate and damage the cement in the lens. The modern synthetic versions used today are inert, more colour stable and can be obtained in various viscosities[(2)].

General cleaning advice for microscope optics

- Treat lenses with great care, as they can be easily scratched.
- Solvents are not recommended for cleaning objective lenses as they have the potential to dissolve the cement in the lens assembly and harm other mechanical components, particularly in older microscopes.
- When cleaning lenses, first blow away any dust with a blower brush, then use a lint-free lens tissue and lens cleaning fluid to clean the objectives lenses and eyepieces.
- Do not use paper towel or regular tissues, as they will scratch the lens.
- Never dry wipe a lens, as this may also cause scratching.
- Remove immersion oil immediately after use with lens tissue and lens cleaning fluid.
- Do not remove eyepieces or objective lenses from their location and clean only their external surfaces. Internal surfaces should be cleaned by a professional.

Science ASSIST has also developed a resource on the use of the care of the compound light microscope see: SOP - Use and care of the compound light microscope

References:

•[(1)] Nikon Instruments, 2009. *Immersion oil and the microscope FAQs.* Melville, NY USA. Micro Video Instruments website, http://www.mviservice.com/Images/Immersion%20Oil%20FAQs%202009.pdf

[(2)] 'The oil immersion guide', Microscopy UK website, http://www.microscopy-uk.org.uk/mag/indexmag.html?http://www.microscopy-uk.org.uk/mag/artmar02/pjoil.html (March 2002)

[(3)]•'Microscope cleaning and maintenance', ZEISS Microscopy Online website, http://zeiss-campus.magnet.fsu.edu/articles/basics/care.html (Accessed November 2015)

(4) ‘Immersion oil’ in Murphy, Douglas B.; Davidson, Michael W. 2013. *Fundamentals of Light Microscopy and Electronic Imaging,* Wiley-Blackwell; New Jersey, USA. https://books.google.com.au/books?id=f8qhtqRjxQMC&pg=PT140&lpg=PT140&dq=...

‘Basic Concepts in Optical Microscopy’, Microscopy Resource Center, OlympusMicro website, http://olympus.magnet.fsu.edu/primer/anatomy/anatomy.html•(Accessed January 2016)

Cargille, John J. 1985. *Immersion oil and the microscope*, New York Microscopical Society Yearbook, Cargille Labs website,• https://cargille.com/wp-content/uploads/2018/03/Immersion_Oil_and_the_Microscope.pdf• (Link updated May 2019)

‘Immersion media’, Microscopy Resource Center, OlympusMicro website, http://olympus.magnet.fsu.edu/primer/anatomy/immersion.html (Accessed January 2016)

‘Oil Immersion and Refractive Index’, ZEISS Microscopy Online website, http://zeiss-campus.magnet.fsu.edu/tutorials/basics/oilimmersionrefractiveindex/indexflash.html (Accessed November 2015)

Oxygen producing plants

Posted by Anonymous on Wed, 2015-02-04 16:39

Oxygen producing plants: Can we use *Ceratophyllum demersum* (fox tail ~~a~~ hornwort) as an alternative plant to *Hydrilla verticillata* in WA? I have tested this plant for the experiment and it is much more effective at producing oxygen, but is similar to the *Hydrilla* plant in many ways. It is again an aquatic weed and a declared weed in Tasmania *but* permitted in WA according to the department of Agriculture and Food WA.

Voting:

No votes yet

Year Level:
7
Senior Secondary
Laboratory Technicians:
Laboratory Technicians

Showing 1-1 of 1 Responses

Answer by labsupport on question Oxygen producing plants

Submitted by sat on 04 February 2015

You are correct that it is a declared weed in Tasmania, but not in other states/territories, and a permitted organism in WA see https://www.agric.wa.gov.au/organisms/85206

The following link has some good information about *Ceratophyllum demersum:*

http://www.environment.gov.au/cgi-bin/biodiversity/invasive/weeds/weedde...

Key points

- Hornwort (*Ceratophyllum demersum*) is a free-floating, submerged, rootless, leafy, annual or perennial freshwater herb, reproducing vegetatively and by seed.
- It occurs in sheltered sites in stagnant or slowly moving water in ponds, dams, streams and reservoirs.
- Hornwort is native to Australia, occurring in all states except Tasmania.
- In Australia, Hornwort rarely causes problems when it is in balance with the surrounding ecosystem and can be beneficial. However, when environmental change occurs, the plant becomes weedy and has a negative effect on stream flow, interferes with navigation, fishing and hydro-electric output.
- Herbicides provide the best means of controlling the growth of Hornwort.[i]

When the ecosystem is in balance, plants like *Ceratophyllum demersum* and *Hydrilla verticillata* do not generally cause a problem, but when there is an influx of nutrients or other changes occur that alter that balance, it can overgrow and cause problems.

Therefore, as you have said, it is permitted in WA so you can use that one. Of course, as you are aware of its potential as a weed, responsible management of it would include destroying any remaining plant material at the end of the activity to ensure that it is not allowed to enter any waterways where it does not already exist.

It seems that the plants that have the most potential to be a weed and cause environmental problems, are the best oxygen producers to demonstrate photosynthesis in science activities! Science ASSIST would welcome any suggestions for plants that may suit this activity.

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[i] http://www.environment.gov.au/cgi-bin/biodiversity/invasive/weeds/weedde...

Preparation of Equipment for Dissections

Posted by Anonymous on Tue, 2016-05-31 14:32

Preparation of Equipment for Dissections: Is it now a requirement that all dissection equipment be disinfected BEFORE being dispensed to a class?

I now put all items through the dishwasher after dissections, and they come out completely clean. Is it required that we then disinfect the items after this process?

Voting:

Average: 5 (1 vote)

Year Level:
7
8
9
10
Senior Secondary

Laboratory Technicians:
Laboratory Technicians

Showing 1-1 of 1 Responses

Preparation of Equipment for Dissections

Submitted by sat on 03 June 2016

There is no requirement to disinfect dissection equipment BEFORE being dispensed to a

class. It is important that dissecting equipment be thoroughly clean and rust free before being issued to students for a dissection, to reduce the likelihood of any infection if the user were to cut or stab themselves.

The cleaning process occurs at the end of the dissection and the implements stored clean and dry ready for the next session.

After the dissection if blood is present on dissecting equipment it is desirable to soak them first in disinfectant. Otherwise washing in hot soapy water or putting them through the dishwasher is recommended practice. After washing, the dissecting instruments can be soaked in 70% v/v ethanol for 20 minutes as an optional additional disinfectant and to avoid equipment from rusting. Soaking in a bleach solution is not suitable as bleach will cause metal instruments to corrode.

