

Practical resources to support the teaching of A level Biology in Wales

| Core Content | Additional Options for Practical Work |
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| Basic biochemistry and cell organisation (AS unit 1) | |
| 1. Chemical elements are joined together to form biological compounds | http://www.britishecologicalsociety.org/wp-content/uploads/Education-Water-lesson.pdf range of practical activities relating to the properties of water |
| 2. Cell structure and organisation | http://www.nuffieldfoundation.org/practical-biology/looking-heart heart dissection, looking at structure of organs http://www.nuffieldfoundation.org/practical-biology/dissecting-lungs lung dissection tissue and organ structure http://www.nuffieldfoundation.org/practical-biology/comparing-flower-structure-different-angiosperms dissection and comparison of different flower structures http://www.nuffieldfoundation.org/practical-biology/aseptic-techniques aseptic techniques for the culturing of bacteria on agar plates http://www.saps.org.uk/secondary/teaching-resources/770-microscopy-looking-at-xylem-and-specialised-cells xylem cells |
| 3. Cell membranes and transport | http://www.nuffieldfoundation.org/practical-biology/effect-size-uptake-diffusion - experiment on rate of diffusion using agar cubes. http://www.nuffieldfoundation.org/practical-biology/estimating-rate-transpiration-plant-cutting rate of transpiration and an animation that supports the ideas of water transport http://www.saps.org.uk/secondary/themes/1274 http://www.nuffieldfoundation.org/practical-biology/tracking-active-uptake-minerals-plant-roots active uptake of minerals in plant roots http://www.nuffieldfoundation.org/practical-biology/investigating-effect-temperature-plant-cell-membranes effect of temperature on plant cell membranes |

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| | (can use colorimeter) |
| 4. Biological reactions are regulated by enzymes | <p>http://www.nuffieldfoundation.org/practical-biology/measuring-rate-metabolism measuring metabolic rate</p> <p>http://www.nuffieldfoundation.org/practical-biology/microscale-investigations-catalase-activity-plant-extracts catalase activity in plants</p> <p>http://www.nuffieldfoundation.org/practical-biology/investigating-effect-temperature-activity-lipase temperature impact on lipase</p> <p>http://www.nuffieldfoundation.org/practical-biology/investigating-effect-ph-amylase-activity amylase and the impact of pH</p> |
| 5. Nucleic acids and their functions | http://www.nuffieldfoundation.org/practical-biology/extracting-dna-living-things extraction of DNA practical work |
| 6. Genetic information is copied and passed on to daughter cells | <p>http://www.nuffieldfoundation.org/practical-biology/investigating-mitosis-allium-root-tip-squash mitosis in a root tip squash, there is an animation to support this practical http://saps.org.uk/secondary/themes/1290</p> <p>http://www.nuffieldfoundation.org/practical-biology/preparing-anther-squash meiosis in an anther squash</p> <p>http://www.nuffieldfoundation.org/practical-biology/making-reebops-model-meiosis model of meiosis</p> |
| Biodiversity and Physiology of Body Systems (AS Unit 2) | |
| 1. All organisms are related through their evolutionary history | <p>http://www.nuffieldfoundation.org/practical-biology/observing-patterns-distribution-simple-plant patterns in plant distribution</p> <p>http://www.nuffieldfoundation.org/practical-biology/investigating-response-worms-soil-improvers investigating the behaviour of animals to different soil conditions</p> <p>http://www.nuffieldfoundation.org/practical-biology/biodiversity-your-backyard</p> |

