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| **Minor Award Name** | Microbiology |
| **Minor Award Code** | 5N0737 |
| **Level** | 5 |

**Suggested resources to support delivery:**

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| **Theme/Topic** | **Type** | **Relevance** | **Author/Source** | **Web Link** |
| Classification of Microorganisms | Powerpoints/Student quizzes. | Introduction to the concepts of microorganism classification and supporting quizzes outlining the differences between different categories. | Boundless.com Online learning environment, requires brief sign up/Google+ ID. | <https://www.boundless.com/microbiology/textbooks/boundless-microbiology-textbook/introduction-to-microbiology-1/microbes-and-the-world-19/classification-of-microorganisms-208-1908/> |
| Describe the characteristics of each group of microorganisms | Website/background material. | Background of the different types of microorganisms supplying examples of how they differ from each other and examples of each in nature. Goes through the shapes of each bacteria with diagrams. | Microbeworld webpage, microbiology online webpage. | <http://www.microbeworld.org/types-of-microbes>  <http://www.microbiologyonline.org.uk/about-microbiology/introducing-microbes/bacteria> |
| Draw labelled diagrams of the common bacterial cell shapes, and the components of a bacterial cell | Powerpoints/website | Available diagrams for students to consult of idealised bacteria.  Also includes breakdown of DNA, ribosomes, capsule, cell membrane, cell wall, pilli and flagella. | Boundless.com Online learning environment, requires brief sign up/Google+ ID. | <https://www.boundless.com/microbiology/textbooks/boundless-microbiology-textbook/cell-structure-of-bacteria-archaea-and-eukaryotes-4/overview-of-prokaryotic-and-eukaryotic-cells-31/characteristics-of-prokaryotic-cells-252-11445/> |
| Illustrate the components of a generalised yeast cell | Website/Associated Youtube links | Outline of Yeast cells, uses and reproduction.  Also includes a clear drawing a yeast cell | Biotopics.co.uk  BBC.co.uk | <http://www.biotopics.co.uk/g11/yeast_cells.html>  <http://www.bbc.co.uk/staticarchive/6640992846e4c1a22b1517003826fb1e7d4f7ced.gif> |
| Illustrate the life cycles of bacteria to include the terms lag, log, exponential, stationary and death | Illustration of graph.  Website outlining background.  Powerpoint | Image supplied for explanation.  Resources and further information available on ehow and boundless.com explaining mechanics of bacterial life cycle and outlining why each stage is triggered. | Google image search.  Ehow website.  Boundless.com website | <http://2.bp.blogspot.com/-bg5b7WuB09Q/T_xxjQJniEI/AAAAAAAAAJ4/3jhVwHZgAVg/s1600/Bacteria+cycle+phase+Wikipedia+abbrev.jpg>  <http://www.ehow.com/about_5380594_bacteria-life-cycle.html>  <https://www.boundless.com/microbiology/textbooks/boundless-microbiology-textbook/culturing-microorganisms-6/microbial-growth-61/generation-time-380-8072/> |
| Illustrate the life cycles of fungi to include the terms germination, vegetative growth, sporulation, asexual reproduction, sexual reproduction and fragmentation | Website/Powerpoint/Youtube | Background reading on fungi available on Britannica website, includes examples of economic uses of microorganisms, asexual and sexual reproduction.  Boundless website includes clear diagrams of asexual and sexual reproduction in fungi including the indicated terms. | Britannica website | <http://www.britannica.com/science/fungus>  <https://www.boundless.com/biology/textbooks/boundless-biology-textbook/fungi-24/characteristics-of-fungi-149/fungi-reproduction-591-11810/>  <https://www.youtube.com/watch?v=iOvrq6ssy2Y&list=PLjRExRyK3ubX2u2WOpAYuCIEGQswc_F9_> |
| Explain the uses of microorganisms in industry. | Website background information. | Background information going from the must humble uses of fungi in the manufacture of bread and beer. Background of how beer may have given rise to agricultural civilisation. | BBC website Boundless website | <http://www.bbc.co.uk/education/guides/zwh9q6f/revision>  <https://www.boundless.com/microbiology/textbooks/boundless-microbiology-textbook/industrial-microbiology-17/industrial-microbiology-198/industrial-microorganisms-997-5801/>  <http://www.livescience.com/10221-beer-lubricated-rise-civilization-study-suggests.html> |
| Explain endospore formation and potential consequences | Website | Background reading and information on endospore formation. Includes reasons why it occurs and highlights their resiliency. | Cornell University | <https://micro.cornell.edu/research/epulopiscium/bacterial-endospores> |
| List physical, chemical and biological factors affecting growth of bacteria and fungi | Website/PDF | Background reading and official guidelines on microbial growth and recommended controls. | FDA guidelines | <http://www.fda.gov/Food/FoodScienceResearch/SafePracticesforFoodProcesses/ucm094145.htm>  <https://mymission.lamission.edu/userdata/brownst/docs/Micro20%20Chapter%206.pdf> |
| List and specify sources for the most common types of food poisoning micro-organisms | PDF | Detailed outline of most common that cause food poisoning and preventative measures. | FSAI recommendations and information. | <https://www.fsai.ie/uploadedFiles/Food_Business/Common%20Food%20Poisoning%20Bacteria.pdf> |
| Compare factors that render some foods high risk for microbial growth and other foods low risk | PDF | Background information with concrete examples of how different types of food should be handled. | Safefood.eu | <http://www.safefood.eu/SafeFood/media/SafeFoodLibrary/Documents/Publications/Research%20Reports/IssuingTemperatureGuidanceToConsumersOnTheCookingAndStorageOfFood.pdf> |