For further information regarding dissections and procedures see any of the following SOPs:

SOP: Performing an eye dissection

SOP: Performing a kidney dissection.

SOP: Performing a heart dissection

SOP - Performing a rat dissection

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preserved specimens

Posted by Anonymous on Wed, 2015-02-11 11:33

Preserved specimens: We have some preserved baby sharks for which the solution needs topping up. We don't know what solution is currently in the glass container ~~w~~as here before I started. What is the correct solution to top the container up with? Thanks.

Voting:•

No votes yet

Australian Curriculum:•
Biological Sciences
Year Level:•
7
8
9
10
Senior Secondary
Laboratory Technicians:•
Laboratory Technicians

Showing 1-1 of 1 Responses

preserved specimens

Submitted by sat on 06 March 2015

Firstly, if you do not know what the solution is, it is important not to top it up. Extra care is

required in handling unknown chemical solutions. We understand that it is difficult when you inherit a situation where a preserving solution is not labelled.

Handling unknown chemical solutions

It is not advised to top up the unknown chemical solution that has been preserving the shark specimens for several reasons.

1. You may be combining incompatible chemicals, which may generate new substances that have unknown properties and unknown hazards.
2. The stability of the chemical is not known and you may create a violent chemical reaction or dangerous substance.
3. The concentration of components of the original preserving fluid may have altered due to the evaporative loss.
4. The solution that is produced may damage the specimen.
5. The solution may discolour or become cloudy not allowing the specimen to be viewed.

‘Managing risks of hazardous chemicals in the workplace –Code of Practice’ [1], states:

> Sections 2.1 Identifying hazards
>
> “The first step in managing risks involves identifying all the chemicals that are used, handled, stored or generated at your workplace.”.
>
> Section 2.3 Labels
>
> “If the contents of the container are not known, this should be clearly marked on the container, for example, 'Caution - do not use: unknown substance'. Such a container should be stored in isolation until its contents can be identified and, if it is then found to be hazardous, the container is appropriately labelled. If the contents cannot be identified, they should be disposed of in accordance with relevant local waste management requirements.”
>
> Sections 4.2 Specific Control Measures: Keeping Hazardous Chemicals Stable and Transfer of Hazardous Chemicals.
>
> “This section includes information on key control measures that should be considered when managing risks from hazardous chemicals in the workplace.”

The chemicals used to fix and preserve specimens can be hazardous and dangerous and may include chemicals such as formalin[2], 70% ethanol and a range of other chemicals. Science ASSIST recommends you treat all unknown chemicals as hazardous and conduct a site-specific risk assessment to assess and control the risks. You will need to determine how to safely handle and dispose of the solution. We have developed a Risk Assessment template for schools to use, see Risk Assessment Template. You will also need to make sure that any new preservatives you use are approved for use in your jurisdiction and educational sector. Local guidelines for the disposal of waste fixative and preservative chemicals should be followed.

Replacing the old preserving solution

If you consider the shark specimens to be in a condition worth saving, it is recommended to go through a procedure of decanting followed by rinsing then replacement with new preservative solution. You will need to take precautions to avoid exposure by contact with skin and eyes, inhalation, and ingestion. It is recommended to work in a fume cupboard and wear appropriate PPE. You should not pour any unknown chemical down the sink. And, at all times care must be taken to avoid damaging the specimen in the process.

When working with preserved specimens it is important to:

- refer to the specific SDS for the new chemicals being used;
- wear appropriate PPE (i.e., safety glasses, gloves, laboratory coat, closed-in shoes);
- work in a fume cupboard or well ventilated area.

Here is a simple method for replacing your old preserving solution.

1. Working in the fume hood or well ventilated area, decant the solution into a glass container which can be properly sealed to avoid evaporative loss. Label as 'Caution - Do Not Use - Unknown Substance (possible fixative or preservative)' for disposal via a chemical waste contractor. Whilst waiting for pickup, store and segregate the waste chemicals safely in approved store rooms or chemical storage cabinets.
2. Wash the specimen several times by soaking for 30 minutes in tap water to remove the old preservative. Collect the washings and store and dispose of as above.
3. Take the specimen through several increasing concentrations of the new fresh preservative (e.g., 1 day in each of the following concentrations 30%, 50% and 70%) to avoid any osmotic issues. Always handle one specimen at a time.
4. Place the specimen into the final preservative solution in a clean glass container that has a tight-fitting lid to prevent any evaporation. Use either 70% ethanol or one of the safer alternatives (see below). The use of Parafilm or some silicone sealant can be used to provide a good seal.
5. Label the container to state type of specimen, type and date of preservative. Most museums put the jar label inside the jar, not on the outside or on the lid. This will lessen the likelihood of the specimen and label being separated. It is important to use paper intended for long-term preservation in fluids. There are a several papers that will do. The Australian Museum[3] currently uses Resistall paper, which they source from the US, but other types of papers have been used in the past including laundry tag paper: https://www.universityproducts.com/cart.php?m=product_list&c=241 . Soft lead pencil

can be used to write on the paper and there are certain inks or ink pens that can be used as well. Any inks used should be of archival quality, resistant to fading and smearing, and be insoluble in the preservative solution. Suitable inks and ink pens can be found in some art or office supply stores and museum supply companies. It is recommended to allow the ink to completely dry before placing the label into the storage solution. Ordinary ballpoint pens should not be used for labelling as they generally dissolve in most preservative solutions. See the Science ASSIST School science suppliers list for local museum supply companies for similar products.

6. Store under conditions to prevent any deterioration i.e. a cool dry place in low light levels and out of direct sunlight.

FIXATION & PRESERVATION METHODS

When preparing specimens for preservation they are generally put through a multi-stage process.

1. Fixation to prevent autolysis and microbial breakdown.
2. Water wash to remove excess fixative.
3. Preservation for long-term storage.

Fixation: Traditionally, marine vertebrates are fixed in a solution of formalin, usually a 10% solution made by combining 1 part formalin with 9 parts water. This is still the best fixative in use today. Formalin is toxic, carcinogenic, highly irritating, acts as a potent sensitizer and should be handled with great care in a fume cupboard or well ventilated area.

Long Term Storage: 70% ethanol has been the method of choice for long-term preservation. Ethanol is highly flammable, prone to rapid evaporation and is a skin irritant. It is also possible to preserve fish specimens for a long time in formalin. Some reports indicate that the formalin is required to be buffered, as the high acidity is able to render some specimens brittle and transparent.