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| | <p>using quadrats to measure biodiversity</p> <p>http://www.nuffieldfoundation.org/practical-biology/model-natural-selection-%E2%80%93-spaghetti-worms modelling natural selection</p> <p>http://www.biology-fieldwork.org/woodland/woodland-plants/investigation-comparing-two-areas-of-woodland.aspx Investigation into ground vegetation in two contrasting areas of woodland, including a spreadsheet for calculating Simpson's Diversity Index</p> <p>http://bigpictureeducation.com/video-whats-buttercup Wellcome Trust video and accompanying data for field work</p> <p>http://www.saps.org.uk/secondary/teaching-resources/258 http://www.saps.org.uk/secondary/teaching-resources/127 http://www.saps.org.uk/secondary/teaching-resources/768 online activities to practice sampling techniques before you get into the field, looking at measuring abundance, random sampling and distribution of species across a footpath</p> |
| <p>2. Adaptations for gas exchange</p> | <p>http://www.nuffieldfoundation.org/practical-biology/modelling-human-ventilation-system modelling human ventilation system</p> <p>http://www.nuffieldfoundation.org/practical-biology/looking-heart heart dissection, looking at structure of organs – link to mass transport system.</p> <p>http://www.nuffieldfoundation.org/practical-biology/using-spirometer-investigate-human-lung-function using a spirometer to measure lung function</p> <p>http://www.nuffieldfoundation.org/practical-biology/investigating-factors-affecting-breathing-rate-locust investigating the factors that affect breathing rate</p> |
| <p>3. Adaptations for transport</p> | <p>http://www.nuffieldfoundation.org/practical-biology/estimating-rate-transpiration-plant-cutting rate of transpiration and an animation that supports the ideas of water transport http://www.saps.org.uk/secondary/themes/1274</p> |

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| | <p>http://www.nuffieldfoundation.org/practical-biology/looking-heart heart dissection, looking at structure of organs – link to mass transport system.</p> |
| 4. Adaptations for nutrition | <p>http://www.nuffieldfoundation.org/practical-biology/evaluating-visking-tubing-model-gut model gut</p> |
| Energy Homeostasis and the Environment (A2 Unit3) | |
| 1. Importance of ATP | <p>http://www.nuffieldfoundation.org/practical-biology/measuring-rate-metabolism measuring metabolic rate</p> <p>http://www.nuffieldfoundation.org/practical-biology/investigating-light-dependent-reaction-photosynthesis using DCPIP as an electron acceptor – investigating light dependent reaction</p> |
| 2. Photosynthesis uses light energy to synthesise organic molecules | <p>http://www.nuffieldfoundation.org/practical-biology/investigating-light-dependent-reaction-photosynthesis using DCPIP as an electron acceptor – investigating light dependent reaction</p> <p>http://www.saps.org.uk/secondary/teaching-resources/235 investigating photosynthesis using algal balls and an animation that outlines respiration and photosynthesis http://www.saps.org.uk/secondary/themes/1281</p> <p>http://www.saps.org.uk/secondary/teaching-resources/181 thin layer chromatography for photosynthetic pigments</p> |
| 3. Respiration releases chemical energy in biological processes | <p>http://www.nuffieldfoundation.org/practical-biology/how-do-plants-and-animals-change-environment-around-them#node-2978 investigating levels carbon dioxide produced by animals and plants in light and dark conditions</p> <p>http://www.nuffieldfoundation.org/practical-biology/measuring-rate-metabolism measuring metabolic rate</p> |
| 4. Microbiology | <p>http://www.nuffieldfoundation.org/practical-biology/aseptic-techniques standard practice for aseptic techniques</p> |

