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| **Overall Expectations** | | **Specific Expectations** |
| A1. demonstrate scientific investigation skills (related to both inquiry and research) in the four areas of skills (initiating and planning, performing and recording, analyzing and interpreting, and communicating)  C3. demonstrate an understanding of the diversity of microorganisms and the relationships that exist between them  C2. investigate the development and physical characteristics of microorganisms, using appropriate laboratory equipment and techniques | | A1.3 identify and locate a variety of print and electronic sources that enable them to address research topics fully and appropriately  A1.1 formulate relevant scientific questions about observed relationships, ideas, problems, or issues, make informed predictions, and/or formulate educated hypotheses to focus inquiries or research  A1.5 conduct inquiries, controlling relevant variables, adapting or extending procedures as required, and using appropriate materials and equipment safely, accurately, and effectively, to collect observations and data  A1.4 apply knowledge and understanding of safe laboratory practices and procedures when planning investigations by correctly interpreting Workplace Hazardous Materials Information System (WHMIS) symbols; by using appropriate techniques for handling and storing laboratory equipment and materials and disposing of laboratory and biological materials (e.g., preserved specimens); and by using appropriate personal protection  A1.12 use appropriate numeric, symbolic, and graphic modes of representation (e.g., biological diagrams, Punnett squares), and appropriate units of measurement (e.g., SI and imperial units)  A1.11 communicate ideas, plans, procedures, results, and conclusions orally, in writing, and/or in electronic presentations, using appropriate language and a variety of formats (e.g., data tables, laboratory reports, presentations, debates, simulations, models)  C3.1 describe the anatomy and morphology of various groups of microorganisms (e.g., eukaryotes, prokaryotes, viruses)  C2.2 compare and contrast the cell structures of eukaryotes such as fungi, protozoa, and algae |
| **Previous concepts** | | |
| **Terminology** | | **Technique** |
| * Microorganism * Taxonomy * Phylogeny | * Binomial nomenclature * Growth conditions * Ecosystem | * Steps to use a microscope [see microscope sheet] * Preparing a wet slide [see wet slide sheet] * Structuring a lab report |
| **Material to prepare** | | **Safety instructions** |
| * Microscope * Slide and cover slip * Adhesive paper * Alcohol * Pliers * Pipette * Water or methylene blue (optional) * Immersion oil * Lens paper * Lens cleaner * 2 different types of bloomy rind cheese | | * Emphasize the importance of keeping your hands away from your face when manipulating microorganisms. * Ensure the tools are cleaned correctly after use. * Wash hands carefully after the lab. |
| **Context**  Distribute the protocol: ***Cheese microbial flora***  Answer the preparatory questions:   1. Why is it important to clean the blade with an alcohol solution? 2. What is the advantage of using methylene blue instead of water? 3. What are the characteristics of microorganisms that make them particularly effective in growing on cheese ? | | |
| **Activity**   * Experiment | | |
| **Pushing further**   * Ask students to find other uses for microorganisms in the environment [i.e., lactobacillus bacteria, which live in our intestines, protect us against allergic reactions such as eczema] * Ask students to choose an ecosystem and explain the roles of the microorganisms in the selected ecosystem (i.e., microorganisms play a central role in the functioning of ecosystems. They are namely involved in biogeochemical cycles, such as those for nitrogen and carbon, and the degradation of contaminants.] | | |
| **Assessment**   * Evaluation of lab work (optional) * Microscope use * Biological drawing technique * Lab report | | |
| **Resources**   * Document: Cheese biodiversity images * Document: Evaluation of lab work (optional) * Document: A few microorganisms involved in cheese ripening * Document: Microorganism lab evaluation grid * Internet * [Observation du fromage au microscope](https://www.acfas.ca/publications/magazine/2012/02/fromage-frais-sur-microscope)   + [<https://www.acfas.ca/publications/magazine/2012/02/fromage-frais-sur-microscope>] * Canadian Food Inspection Agency   + *[*[*https://inspection.canada.ca/eng/1297964599443/1297965645317*](https://inspection.canada.ca/eng/1297964599443/1297965645317)] * [Les microorganismes intervenant dans l’affinage des fromages à pâte lactique](http://bergers-fromagers.org/public/Technique/Production-Transformation/MICROFLORE_-_Les_micro_organismes_dans_affinage_des_fromages_a_pate_lactique.pdf)   + *[*[*http://bergers-fromagers.org/public/Technique/Production-Transformation/MICROFLORE\_-\_Les\_micro\_organismes\_dans\_affinage\_des\_fromages\_a\_pate\_lactique.pdf*](http://bergers-fromagers.org/public/Technique/Production-Transformation/MICROFLORE_-_Les_micro_organismes_dans_affinage_des_fromages_a_pate_lactique.pdf)*]* * [Fromage : les autres microorganismes](https://www.futura-sciences.com/sante/dossiers/gastronomie-lait-cru-pasteurise-tradition-hygiene-1712/page/6/)   + [[*https://www.futura-sciences.com/sante/dossiers/gastronomie-lait-cru-pasteurise-tradition-hygiene-1712/page/6/*](https://www.futura-sciences.com/sante/dossiers/gastronomie-lait-cru-pasteurise-tradition-hygiene-1712/page/6/)*]* * [Mieux comprendre l’activité des levures et des moisissures](http://lait.org/fichiers/Revue/PLQ-2011-06/recherche.pdf)   + [[*http://lait.org/fichiers/Revue/PLQ-2011-06/recherche.pdf*](http://lait.org/fichiers/Revue/PLQ-2011-06/recherche.pdf)*]* * [Utilisation des microorganismes en biotechnologie médicale](http://azech.unblog.fr/2012/05/05/utilisation-ds-microorganisme-en-biotechnologie-medicale/)   + *[*[*http://azech.unblog.fr/2012/05/05/utilisation-ds-microorganisme-en-biotechnologie-medicale/*](http://azech.unblog.fr/2012/05/05/utilisation-ds-microorganisme-en-biotechnologie-medicale/)*]* * [Biotech blanche](http://www.innovatech.be/biotech-blanche-microorganismes-usine/)   + *[*[*http://www.innovatech.be/biotech-blanche-microorganismes-usine/*](http://www.innovatech.be/biotech-blanche-microorganismes-usine/)*]* * [La microbiologie marine](https://parlonssciences.ca/ressources-pedagogiques/les-stim-en-contexte/la-microbiologie-marine-a-la-rencontre-des-microbes-de)   + *[*[*https://letstalkscience.ca/educational-resources/stem-in-context/marine-microbiology-meet-microbes-sea?\_ga=2.94798300.1166490927.1622830676-2138215416.1622830676*](https://letstalkscience.ca/educational-resources/stem-in-context/marine-microbiology-meet-microbes-sea?_ga=2.94798300.1166490927.1622830676-2138215416.1622830676)*]* | | |