Here are some links to interesting articles on the fixation and preservation of wet collections in general as well as some specific to fish:

http://conservation.myspecies.info/node/33

https://www.nps.gov/museum/publications/mhi/appendixt.pdf

https://www.burkemuseum.org/collections-and-research/biology/ichthyology

http://research.amnh.org/vz/ichthyology/congo/other05.html

ALTERNATIVES

Today there are some less-hazardous alternatives to these traditional fixatives and preservatives. However, some are untried for long-term storage and may not protect the specimen adequately.

Glycerol (synonyms: glycerin, glycerine) is a safe and reliable alternative to ethanol. Glycerol has low-toxicity, a flash point at 160℃, preserves and revives colour. And, if the specimen is

transferred through baths of increasing concentration, it will not shrink the specimen. The Australian Museum[3] uses either 100% glycerol or 70% ethanol for preservation of its fish specimens.

Another alternative is 2-phenoxyethanol (synonyms: phenoxetol, phenoxytol) which is non-flammable compared with 70% ethanol and is less volatile and of lower toxicity when compared with formaldehyde. See the following article which discusses the relative hazards of 2-phenoxyethanol compared with formaldehyde and ethanol: https://www.academia.edu/9751098/Phenoxetol_as_a_formaldehyde-removing_agent_for_long-term_preservation_our_experience

See the following link for a recipe: https://web.archive.org/web/20170219043724/http://www.rtg.wa.edu.au/solu... (redirected to Internet Archive's Wayback Machine, July 2017). Note that this is a storage solution only and was introduced because it is non-flammable. This removed the requirement in WA to store specimens that were preserved in 70% ethanol in a flammable liquids cabinet.[4]

The following link has good information on traditional and alternative fixation and preservation fluids: Fluid Preservation: A Comprehensive Reference

It is important to check that the preservative you choose is approved for use in your jurisdiction and educational sector.

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[1] Safe Work Australia. 2012. 'Managing risks of hazardous chemicals in the workplace – Code of Practice' http://www.safeworkaustralia.gov.au/sites/swa/about/Publications/Documen... Copyright https://creativecommons.org/licenses/by-nc/3.0/au/

[2] Formalin is a solution of formaldehyde (methanal), usually a saturated (37%) solution.

[3] McGrouther, Mark. 2015. Fish Collection Manager, Australian Museum Research Institute, Australian Museum, Sydney. Personal communication

[4] Kempton, Ruth. 2014. Team Leader, Regional Laboratory Technicians, WA Department of Education. Personal communication

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Preserving sheep brains without formalin

Posted by Anonymous on Wed, 2015-10-14 17:38

Preserving sheep brains without formalin. We no longer use formalin (formaldehyde) for tissue specimens. Which reagents or products do you recommend for fixing and preserving sheep brains? We've had mediocre results with alcohols, and freezing did not work.

Voting:

No votes yet

Year Level:
7
8
9
10
Senior Secondary

Laboratory Technicians:
Laboratory Technicians

Showing 1-1 of 1 Responses

Preserving sheep brains without formalin

Submitted by sat on 30 October 2015

In Brief:

Fresh brain tissue is delicate, very soft, and can be easily damaged, even when being gently

handled. Specimens are generally fixed to prevent tissue breakdown and to render them firm to allow for easy dissection. For long-term storage, they are kept in preservative solutions. The chemicals used to fix and preserve specimens can be hazardous and dangerous. Traditionally, 10% formalin and 70% ethanol have been the chemicals of choice, and are still in use today.

Formalin[1] is toxic, carcinogenic, highly irritating and acts as a potent sensitizer. Formalin is usually used as a 10% solution made by combining 1 part formalin with 9 parts water. This is still the best fixative in use today. Formalin may be used in instances where colour is important, since alcohol dissolves most colours almost immediately. Formalin needs to be handled with great care in a fume cupboard or well-ventilated area. Science ASSIST does not recommend formalin for use in schools. [i]

Ethanol[2] (Ethyl alcohol) usually comes in the 95% concentrated form. For long-term preservation and storage, it is usually diluted with distilled water to 70–75% strength. This is the lowest concentration at which preservation will be maintained. Alcohol is highly flammable, usually safe to handle, but can cause irritation to the skin in cases of prolonged contact.

Today there are many less hazardous chemicals available, as well as some chemical-free methods for fixing and preserving specimens.

Science ASSIST recommends you refer to the specific SDS for any chemicals being used and conduct a site-specific risk assessment to assess and control any risks. We have developed a Risk Assessment template for schools to use, see Risk Assessment Template. You will need to make sure that any fixative or preservatives are approved for use in your jurisdiction and educational sector and are disposed of appropriately following local guidelines.

We outline some methods below for you to try. As they require the use of a needle and syringe, we recommend you check with your school jurisdiction for any regulations on the use of needles.

Note: These preservative solutions should not be handled by students.

Chemical Methods:

(Note: % v/v is used for concentrations of solutions of liquids and is calculated as [(volume solute)/(volume of final solution)] x 100%. For example, 80% v/v means that 100 mL of solution contains 80 mL of the solute.)

Method 1: 25% glycerol in 80% v/v ethanol

The Tasmanian Museum[3] uses this method for preservation of its soft-bodied animal specimens.

1. First prepare an 80% v/v ethanol solution: for 100 mL, measure 84 mL ethanol (95%) and make up to 100 mL with distilled water.
2. For 100 mL glycerol/ethanol solution, measure 25 mL glycerol and make up to 100 mL with the 80% ethanol solution (or combine 1 part glycerol with 3 parts ethanol (80%)).
3. Using a 10 mL syringe and 21 g x 38 mm needle, inject the solution into the brain tissue

in several places ~~in~~ both the left and right cerebral hemispheres. Injection of the brain helps penetrate the inner tissues before immersion in the preservative solution.
4. Immerse the brain in the solution for storage in a clean glass container that has a tight-fitting lid to prevent any evaporation. The use of Parafilm or some silicone sealant can be used to provide a good seal.
5. Store under conditions to prevent any deterioration i.e. a cool dry place with low-light levels and out of direct sunlight. As the solution is flammable, it should be stored in the flammable liquids cabinet.
6. Leave for 2~~-3~~ days to fix the tissue.
7. After 3 days, pour off the solution and refresh with a new batch.
8. Leave for at least one month before use for dissection or as a display specimen.
9. Collect any waste solution into a glass waste container, which can be properly sealed to avoid evaporative loss. Label appropriately and dispose via a chemical waste contractor.