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| | <p>http://www.nuffieldfoundation.org/practical-biology/incubating-and-viewing-plates standard practice for viewing and incubating agar plates</p> <p>http://www.nuffieldfoundation.org/practical-biology/making-nutrient-agars making up nutrient agars</p> <p>http://www.nuffieldfoundation.org/practical-biology/pouring-agar-plate how to pour agar plates</p> <p>http://www.microbiologyonline.org.uk/teachers/resources practical books on microbiology available for teachers to download for free</p> |
| <p>5. Population size and ecosystems</p> | <p>http://www.nuffieldfoundation.org/practical-biology/nitrogen-fixing-bacteria-free-living-soil - links to nitrogen cycle, recycling chemical elements and impact that humans can have on ecosystems.</p> <p>http://www.biology-fieldwork.org/freshwater/freshwater-animals/investigation-freshwater-energy-flow.aspx An investigation into energy flow using freshwater invertebrates, to construct pyramids of numbers, biomass and energy and calculate efficiency</p> <p>http://www.biology-fieldwork.org/seashore/sand-dunes/investigation-primary-succession-in-sand-dunes.aspx An investigation into primary succession in sand dunes</p> <p>http://www.biology-fieldwork.org/grassland/grassland-plants/fieldwork.aspx Fieldwork techniques for investigating the effects of mowing and trampling in grasslands (human impact on ecosystems)</p> <p>http://www.saps.org.uk/secondary/teaching-resources/127 online activity to explore the how to look at distribution of species across a footpath before you go out into the field</p> <p>http://bigpictureeducation.com/video-whats-buttercup Wellcome Trust video and accompanying data for field work</p> |

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| | <p>http://www.saps.org.uk/secondary/teaching-resources/258 http://www.saps.org.uk/secondary/teaching-resources/127 http://www.saps.org.uk/secondary/teaching-resources/768 online activities to practice sampling techniques before you get into the field, looking at measuring abundance, random sampling and distribution of species across a footpath</p> |
| 6. Human impact on the environment | <p>http://www.biology-fieldwork.org/grassland/grassland-plants/fieldwork.aspx Fieldwork techniques for investigating the effects of mowing and trampling in grasslands (human impact on ecosystems)</p> |
| 7. Homeostasis and the kidney | <p>http://www.nuffieldfoundation.org/practical-biology/investigating-factors-affecting-breathing-rate-locust investigating the factors that affect breathing rate</p> <p>http://www.nuffieldfoundation.org/practical-biology/investigating-factors-affecting-heart-rate-daphnia investigating factors that affect heart rate</p> <p>http://www.nuffieldfoundation.org/practical-biology/observing-effects-exercise-human-body effects of exercise on humans</p> |
| 8. The nervous system | <p>http://www.nuffieldfoundation.org/practical-biology/using-choice-chamber-investigate-animal-responses-stimuli animals response to stimuli</p> <p>http://www.nuffieldfoundation.org/practical-biology/investigating-response-calliphora-larvae-light larvae response to light</p> |
| Variation Inheritance and options (A2 Unit 4) | |
| 1. Sexual reproduction in humans | |
| 2. Sexual reproduction in plants | <p>http://www.nuffieldfoundation.org/practical-biology/comparing-flower-structure-different-angiosperms dissection and comparison of different flower structures</p> |
| 3. Inheritance | <p>http://www.dnadarwin.org/ explore the molecular evidence for evolution through practical bioinformatics activities that use data analysis tools and molecular data.</p> |

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| | <p>http://www.yourgenome.org/ range of activities and animations from Sanger Institute</p> |
| 4. Variation and evolution | <p>http://www.nuffieldfoundation.org/practical-biology/gene-induction-%C3%9F-galactosidase-e-coli induction of genes (genetic control)</p> <p>http://www.nuffieldfoundation.org/practical-biology/following-gene-transfer-conjugation-bacteria horizontal gene transfer in bacteria</p> <p>http://www.yourgenome.org/ range of activities and animations from Sanger Institute</p> |
| 5. Application of reproduction and genetics | <p>http://www.nuffieldfoundation.org/practical-biology/cloning-living-organism taking cuttings from plants</p> <p>http://www.saps.org.uk/secondary/teaching-resources/706 new effective technique for cloning cauliflowers</p> |
| Choice of one option from three: | |
| <p>A. Immunology and Disease</p> <p>B. Human Musculoskeletal Anatomy</p> <p>C. Neurobiology and Behaviour</p> | <p>http://www.nuffieldfoundation.org/practical-biology/modelling-sliding-filament-hypothesis proteins and muscle movement</p> <p>http://www.nuffieldfoundation.org/practical-biology/using-choice-chamber-investigate-animal-responses-stimuli animals response to stimuli</p> <p>http://www.nuffieldfoundation.org/practical-biology/investigating-response-worms-soil-improvers investigating the behaviour of animals to different soil conditions</p> <p>http://www.nuffieldfoundation.org/practical-biology/investigating-response-calliphora-larvae-light larvae response to light</p> |

