**Stage 1 Scientific Studies – Semester 1 Program 1**

**Biological Science Focus**

This program articulates with LAP 1

This is a 10-credit program for students intending to study Stage 1 Scientific Studies.

Number of lessons equivalent to 60 hrs per semester, including 25–30 hrs of practical activities.

| **Science Inquiry Skills** | **Possible contexts** | **Activities/teaching strategies** | **SHE** |
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| **Week 1** | | | |
| **Scientific evidence** | Introduction to biology.  Living things are distinguishable from non-living things.  The characteristics of living things.  The cell theory unifies all living things.  Living things are made up of one or more cells.  Consider the benefits (and limitations) of The Cell Theory, advanced by Rudolf Virchow in 1858. | Class discussion on what defines “Biology”?  Review the concept of living compared to non-living.  List the characteristics of living things, e.g. REMRING or MRS GREN.  Use microscopes and diagrams to show that cells are the structural and functional units of life, come from pre-existing cells, and contain hereditary material.  Introduce the concepts of unicellular and multicellular. | The development of the microscope – a brief history: Robert Hooke’s development of the compound microscope and examination of cork tissue.  Watch YouTube Video: Cell Theory (3.30 min)  (<https://youtu.be/dscY_2QQbKU>) |
| **Week 2–3** | | | |
| What distinguishes **science and engineering** (and the scientific method and engineering design process) from other areas of human knowledge? | Discuss how some human endeavours are ‘scientific’ but others may not be. For example, the scientific method can be used to investigate how old a painting is, and whether it is genuine or a fake. However, science cannot readily be used to assess ‘appreciation’ of art.  Compare the scientific method and engineering design process:  https://www.sciencebuddies.org/engineering-design-process/engineering-design-compare-scientific-method.shtml | Students work in groups to analyse a practical investigation description and determine hypothesis, variables, possible limitations etc. (This could involve analysis of the engineering design process.) | Investigate scientific techniques used in the art world:  http://www.bbc.co.uk/programmes/articles/3Nmwcg5qFBxgJMJqq0r6h4C/scientific-techniques |
| **Week 4–6** | | | |
| Investigate the importance of making accurate **observations**, using appropriate equipment.  **Scale drawings and diagrams** | Use the work of Hooke and van Leeuwenhoek as examples.  Research Antonie van Leeuwenhoek’s work to illustrate the main types of bacteria.  Investigate the work of Schleiden and Schwann (1838 and 1839).  Students draw schematic diagrams to show the main structures of plant and animal cells from personal observation.  Draw a table to compare animal, plant, and bacterial cell structure. | Practical: Review the use of a light Microscope.  Microscope skills: view cells from various organisms.  Activity: Look at photomicrographs of various organelles and draw schematic diagrams.  Use staining techniques to identify different cell components.  Observe the heartbeat of *Daphnia* under the microscope. | **Summative: SHE inquiry**  Choose a landmark discovery in biology (e.g. cell theory, microbes and disease, etc., or a recently announced discovery) and investigate and analyse the role of new technologies, communication, the influence of other areas of science, and the beneficial or unexpected consequences. |
| **Week 7–8** | | | |
| Investigate the importance of **questioning and thinking**, **design**, and **conducting investigations**. | Use the work of Pasteur and Koch as examples.  In ideal conditions bacteria grow exponentially.  Different bacteria require specific conditions for growth.  Discussion on what bacteria require to grow, look at different types of bacteria and their requirements for survival, e.g. not all bacteria require oxygen.  Interpret graphs that show the growth cycle of bacteria.  Describe the way bacteria reproduce using binary fission.   * Binary fission is an asexual process- produces genetically identical offspring. * The concept of the bacterial colony. | Practical: Grow bacteria on agar plates – investigate factors that affect bacterial growth. Consider the effects of factors such as:   * temperature * nutrient availability * moisture * pH * removal of wastes * oxygen * antibiotics/ * antiseptics   **Summative: SIS task: Analysis and Interpretation**  Students are presented with data, diagrams and information about health and hygiene in the Middle Ages. Students analyse and interpret the presented information and answer a series of questions to demonstrate knowledge and understanding of how improved medical technologies have contributed to extended life spans, and evaluate the health and hygiene practices in Europe during the Middle Ages. |  |
| **Week 9–10** | | | |
| Investigate the importance of **collecting** (and analysing) **and representing** **data**. | Use simulations of Mendelian inheritance to analyse data of simple breeding experiments. Provide raw data to enable students to format tables/graphs appropriately. |  |  |
| **Week 11–13** | | | |
| **Design**  - hypothesis  **-** variables  **-** analysis  **Evaluation** | Worksheet on designing an investigation, followed by class discussion. | **Summative: SIS task: Design**  Design and conduct a practical investigation to test the hypothesis that antibacterial products kill 99.9% of bacteria. |  |
| **Week 14–16** | | | |
| **Collaborative Inquiry – group design** |  | **Summative Task**  Students work in groups to choose an investigation of interest, within this framework, for which the outcome is uncertain. They record their individual contribution and progress in a journal to reflect their ideas, learning and development of the method. They also record the data collected and analyse it for meaning.  After conducting the investigation, students individually prepare a presentation in the form of a pitch, defence, or justification that evaluates the procedures used and the results/outcome, and the effectiveness of the collaboration. |  |