It is beneficial to use at least 2~~-3~~ fresh changes of the solution. The more changes the better for fixing (retaining colour) and rendering the tissue firm and rubbery for dissection purposes.

Using the ratio of 25% glycerol in 80% ethanol has the benefit of no real shrinkage; the glycerol makes the brain tissue pliable and it is relatively safe to use. Glycerol[4] has low toxicity and helps in preserving and reviving colour.

Method 2: 75% ethanol in 95% ethyl acetate solution (a variation on the Ethanol/Glycerol method)

1. First prepare a 95% ethyl acetate solution: for 100 mL, measure 95 mL ethyl acetate and make up to 100 mL with distilled water.
2. For 100 mL of ethanol/ethyl acetate solution, measure 80 mL of ethanol (95%) and make up to 100 mL with the 95% ethyl acetate solution, (or combine 4 parts ethanol (95%) with 1 part of the 95% ethyl acetate solution).
3. Using a 10 mL syringe and 21 g x 38 mm needle carefully inject the solution deep into the brain tissue in several places ~~in~~ both the left and right cerebral hemispheres, then leave the specimen in the solution for fixation for around 48 hours. This assists in hardening and reduces shrinkage.
4. Drain and then preserve in the ethanol/glycerol mixture described above in Method 1. Store in a flammable liquids cabinet.
5. Leave for at least one month before use for dissection or as a display specimen.
6. Dispose of waste ethanol/ethyl acetate solution and ethanol/glycerol solution as in Method 1.

The idea behind this is to “set” the tissue before preserving while the glycerol keeps it from getting too hard. If the brain tissue still ends up too soft, then before putting into the preserving solution, place in a solution of 20 drops of ethylene glycol to 100 ml of ethanol/ethyl acetate for 24 hrs.

7. Collect any waste ethylene glycol/ethanol/ethyl acetate solution into a glass container, which can be properly sealed to avoid evaporative loss. Label appropriately for disposal via a chemical waste contractor.

Ethyl acetate[5] is used as a fixative and is classified as hazardous and flammable. It is a

colorless liquid and has a characteristic sweet smell (similar to pear drops).

Ethylene glycol[6] assists with hardening tissue. It is classified as hazardous and is toxic if ingested.

Method 3: 75% v/v Ethanol Solution

1. For 100 mL of solution: measure 80 mL of ethanol (95%) and make up to 100 mL with distilled water, (or combine 4 parts ethanol (95%) with 1 part distilled water). Note do not use denatured alcohol if using as a preservative. Some denaturants can have adverse effects on specimens[7].
2. Using a 10 mL syringe and 21 g x 38 mm needle carefully inject the ethanol solution deep into the brain tissue in several places ~~in~~ both the left and right cerebral hemispheres.
3. Immerse the brain in the ethanol solution for storage in a clean glass container that has a tight-fitting lid to prevent any evaporation. The use of Parafilm or some silicone sealant can be used to provide a good seal.
4. Leave for 2~~-3~~ days to fix the tissue.
5. After 3 days, pour off the solution and refresh with a new batch.
6. Leave for at least one month before use for dissection or as a display specimen.
7. Store under conditions to prevent any deterioration i.e. a cool dry place with low-light levels and out of direct sunlight. Store in a flammable liquids cabinet.
8. Collect any waste solution into a glass waste container, which can be properly sealed to avoid evaporative loss. Label appropriately and dispose via a chemical waste contractor.

This is a good fixative and preservative that will not overly dehydrate the tissue. Concentrations higher than this are not recommended as they can excessively dehydrate the tissue.

Note: While waiting for pick up, store and segregate waste chemicals safely in approved store rooms or chemical storage cabinets.

Method 4: 2-phenoxyethanol

Another alternative is 2-phenoxyethanol (synonyms: phenoxetol, phenoxytol), which is non-flammable compared with 70% ethanol, is less volatile and of lower toxicity when compared with formaldehyde. See the following article which discusses the relative hazards of 2-phenoxyethanol compared with formaldehyde and ethanol: http://www.academia.edu/9751098/Phenoxetol_as_a_formaldehyde-removing_ag... . See the following link for a recipe: https://web.archive.org/web/20170219043724/http://www.rtg.wa.edu.au/solu... (link changed to an archived copy on the Internet Archive's Wayback Machine July 2017). Note that this is a storage solution only and was introduced because it is non-flammable. This removed the requirement in WA to store specimens that were preserved in 70% ethanol in a flammable liquids cabinet[8].

Safety

When working with preserved specimens it is important to:

- work in a fume cupboard or well-ventilated area;
- wear appropriate PPE (i.e., safety glasses, nitrile gloves, laboratory coat, closed-in shoes);
- refer to the specific SDS for the chemicals being used and prepare a site-specific risk assessment;
- rinse preserved specimens with running water or preferably soak overnight in water before using for dissection;
- store all flammable preserving solutions in a flammable-liquids cabinet;
- dispose of all waste solutions via a chemical waste contractor;
- following dissection, all of the brain tissue should be wrapped in newspaper, double bagged and frozen for later disposal via a waste contractor;
- attach and dispose of syringe needles safely. Attach sheathed needles only to the syringe and never re-sheath needles as this is how most needle-stick injuries occur.

Dispose of used syringe needles in an approved sharps container ~~p~~positioned at the point of use. Seal and dispose of a full sharps container at a sharps collection facility, sharps disposal bin via a State Health recommended facility or a facility recommended by your local council. More information on sharps and disposal can be found on the Science ASSIST website Sharps container disposal, and at the following website.

Safe Work Australia National Code of Practice for the Control of Work-related Exposure to Hepatitis and HIV (Blood-borne) Viruses [NOHSC: 2010(2003)]
http://www.safeworkaustralia.gov.au/sites/swa/about/publications/Documen...

Alternatives

1) Purchase of preserved specimens

Purchasing preserved brains from a reputable biological supplier is another option available to you. Specimens are initially fixed with a formaldehyde solution, then displaced first with water and lastly preserved with a glycol solution, producing a low-fume specimen, which will not decay over time. No refrigeration is required.

Safety Note ~~-~~Specimens should be washed in water before use and the dissection should be performed in a well-ventilated laboratory.

Wear appropriate personal protective equipment (PPE).

Obtain and read the safety data sheet (SDS) from the supplier and prepare a site-specific risk assessment.

2) Freeze-dried specimens

Freeze-dried brains. They are preserved without chemicals or fluids, can be used for external study and dissection. The specimens are rehydrated with dilute (20%) alcohol solution and need to be rinsed before use. This is also a technique taxidermists use to preserve

specimens. However, this is an expensive procedure and would only be cost effective with a bulk order of specimens.