Support for specified practical work

| Specified practical work | Extra Practical Support |
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| Biochemistry and Cell organisation (AS Unit 1) | |
| <ul style="list-style-type: none"> Food tests to include: iodine-potassium iodide test for starch; Benedict's test for reducing and non-reducing sugars; biuret test for protein; emulsion test for fats and oils | http://www.nuffieldfoundation.org/practical-biology/quantitative-food-test-protein-content-powdered-milk establishing the quantity of protein in powdered milk |
| <ul style="list-style-type: none"> Calibration of the light microscope at low and high power, including calculation of actual size of a structure and the magnification of a structure in a drawing Preparation and scientific drawing of a slide of living cells e.g. onion/ rhubarb/ Amoeba including calculation of actual size and magnification of drawing | http://www.nuffieldfoundation.org/practical-biology/comparing-flower-structure-different-angiosperms dissection and comparison of different flower structures http://www.saps.org.uk/secondary/teaching-resources/770-microscopy-looking-at-xylem-and-specialised-cells xylem cells, trichomes http://www.saps.org.uk/secondary/teaching-resources/1325 phloem and xylem |
| <ul style="list-style-type: none"> Determination of water potential by measuring changes in mass or length Determination of solute potential by measuring the degree of incipient plasmolysis Investigation into the permeability of cell membranes using beetroot | http://www.nuffieldfoundation.org/practical-biology/investigating-effect-concentration-blackcurrant-squash-osmosis-chipped-potatoes http://www.nuffieldfoundation.org/practical-biology/observing-osmosis-plasmolysis-and-turgor-plant-cells observing osmosis http://www.nuffieldfoundation.org/practical-biology/investigating-effect-temperature-plant-cell-membranes effect of temperature on plant cell membranes (can use colorimeter) |
| <ul style="list-style-type: none"> Investigation into the effect of temperature or pH on enzyme activity Investigation into the effect of enzyme or substrate concentration on enzyme activity | http://www.nuffieldfoundation.org/practical-biology/investigating-effect-temperature-plant-cell-membranes effect of temperature on plant cell membranes |
| <ul style="list-style-type: none"> Simple extraction of DNA from living material | http://www.nuffieldfoundation.org/practical-biology/extracting-dna-living-things extraction of DNA practical work |
| <ul style="list-style-type: none"> Scientific drawing of cells from slides of root tip to show stages of mitosis | http://www.nuffieldfoundation.org/practical-biology/investigating-mitosis-allium- |

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| <ul style="list-style-type: none"> Scientific drawing of cells from prepared slides of developing anthers to show stages of meiosis | <p>root-tip-squash mitosis in a root tip squash</p> <p>http://www.nuffieldfoundation.org/practical-biology/preparing-anther-squash meiosis in an anther squash</p> |
| <p>Biodiversity and Physiology of Body Systems (AS Unit 2)</p> | |
| <ul style="list-style-type: none"> Investigation into biodiversity in a habitat | <p>http://www.nuffieldfoundation.org/practical-biology/observing-patterns-distribution-simple-plant patterns in plant distribution</p> <p>http://www.nuffieldfoundation.org/practical-biology/investigating-response-worms-soil-improvers investigating the behaviour of animals to different soil conditions</p> <p>http://www.nuffieldfoundation.org/practical-biology/biodiversity-your-backyard using quadrats to measure biodiversity</p> <p>http://www.nuffieldfoundation.org/practical-biology/model-natural-selection-%E2%80%93-spaghetti-worms modelling natural selection</p> <p>http://www.biology-fieldwork.org/woodland/woodland-plants/investigation-comparing-two-areas-of-woodland.aspx Investigation into ground vegetation in two contrasting areas of woodland, including a spreadsheet for calculating Simpson's Diversity Index</p> <p>http://bigpictureeducation.com/video-whats-buttercup Wellcome Trust video and accompanying data for field work</p> <p>http://www.saps.org.uk/secondary/teaching-resources/258 http://www.saps.org.uk/secondary/teaching-resources/127 http://www.saps.org.uk/secondary/teaching-resources/768 online activities to practice sampling techniques before you get into the field, looking at measuring abundance, random sampling and distribution of species across a footpath</p> |
| <ul style="list-style-type: none"> Investigation into stomatal numbers in leaves | <p>http://www.nuffieldfoundation.org/practical-biology/window-past-measuring-stomatal-density identifying the number of stomata on either side of a leaf.</p> |

