Forensic Science: Year 12 & 13

Introduction

Introduce our year 12 students to the world of Forensic Science via four 1.5 hour sessions in our General Studies Enrichment Programme. It is also envisaged that the sessions, either shortened or extended, could be used in AS/A2 GCE Biology, Chemistry and Physics lessons in order to make them more engaging and relevant.

Session 1

- Short talk on an introduction to Forensic Science and the possible career paths

Bloodstain pattern analysis

- Talk on blood and its components
- Talk on blood as a liquid
- Investigation of bloodstain patterns

1. Teacher Demonstration of apparatus to be used to drop 'blood' droplets to form splatters on white card, and how to record results
2. Students to verify following equation by experiment involving the dropping of 'blood'droplets on to an inclined surface

$$\text{Sine(impact angle)} = \frac{\text{width of stain}}{\text{length of stain}}$$

3. Students to carry out exercise to find the point of origin of blood from a series of blood splatters

Apparatus: Plastic pipettes, 'blood' made from single cream and red food dye, clamp stand, metre rule, white card, protractor, plasticine, string.

Health and Safety: Red food dye will stain clothes – laboratory coats required; wear safety glasses.

Links to AS/A syllabus:
OCR AS/A GCE Biology, Module 2801- Foundation: 5.1.2 (h) Role of water in living organisms; 5.2.3 (a) Blood vessels in lung tissue; 5.2.3 (e) Pulse rate and heart rate
Module 2803 – Transport:5.3.1 (b) Structure of arteries, veins and capillaries; 5.3.1 (d) Structure of blood cells;5.3.2 (c) Mammalian circulatory system

Useful websites:
http://www.physics.carleton.ca/~carter/
http://www.bloody1.com/bloody1/
http://www.compusmart.ab.ca/msweet/

Session 2

Part 1: Fibre analysis using microscopes

- Short introductory talk on fibres and hair, and how to obtain and mount fibres
- Students to look at examples under a microscope
- Students to obtain and analysis contents from each other's 'empty' pockets

Apparatus: Samples of fibres, animal and human hair, microscope, microscope slides, double-sided sticky tape, Petri dishes, clear sticky tape, soft brush, plain white paper, forceps, polythene bags.

Health and Safety: Normal laboratory safety precautions.

Links to AS/A syllabus:
OCR AS/A GCE Biology, Module 2801 – Foundation: 5.1.1 (a) Using a light microscope

Useful websites:
http://www.chemsoc.org/exemplarchem/entries/2003/hull_barry/AG%20Fibres.htm
http://www.chemsoc.org/exemplarchem/entries/2003/hull_barry/AG%20Rope%20analysis.htm
http://www.forensic-access.co.uk/forensic-access-publications/benchmark-newsletter/fibre-analysis.htm

Part 2: Fingerprints

- Short talk on fingerprint characteristics and classification with examples
- Class exercise in which students take each other's fingerprints using an ink pad and then one/two student(s) leave the room. During their absence one of the remaining students picks up a clean glass with between thumb and fore-finger. The student(s) then return, dust for prints on glass with brush and carbon powder, lift the prints with sticky tape, mount on a slide and use a microscope in order to match prints

Apparatus: Ink pad, white card, magnifying glass, microscope, blush brush, carbon powder, sticky tape, acetate sheets, digital camera.

Health and Safety: Safety glasses should be worn; contact with fine carbon powder should be avoided

Links to AS/A syllabus:
OCR AS/A GCE Biology, Module 2801 – Foundation: 5.1.6 (a) Growth and repair via mitosis Module 2804 – Central Concepts: 4.4.4 Genetics and meiosis; 5.4.5 (f) Variation Module 2805 – 02: Applications of genetics; 5.6.1 (b) Continuous and discontinuous variation

Useful websites:
www.research.ibm.com/ecvg/pubs/sharat-handbook.pdf
http://rpsec.usca.sc.edu/travelingscience/fingerprint_analy.html
http://www.crimtrac.gov.au/fingerprintanalysis.htm

Session 3

Part 1: DNA finger-printing

- Talk on DNA finger-printing
- Experiment for the extraction of DNA from kiwi fruit

[Ref: Local Heroes Do-It-Yourself Science, Adam Hart-Davis & Paul Bader, ISBN 0-563-55165-8]

- Experiment using electrophoresis equipment

[Ref: Electrophoresis Kit G3-0030, Philip Harris]

Apparatus: Samples of fibres, animal and human hair, microscope, microscope slides, double-sided sticky tape, Petri dishes, clear sticky tape, soft brush, plain white paper, forceps, polythene bags.

Health and Safety: Safety glasses should be worn;

Links to AS/A syllabus:
OCR AS/A GCE Biology, Module 2801 – Foundation: 5.1.5 (a) Structure of DNA;
5.1.5 (b) Semi-conservative replication
Module 2802 – Human Health and Disease:5.2.1 (c) Example of an inherited disease;
5.2.1 (g) Human Genome Project
Module 2804 – Central Concepts: 5.4.4 (b) Meiosis and variation; 5.4.4 (d) Genetic diagrams
Module 2805 01 - Applications of Genetics: 5.5.2 Asexual reproduction and cloning
Module 2805 04 - Microbiology and Biotechnology; 5.8.2 (c) Safe working practices

AQA AS/A GCE Biology A, Module 2: Making use of Biology.
Edexcel AS/A GCE Biology, Unit 5B: Genetics, evolution and biodiversity, Topic: Gene technology.
Edexcel AS/A GCE Salters Nuffield Biology, Unit 1: Lifestyle, Transport, Genes and Health, Topic 2: Genes and health; Topic 6: Infection, immunity and forensics
WJEC AS/A GCE Biology, Assessment Unit B11: Fundamental Concepts and Organisation.
OCR AS/A GCE Chemistry, Module 2815, Component 04: Methods of Analysis and Detection.
OCR AS/A GCE Salters Chemistry, Module 2849: Chemistry of Materials, Unit: Engineering Proteins

Useful websites:
http://www.dnai.org/d/index.html (DNA applications)
http://www.pbs.org/wgbh/nova/sheppard/ (DNA fingerprinting and forensic)
http://gslc.genetics.utah.edu/features/forensics/ (Genetics and forensics)
http://www.dnalc.org/resources/BiologyAnimationLibrary.htm (Animations of genetic fingerprinting, PCR etc.)
http://www.ac-creteil.fr/biotechnologies/doc_englishbiomol.htm (Animation of DNA electrophoresis)

Part 2: Making a cast

- Short talk on making a cast of footprints and car tyre-track impressions, including a demonstration.

Apparatus: Plastic tray, sand or soil, plastic container, spoon, plaster of Paris, ruler, model cars, ink pad, white card or paper, digital camera.

Health and Safety: Avoid inhalation and skin contact with plaster of Paris, Safety glasses should be worn.

Links to AS/A syllabus:
OCR AS/A GCE Chemistry, Module 2815/01 Trends and Patterns: The Group II elements and their compounds

Useful websites:
http://rpsec.usca.sc.edu/travelingscience/fingerprint_analy.html
http://www.crimtrac.gov.au/fingerprintanalysis.htm
http://www.peelpolice.on.ca/FIS/FIS-Foot.html
www.kilvington.vic.edu.au/cyber/book_w6.doc

Session 4

The Crime Scene Investigation

- The final exercise involves the students forming themselves into a Forensic team in order to investigate a crime scene put together by the teacher.

Apparatus: Digital camera plus all relevant materials used throughout course.

Health and Safety: All considerations as stated above plus area of room or outside area to conform to H&S requirements.

Credits: Written by Cranbrook School, UK