Contact your local museum or taxidermist for more information.

3) Rubber/plastic models

Rubber/plastic brain models to examine the brain. These can be sourced from Biological suppliers.

4) Freezing

Fresh offal is always best for dissection purposes, but if you want to store fresh sheep brains in the freezer for later dissection, they are best dissected semi-frozen to avoid the mush factor! Freezing can cause loss of integrity, colour and some shrinkage. The formation of ice crystals can also damage the tissue.

Using a 0.9% saline solution[9] may assist the cells and tissue structure of the brain to maintain their normal state during the freezing process.

Soak the brain tissue overnight in the 0.9% saline solution and inject parts of the brain tissue (described in Method 1) before freezing separately in sealed zip-lock bags.

Additional Information:

Fixation and Preservation

When preparing specimens for preservation, they are generally put through a multi-stage process.

- Fixation to prevent autolysis and microbial breakdown
- Water wash to remove excess fixative
- Preservation for long-term storage

Labels

Containers should be labelled to state type of specimen and type and date of preservative. Most museums put the jar label inside the jar, not on the outside or on the lid. This will lessen the likelihood of the specimen and label being separated. It is important to use paper intended for long-term preservation in fluids. There are a several papers that will do, including laundry tag paper. See Resistall labels and specimen tags: https://www.universityproducts.com/cart.php?m=product_list&c=241. Soft lead pencil can be used to write on the paper and there are certain inks or ink pens that can be used as well. Any inks used should be of archival quality, resistant to fading and smearing, and be insoluble in the preservative solution. Suitable inks and ink pens can be found in some art or office supply stores and museum supply companies. It is recommended to allow the ink to completely dry before placing the label into the storage solution. Ordinary ballpoint pens should not be used for labelling as they generally dissolve in most preservative solutions.

See the Science ASSIST School science suppliers list for local museum supply companies for

similar products.

More information on fixation and preservation can be found on the Science ASSIST website link: preserved specimens.

The following links have more information on fixation and preservation of wet collections.

http://conservation.myspecies.info/node/33

Fluid Preservation: A Comprehensive Reference

References:

[1] Chemwatch Gold 2013 *Safety Data Sheet: 10%* formalin. https://jr.chemwatch.net/chemwatch.web/ (Subscription required) (Accessed October 2015)

[2] Chemwatch Gold 2013 *Safety Data Sheet: Ethyl Alcohol.* https://jr.chemwatch.net/chemwatch.web/ (Subscription required) (Accessed October 2015)

[3] Gordon, Tammy. 2015. Natural Science Collections Officer, Tasmanian Queen Victoria Museum, Launceston. Personal communication

[4] Chemwatch Gold 2013 *Safety Data Sheet: Glycerol.* https://jr.chemwatch.net/chemwatch.web/ (Subscription required) (Accessed October 2015)

[5] Chemwatch Gold 2013 *Safety Data Sheet: Ethyl Acetate.* https://jr.chemwatch.net/chemwatch.web/ (Subscription required) (Accessed October 2015)

[6] Chemwatch Gold 2013 *Safety Data Sheet: Ethylene Glycol.* https://jr.chemwatch.net/chemwatch.web/ (Subscription required) (Accessed October 2015)

[7]'Standards in the care of wet collections', NHM Conservation Centre website, http://conservation.myspecies.info/node/33 (July 2014)

[8] Kempton, Ruth. 2014. Team Leader, Regional Laboratory Technicians, WA Department of Education. Personal communication

[9] Dungey, Barbara. 2006. *The Laboratory: a science reference and preparation manual for schools* (Rev. ed), National Library of Australia: Traralgon, Vic.

'National Code of Practice for the Control of Work-related Exposure to Hepatitis and HIV (Blood-borne) Viruses [NOHSC: 2010(2003)]', Safe Work Australia website http://www.safeworkaustralia.gov.au/sites/swa/about/publications/pages/c... (1 January 1993)

Simmons, John E. 2014. *Fluid Preservation: A Comprehensive Reference*. Rowman & Littlefield. https://books.google.com.au/books?id=_WqYAwAAQBAJ&pg=PA47&lpg=PA47&dq=sa...

Tandon, A; Bhatnagar, R; Pokhrel, Rishi and Solanke, Kirti. 2014. 'Phenoxetol as a

formaldehyde-removing agent for long-term preservation:out experience' *Eur. J. Anat* 18 (4) : 267-272. Academia.edu website, https://www.academia.edu/9751098/Phenoxetol_as_a_formaldehyde-removing_agent_for_long-term_preservation_our_experience (Click on 'Read paper' at the base of the screen to open article)

[i] 'List of recommended chemicals for science in Australian schools', Science ASSIST website /resource/3052/list-recommended-chemicals-science-australian-schools?search-id=34587a4 (October 2015)

Storage of offal

Posted by Anonymous on Fri, 2017-09-29 15:32

Storage of offal: Is it acceptable to store offal, such as plucks, hearts, kidneys, etc., in a freezer for long periods (months) for future use? If so, and the freezer is located in a prep room (i.e. not accessible by students and used only for science purposes) is there any requirement to have this locked?

Authored 2017-03-06

Voting:

Average: 5 (1 vote)

Year Level:
8
9
10
Senior Secondary

Laboratory Technicians:
Laboratory Technicians

Showing 1-1 of 1 Responses

Storage of offal

Submitted by sat on 29 September 2017

In brief:

Yes, it is acceptable to store offal such as plucks, hearts, kidneys, etc., in•the freezer for long periods (months) for future use, however over time there will be a loss of quality[1]. Generally, meat intended for human consumption is recommended to be stored for 2-6 months[2]. As offal for dissection purposes is not for human consumption, it can be stored for longer and we recommend only storing for up to 12 months to maintain the quality of the items.

The freezer can be located in a preparation room and it is good practice to ensure that the preparation room is not accessible by students. There is no requirement to have the freezer locked, but it is recommended that appropriate signage is placed on the freezer "**No foodstuffs for human consumption to be stored in this freezer**" to avoid contamination of food for human consumption[3].

It is also recommended that signage, such as **'Do not turn off power"** should be placed near the power point (GPO) to prevent accidental shutting off of the power. Cleaners, relevant staff and contractors should be aware that the GPO should never be turned off. •In the case of power outage, relevant contact details should be available to arrange alternate storage to avoid the loss of frozen materials.