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| <ul style="list-style-type: none"> Dissection of fish head to show the gas exchange system Scientific drawing of a low power plan of a prepared slide of T.S. dicotyledon leaf e.g. Ligustrum (privet), including calculation of actual size and magnification of drawing | <p>http://www.saps.org.uk/secondary/teaching-resources/1325-a-level-set-practicals-dissection-and-microscopy-of-a-plant-stem microscope activity</p> |
| <ul style="list-style-type: none"> Investigation into transpiration using a simple potometer Scientific drawing of a low power plan of a prepared slide of T.S artery and vein, including calculation of actual size and magnification of drawing Dissection of mammalian heart | <p>http://www.nuffieldfoundation.org/practical-biology/estimating-rate-transpiration-plant-cutting rate of transpiration and an animation that supports the ideas of water transport http://www.saps.org.uk/secondary/themes/1274</p> <p>http://www.nuffieldfoundation.org/practical-biology/measuring-rate-water-uptake-plant-shoot-using-potometer using a potometer</p> <p>http://www.saps.org.uk/secondary/teaching-resources/1263 a simpler set of potometer apparatus</p> <p>http://www.nuffieldfoundation.org/practical-biology/tracking-active-uptake-minerals-plant-roots active uptake of minerals in plant roots</p> <p>http://www.nuffieldfoundation.org/practical-biology/looking-heart heart dissection, looking at structure of organs – link to mass transport system.</p> |
| <p>Energy Homeostasis and the Environment (A2 Unit3)</p> | |
| <ul style="list-style-type: none"> Investigation of dehydrogenase activity using artificial hydrogen acceptors, as illustrated by methylene blue, DCPIP or tetrazolium compounds | <p>http://www.nuffieldfoundation.org/practical-biology/measuring-rate-metabolism measuring metabolic rate</p> <p>http://www.nuffieldfoundation.org/practical-biology/investigating-light-dependent-reaction-photosynthesis using DCPIP as an electron acceptor – investigating light dependent reaction</p> |
| <ul style="list-style-type: none"> Investigation into the separation of chloroplast pigments by chromatography Investigation into factors affecting the rate of photosynthesis | <p>http://www.saps.org.uk/secondary/teaching-resources/181 thin layer chromatography for photosynthetic pigments</p> <p>http://www.nuffieldfoundation.org/practical-biology/investigating-light-dependent-reaction-photosynthesis using DCPIP as an electron acceptor – investigating light dependent reaction</p> |