| Explain cleaning, disinfecting and sterilising and suitable materials for each | Website | Outlines differences between the three terms and concrete examples of each. Autoclave should be explained in some detail. | QCS | <http://www.ukqcs.co.uk/what-is-the-difference-between-cleaning-disinfection-and-sterilisation/>  <http://www.tuttnauer.com/autoclave> |
| Outline methods of preventing cross- contamination between raw and cooked foods, and between food handlers and food | Website | Plain English explanation of prevention of cross contamination in food preparation. | Safefood.eu | <http://www.safefood.eu/Food-safety/Cross-Contamination.aspx> |
| Sterilise materials and equipment using aseptic techniques | YouTube video. | Video explaining asceptic technique. | BioRad YouTube | <https://www.youtube.com/watch?v=bRadiLXkqoU> |
| Prepare sterile nutrient and selective media | YouTube video  Website | Video explaining agar pouring technique.  Webpage explains the process and advises on which agar should be used for which purpose including selective media. | Science buddies website. | <https://www.youtube.com/watch?v=WgJ75pIWIDI>  <http://www.sciencebuddies.org/science-fair-projects/project_ideas/MicroBio_Agar.shtml> |
| Prepare serial dilutions of a sample | YouTube video  Powerpoint | Video outlines the process while the powerpoint provides worked examples of who to plan the serial dilutions. | Austin University | <https://www.youtube.com/watch?v=pmRUBYlPMBM>  <http://www.austincc.edu/mlt/clin1/ser_SerialDilutions.ppt> |
| Use a microscope correctly | Tutorial on website | Tutorial on microscope to take through students. Includes useful tips and points to draw their attention to including magnification numbers. | Biology Corner | <http://www.biologycorner.com/worksheets/microscope_use.html> |
| Perform staining techniques to include: simple stain, background (negative) stain, spore stain, gram stain | YouTube video | Summary document on staining techniques and what they are useful for,  Instructional video on how to perform a gram stain. | Cliffs Notes. | <http://www.cliffsnotes.com/study-guides/biology/microbiology/microscopy/staining-techniques>  <https://www.youtube.com/watch?v=sxa46xKfIOY> |
| Prepare isolated cultures of microorganisms from various sources including from body surfaces, soil, water and foods | Online tutorial.  YouTube video | In depth tutorial on production of streak plates with multiple methodologies. | Amrita University | <https://www.youtube.com/watch?v=0heifCiMbfY>  <http://vlab.amrita.edu/?sub=3&brch=73&sim=213&cnt=2> |
| Write up an incident report on a laboratory accident | PDF | Scientific articles on methods for writing up accident reports. | Informatics | <http://ajcp.ascpjournals.org/content/120/1/18.full.pdf> |
| Distinguish between aerobic and anaerobic microorganisms and facultative anaerobes through laboratory investigations | Websites | Background information on both including diagrams of where different types grow in growth media. | Bio101 and Textbook of Bacteriology | <http://www.bio101.info/aerobic-versus-anaerobic-bacteria-and-their-examples/>  <http://textbookofbacteriology.net/nutgro_4.html> |
| Identify basic types of fungi with the aid of a microscope | Website | Tutorial on fungal identification including mounting and staining tips. | New Brunswick Museum | <http://website.nbm-mnb.ca/mycologywebpages/Moulds/Examination.html> |
| Outline a plan to control microbial growth in a variety of situations | Website | Explains methods of controlling microbial growth. Differences between antibiotics and antimicrobials highlighted. | Boundless Website  Textbook of bacteriology | <https://www.boundless.com/microbiology/textbooks/boundless-microbiology-textbook/culturing-microorganisms-6/control-of-microbial-growth-67/considerations-in-microbial-control-396-10995/>  <http://textbookofbacteriology.net/control.html>  <http://amrls.cvm.msu.edu/pharmacology/antimicrobials/antimicrobials-an-introduction> |
| Identify common cultures using selective media, including using streak plate technique | Tutorial | Tutorial with details on which media is useful for specifically growing only one type of bacteria. | Science Professor Online | <http://www.scienceprofonline.org/microbiology/differential-selective-bacterial-growth-media.html>  <http://vlab.amrita.edu/?sub=3&brch=73&sim=720&cnt=1> |
| Test samples of water for coli forms | Scientific paper. | Scientific paper on MPN method of calculating bacterial numbers | Applied and Environmental Microbiology | <http://aem.asm.org/content/55/11/2789.full.pdf> |
| Carry out microbiological work practices in compliance with appropriate current health, safety and environmental regulations and controls | PDF | Documentation covering OHAS as it relates to microbiology in Ireland. | HAS documentation | <http://www.hsa.ie/eng/Publications_and_Forms/Publications/Chemical_and_Hazardous_Substances/Guidelines-for-Biological-Agents-2014.pdf> |

**Useful Organisations:**

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| **Name** | **Contact Information** |
| Boundless website | [www.boundless.com](http://www.boundless.com) |
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| **MOOCs (Massive Online Open Courses)** | |
| Free access to online courses  Search regularly for new courses and new start dates | <https://www.mooc-list.com/>  <https://www.mooc-list.com/course/microbiology-and-forensic-science-open2study?static=true>  <https://www.mooc-list.com/course/microbiology-saylororg?static=true>  <https://www.mooc-list.com/course/microbes-rule-world-effects-disease-history-canvasnet?static=true> |