Other considerations:

- Prior to storage, the offal should be
    - good quality i.e. fresh and passed relevant health inspections
    - wrapped individually or in class sets to enable easy defrosting
    - wrapped with air-tight packaging to avoid freezer burn,
- The freezer should:
    - operate at -18^{0}C. This temperature can be monitored by using an external freezer thermometer available from electronics stores, kitchen and department stores.
    - be suitably located to enable ventilation and avoid being located in hot places
    - be stocked to allow frozen air to effectively penetrate all stock and stock should be rotated to ensure that older items are used first.
    - be defrosted regularly to prevent ice build-up. Ensure there is an alternate freezer to relocate the offal prior to defrosting

References and further reading:

[1] 'Freezer storage times'. Food Safety Information Council website. http://foodsafety.asn.au/freezer-storage-times/ (Accessed September 2017)

[2] Australian Health Food. The big chill. Storage times for the refrigerator and freezer. http://www.healthyfoodguide.com.au/articles/2013/march/big-chill (accessed September 2017)

[3] Standards Australia. 2005. AS/NZS 2243 *Safety in Laboratories, Part 1: 2005 Planning and Operational Aspects*. Sydney, Australia.

CSIRO. Handling food in the home.•https://www.csiro.au/en/Research/Health/Healthier-safer-foods/Food-safety/Food-handling•(Link updated July 2019)

Tarantula kept in classroom

Posted by Anonymous on Fri, 2015-11-06 15:16

Tarantula kept in classroom: Is it perfectly okay to keep a tarantula in a locked container in the classroom?

Voting:

No votes yet

Year Level:
7
8
9
10
Senior Secondary

Laboratory Technicians:
Laboratory Technicians

Showing 1-1 of 1 Responses

Tarantula kept in classroom

Submitted by sat on 18 November 2015

In Brief:

Australian Tarantulas may be kept in the classroom, subject to the regulations in your state/territory. These regulations may be covered in information concerning animal ethics

and/or the government department that manages wildlife in your state/territory. See the following Science ASSIST Information Sheet for links to state and territory websites that contain support material regarding animal ethics and licensing, AIS: Links ~~-~~Biological sciences safety. It is important to access the latest information available, which may mean directly contacting the relevant person in the correct department.

This question has been asked in Western Australia, where a permit is required from the Department of Parks and Wildlife, (DPAW). See https://www.dpaw.wa.gov.au/plants-and-animals/licences-and-authorities for current information and links to forms. If Tarantulas are imported into WA from other states, this also requires an import licence.[i] There is also a requirement to have a written plan detailing an educational program, see https://www.dpaw.wa.gov.au/images/documents/plants-animals/licences-perm... (Link to DPAW website updated September 2021)

Schools in other states should investigate current requirements for their jurisdiction.

Science ASSIST recommends the following

- Containment of the tarantula is a major consideration and schools should have this aspect addressed well in advance of the acquisition of a tarantula.
- Any study should be observational only as the spider is very delicate and can inflict a nasty bite. There should be no direct contact by students, which includes feeding and cleaning of the housing.
- Consideration could be given to observing tarantulas in zoos such as the Nocturnal House at Perth Zoo.
- Consideration could also be given to the use of alternate invertebrates, such as stick insects.

General considerations for using animals in schools

Science ASSIST recommends that prior to embarking on any activity that involves the use of live animals that consideration be given to the following.

- The educational outcome from holding the animal in captivity. Can the same outcome be achieved without keeping the animal in the classroom? Are alternatives available such as visiting a museum or zoo?
- Any ethical issues, such as the impact of captivity on the welfare of the animal.
- Are any permits or licences required?
- Who will be responsible for the handling and care?
- The number required. Use as few as are necessary.

If it is determined that the animal will be obtained and kept in the classroom then the following should be considered:

- purchase from a reputable supplier;
- reference material/guidelines should be consulted with regard to proper care, including an appropriate diet;
- an environment be provided and maintained as close as possible to the natural habitat. This includes suitable environmental conditions such as temperature, lighting and

humidity. The specimen should also be protected from any climate extremes;
- the enclosure be large enough for the well-being of the animal;
- the enclosure should be kept clean, well ventilated, escape proof and secure from other animal interference;
- the amount of student interaction in the care of the animal;
- a program be instigated for the care to continue over weekends and during holiday periods. Students should not be allowed to take the animal home, unless written approval is obtained;
- a record should be maintained of the upkeep and animal behaviour. Look for any signs of distress or pain;
- a plan should be in place for the fate of the animal at the completion of the activity.

Keeping tarantulas

In addition to general considerations of keeping animals, the following should be considered:

- the likelihood of the spider escaping;
- the likelihood of students removing the cage;
- the consequences to human health;
- the consequences to other animals such as dogs.

A site-specific risk assessment should be performed prior to purchasing a tarantula to ascertain the hazards, the likelihood and consequences of those hazards occurring, and if sufficient control measures are able to be put into place.

Additional Information

Australian tarantulas:

- have an average body length of 6 cm, a leg span of 16 cm and their fangs are up to 1 cm long;[ii]
- females may live up to twelve years, but the males usually die after mating at around five years of age. Females tend to be larger than males;[iii]
- are not usually aggressive, but can deliver a painful bite. Though not usually fatal to humans, at least one case has been reported that resulted in severe illness; [iii]
- can deliver a fatal bite to dogs and cats;
- should not be handled, and great care taken when cleaning their containers;[iv]
- should be housed in an environment that is safe and secure.

Characteristics and care of tarantulas

Further information regarding the characteristics and care of tarantulas can be found at the following websites:

https://petmagic.com.au/pages/tarantula (link updated June 2019)

https://australianmuseum.net.au/australian-tarantulas

https://www.amazingamazon.com.au/bird-eating-spider-tarantula-australian-care

https://perthzoo.wa.gov.au/animal/australian-tarantula

http://perthzoo.wa.gov.au/wp-content/uploads/2011/06/Australian-Tarantul... (Last accessed 29 June 2016).

https://environment.des.qld.gov.au/wildlife/animals-az/tarantulas.html

http://www.arachne.org.au/01_cms/details.asp?ID=2410

https://mtq.qm.qld.gov.au/Explore/Find+out+about/Animals+of+Queensland/Spiders/Primitive+Spiders+

https://www.australiangeographic.com.au/topics/wildlife/2012/08/gallery-... (Link updated August 2018).

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[i] WA Department of Parks and Wildlife personal communication

[ii] Australian Museum *Australian Tarantulas* https://australianmuseum.net.au/australian-tarantulas accessed November 2015

[iii] Arachne.org.au *THERAPHOSIDAE Whistling Tarantulas* http://www.arachne.org.au/01_cms/details.asp?ID=2410 accessed November 2015

[iv] Australian Museum *Australian Tarantulas* https://australianmuseum.net.au/australian-tarantulas accessed November 2015

Use of a spirometer

Posted by Anonymous on Fri, 2015-07-17 10:27

Use of a spirometer: One of our teachers would like to use a spirometer in class. The spirometer requires the user to breath in rather than blow air out. Are we allowed to do this, if we have disposable mouthpieces?

Voting:•

No votes yet

Year Level:•
Senior Secondary
Laboratory Technicians:•
Laboratory Technicians

Showing 1-1 of 1 Responses

Use of a Spirometer

Submitted by sat on 24 July 2015

When using a spirometer, it is more common for the activities being conducted to use an expired air measurement. However, inspired air measurements are permissible if single-use disposable mouthpieces fitted with bacterial/viral filters are used. Bacterial filters trap expectorated matter as well as bacteria and viruses making them suitable for inspired as well as expired air activities.

Some disposable mouthpieces are fitted with one-way valves and are suitable for expired air

measurements. This type allows air to flow in one direction only into the measuring device and prevents the user from inhaling bacteria, viruses or other matter from the spirometer from previous users. These are not suitable for inspired air activities.

Mouth pieces that have no filters or valves are not recommended for use with spirometers, as they offer no protection from the possibility of cross infection between users.

The National Asthma Council of Australia have developed a “Spirometer users’ and buyers’ guide”, which contains some very useful information regarding general information about spirometry. This document includes details on the importance of taking precautions to minimise the risk of cross infection, as well as the regular cleaning and calibration of the spirometer. It also deals with the factors to consider when purchasing a spirometer, such as the initial cost of the spirometer and ongoing costs of disposable items. This guide also contains a list of resource respiratory function laboratories, for health professionals to contact for advice. For more detailed information see https://www.nationalasthma.org.au/health-professionals/spirometry-training-and-tools

References

Johns DP, Burton D, Swanney MP. 2015. *Spirometer Users’ and Buyers’ Guide.* National Asthma Council Australia: Melbourne. https://www.nationalasthma.org.au/health-professionals/spirometry-training-and-tools

‘Bacterial Viral Filters’ Vitalograph website. https://vitalograph.ie/product/162441/bacterial-viral-filters (accessed May 2016)

‘Pulmonary Function Test Kits’ Vitalograph website. https://vitalograph.ie/product/162442/pulmonary-function-test-kits (accessed May 2016)

Using body fluids in science

Posted by Anonymous on Tue, 2015-10-20 07:32

Using body fluids in science. Can students prepare their own cheek cells for microscopy? Is there a legislation or policy for this?

Voting:

No votes yet

Year Level:
7
8
9
10
Senior Secondary

Laboratory Technicians:
Laboratory Technicians

Showing 1-1 of 1 Responses

Using body fluids in science

Submitted by sat on 22 October 2015

In Brief:

Currently there is no consistency throughout Australia concerning the use of human tissue (for example cheek cells) and body fluids in school science activities. Each state and territory in

Australia is governed by its own regulators, who enforce compliance with the acts and regulations. Each state/territory has its own health department, which deals with the control of infectious diseases. Government educational jurisdictions establish policies for their own state/territory school sector and educational sectors outside the government schools systems will also establish their own policies based upon legislation, Australian Standards and their own risk assessments.

Some state school sectors indicate that cheek cells can be used, if students handle their own sample, whilst other states rule out their use completely. To the best of our knowledge the table below indicates the current status of what is permitted/prohibited in the Australian state and territory jurisdictions regarding the use of body tissues and fluids. Most schools in government jurisdictions prohibit the use of fresh human tissues or body fluids.

State/Territory	Use of human body tissue and fluids
ACT	Experiments involving the use of fresh human tissues or body fluids, e.g. cheek cell smears, blood typing, blood smears & urine samples are prohibited.
NSW	Experiments using fresh human blood products, urine and fresh human tissue, e.g. cheek cell smears should not be used. A student using their own saliva is permitted.
NT	A risk assessment must be conducted prior to the use of biological materials and all appropriate control measures must be implemented
QLD	Subject to a Risk Assessment. Students must only use their own cheek cells.
SA	Subject to a Risk Assessment. Students must only use their own cheek cells.
TAS	Testing of body fluids, i.e. blood, vomit, urine and faeces, must not be conducted in schools by staff or students. Experiments that involve saliva or cheek cells may be undertaken, but appropriate risk management and disposal procedures need to be in place, including consideration of whether blood is visible in the saliva.
VIC	Any uses of body fluids/cells are subject to individual school risk assessment. Taking of blood is banned.

WA	Experiments on any human body fluid or tissue including cheek cell and skin scrapings are banned.

Human tissue and body fluids have the potential to transmit infectious diseases.

Science ASSIST is aware of the great diversity in science facilities and staff training in the areas of microbiology and knowledge of infectious diseases. As a result of all of these different factors, **Science ASSIST does not recommend the use of human tissue or body fluids in school science practical classes due to the risk of disease transmission.**

Science ASSIST is currently developing detailed safety guidelines regarding the use of body tissue and fluids as well as microbiology.

Some alternative activities include:

- using commercially prepared microscope slides of cheek cells;
- using Biosets (photomicrographs) of cells with Bioviewers that are available from various scientific suppliers: see the School science suppliers list;
- preparing slides of animal cells from dissection material such as sheep kidneys.

Additional Information:

The oral cavity normally has a large microbial flora, some of which can be pathogenic. Numerous disease-causing microbes can reside in this area such as: *Neisseria meningitidis* (meningococcal disease)*, Candida albicans* (thrush)*, Group A streptococcus* (strep throat) and Epstein Barr virus (glandular fever)[i]. Anaerobes, some of which are disease causing, can also be found in the gingival (or gum) crevice areas.

There is the risk also that any cheek cell samples collected may be contaminated with blood, hence there is a possibility of contracting viruses such as HIV, Hep B and Hep C from contact with the sample. A student may be unaware that they have bleeding gums or sample too vigorously and cut the gum area. Schools may not be aware of potential infectious diseases that staff or students may have and there may also be people who are immuno-suppressed, who are at risk of acquiring infections.

Generally, school science laboratories are classified as Physical Containment level 1 (PC1), **if** they conform to the requirements specified in Section 5 of AS/NZS 2243.3:2010 Safety in Laboratories –Microbiological safety and containment. If they conform to these requirements, then they are only suitable for work with microorganisms where the hazard levels are low, and where laboratory or facility personnel can be adequately protected by standard laboratory practice. Body fluids should not be handled in a PC1 laboratory. Microorganisms that are classified as Risk Group 1 are the only ones that should be used in PC1 laboratories [ii]. Higher levels of Physical Containment are required for handling fresh human tissues or body fluids and microorganisms of Risk Groups 2-4 [iii].

Schools considering using cheek cells for a science activity should carefully evaluate their facilities, the level of staff training, student behaviour management and all the risks associated

with handling human tissue. Appropriate risk management, risk assessment and disposal procedures will need to be in place. A good understanding of the handling of potentially infectious material using aseptic techniques is required by the supervising teacher and technician to make sure that students only handle their own sample to prevent any cross infection. A requirement to use soft cotton buds, as opposed to sharp implements such as toothpicks, should be mandatory. All used cotton buds, slides and any other contaminated items would need to be decontaminated using either of the following methods.

- Soaked in a bleach solution of sufficient strength for a sufficient length of time. A freshly prepared 0.5–1% v/v (5000–10000 ppm) chlorine solution is recommended and items left for a minimum of 10 minutes before discarding into the bin. This is the concentration required for the inactivation of viruses such as HIV and Hepatitis in blood [iii, iv].
- Put through an autoclave or pressure cooker (121° C, 15 psi for 15–20 minutes) to decontaminate the material for disposal.

Science ASSIST has previously answered a question on the use of tears in school science experiments, which has further information on the use of human body fluid. See use of tears in a school practical.

The following links provide some good information on biological materials and infection control guidelines.

INFECTION CONTROL PROCEDURES - University of Sydney

http://www.safeworkaustralia.gov.au/sites/SWA/about/Publications/Documen...

References:

[i] Tilbrook, Dr Peta. 2015. Technical Services Manager, Department of Environment and Agriculture, School of Science, Curtin University, WA. Personal communication.

[ii] 'Microbiology', University of Sydney website, https://intranet.sydney.edu.au/services/safety-wellbeing/standards-guidelines.html (Accessed October 2015)

[iii] Australian Standards AS NZS 2243.3-2010. Safety in Laboratories –Microbiological safety and containment

[iv] 'Infection Control Procedures', University of Sydney, https://intranet.sydney.edu.au/services/safety-wellbeing/standards-guidelines.html (Accessed October 2015)

Safe Work Australia. 2011. 'National Hazard Exposure Worker Surveillance: Exposure to Biological Hazards and the Provision of Controls against Biological Hazards in Australian Workplaces', Safe Work Australia website http://www.safeworkaustralia.gov.au/sites/SWA/about/Publications/Documen...

Wildlife camera

Posted by Anonymous on Thu, 2016-03-31 12:27

We are considering using a wildlife camera that senses movement and then records a few minutes of video footage. It would be placed in a treed area on the school grounds overnight. Our aim is to capture footage of nocturnal animals for our ecology topics. Are there any regulations or restrictions that we should be aware of?

Voting:

No votes yet

Australian Curriculum:

Living things live in different places where their needs are met
Living things depend on each other and the environment to survive
Interactions between organisms, including the effects of human activities, can be represented by food chains and food webs
Ecosystems consist of communities of interdependent organisms and abiotic components of the environment; matter and energy flow through these systems

Year Level:

1
4
7
9
Senior Secondary

Laboratory Technicians:

Showing 1-1 of 1 Responses

Answer by ritasteffe on question Wildlife camera

Submitted by sat on 06 April 2016

In brief

The Animal Welfare officer for NSW DET schools has indicated ‘that there are no implications under the animal welfare policies for this activity. Your school, however, will need to seek its own advice about the legal issue of using surveillance cameras in the school’[1]. Contact should be made with the legal department in your specific jurisdiction.

The activity you describe involves the observation of animals in their natural environment and does not involve the capture or handling of any animal. Minimal disturbance might only be due to a flash, if used with the camera.

Consideration should be given to the location and position of the camera to avoid any privacy issues.

- Ensure that the camera does not film neighbouring houses or yards.
- Ensure that the camera is not active during school hours to avoid inadvertently filming students or staff. The use of a timer may assist.

Additional information

The use of animals in all primary and secondary schools in the government and non-government sectors in NSW is governed by the Animal Research Act 1985 (NSW) and the Australian code of practice for the care and use of animals for scientific purposes[2]. All animals in NSW are also protected by the•Prevention of Cruelty to Animals Act 1979•(NSW).

The establishment of the•Animals in schools•website provides advice to all schools in all sectors in NSW. Here you will find information on the following aspects for your consideration.

- Legislation.
- The Schools Animal Care and Ethics Committee (SACEC), which has been established to assist schools to monitor the use of animals for teaching purposes and to comply with the Animal Research Act 1985 (NSW).
- Approved activities.
- Application forms.
- Educational justification.
- Specific species kept in schools and their handling, housing, feeding and health requirements.
- Specific issues with acquiring, dissecting, disposal and security of animals.

References

[1]•Personal communication, TAS Advisor and Animal Welfare Officer. Learning and Teaching Directorate, NSW Department of Education, 4 April 2016

[2] 'Animals in schools', *Animals in schools* website, http://nswschoolanimals.com/ (Accessed April 2016)

'Animal Research Act 1985 No 123', NSW Government, NSW Legislation website, https://legislation.nsw.gov.au/view/html/inforce/current/act-1985-123, https://legislation.nsw.gov.au/view/html/inforce/current/act-1985-123 (Link Update September 2021)

'Animal Welfare in a DET Context' NSW Department of Education and Communities website, https://education.nsw.gov.au/policy-library/policies/animal-welfare-poli... (Updated December 2016)

Meek, Paul; Ballard, Guy; Fleming, Peter. 2012. *An introduction to camera trapping for wildlife surveys in Australia,* NSW Department of Primary Industries: Orange, Pestsmart website, https://pestsmart.org.au/wp-content/uploads/sites/3/2020/06/CameraTrapMa... (Link Updated November 2021)

National Health and Medical Research Council. 2013. *Australian code for the care and use of animals for scientific purposes*, 8th edition. Canberra: National Health and Medical Research Council, NHMRC website, http://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/ea28_code_...

'Prevention of Cruelty to Animals Act 1979 No 200' NSW Government, NSW Legislation website, http://www.legislation.nsw.gov.au/viewtop/inforce/act+200+1979+FIRST+0+N... (15 January 2016)