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| <ul style="list-style-type: none"> Investigation into the role of nitrogen and magnesium in plant growth | <p>http://www.saps.org.uk/secondary/teaching-resources/235 investigating photosynthesis using algal balls and an animation that outlines respiration and photosynthesis http://www.saps.org.uk/secondary/themes/1281</p> |
| <ul style="list-style-type: none"> Investigation into factors affecting the rate of respiration in yeast Investigation into the numbers of bacteria in fresh and stale milk, using techniques of serial dilution, plating and counting colonies | <p>http://www.nuffieldfoundation.org/practical-biology/aseptic-techniques standard practice for aseptic techniques</p> <p>http://www.nuffieldfoundation.org/practical-biology/incubating-and-viewing-plates standard practice for viewing and incubating agar plates</p> <p>http://www.nuffieldfoundation.org/practical-biology/making-nutrient-agars making up nutrient agars</p> <p>http://www.nuffieldfoundation.org/practical-biology/pouring-agar-plate how to pour agar plates</p> <p>http://www.microbiologyonline.org.uk/teachers/resources practical books on microbiology available for teachers to download for free</p> |
| <ul style="list-style-type: none"> Investigation into the abundance and distribution of organisms in a habitat | <p>http://bigpictureeducation.com/video-whats-buttercup Wellcome Trust video and accompanying data for field work</p> <p>http://www.saps.org.uk/secondary/teaching-resources/258 http://www.saps.org.uk/secondary/teaching-resources/127 http://www.saps.org.uk/secondary/teaching-resources/768 online activities to practice sampling techniques before you get into the field, looking at measuring abundance, random sampling and distribution of species across a footpath</p> |
| <ul style="list-style-type: none"> Dissection of kidney | |
| Variation Inheritance and options (A2 Unit 4) | |
| <ul style="list-style-type: none"> Investigation of the digestion of starch agar using germinating seeds | <p>http://www.nuffieldfoundation.org/practical-biology/comparing-flower-structure-different-angiosperms dissection and comparison of different flower structures</p> |

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| <ul style="list-style-type: none">• Dissection of wind and insect-pollinated flowers | |
| <ul style="list-style-type: none">• Scientific drawing of a low power plan of a prepared slide of an anther, including calculation of actual size and magnification of drawing | |
| <ul style="list-style-type: none">• Experiment to illustrate gene segregation including the use of the chi squared test in assessing the significance of genetic outcomes | |
| <ul style="list-style-type: none">• Investigation of continuous variation in a species (including use of the Student's t test) | |

Practical resources to support the teaching of practical skills in Biology A levels in Wales

| Practical techniques | Additional options for practical work |
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| use appropriate apparatus to record a range of quantitative measurements (to include mass, time, volume, temperature, length and pH) | http://www.saps.org.uk/secondary/teaching-resources/235 investigating photosynthesis using algal balls (pH and colour) |
| use appropriate instrumentation to record quantitative measurements, such as a colorimeter or potometer | <p>http://www.nuffieldfoundation.org/practical-biology/measuring-rate-water-uptake-plant-shoot-using-potometer using a potometer</p> <p>http://www.saps.org.uk/secondary/teaching-resources/1263 a simpler set of potometer apparatus</p> <p>http://www.nuffieldfoundation.org/practical-biology/quantitative-food-test-protein-content-powdered-milk establishing the quantity of protein in powdered milk – can use a colorimeter in this practical</p> <p>http://www.nuffieldfoundation.org/practical-biology/investigating-effect-temperature-plant-cell-membranes effect of temperature on plant cell membranes (can use colorimeter)</p> <p>http://www.saps.org.uk/secondary/teaching-resources/235 and http://www.saps.org.uk/secondary/teaching-resources/1224 investigating photosynthesis using algal balls (can use a colorimeter)</p> |
| use laboratory glassware apparatus for a variety of experimental techniques to include serial dilutions | |
| use of light microscope at high power and low power, including use of a graticule | <p>http://www.nuffieldfoundation.org/practical-biology/investigating-mitosis-allium-root-tip-squash mitosis in a root tip squash</p> <p>http://www.nuffieldfoundation.org/practical-biology/preparing-anther-squash meiosis in an anther squash</p> <p>http://www.saps.org.uk/secondary/teaching-resources/770-microscopy-looking-at-xylem-and-specialised-cells xylem cells, trichomes</p> |

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| | <p>http://www.saps.org.uk/secondary/teaching-resources/1325 preparing a temporary slide to show and measure phloem and xylem</p> |
| produce scientific drawing from observation with annotations | <p>http://www.nuffieldfoundation.org/practical-biology/investigating-mitosis-allium-root-tip-squash mitosis in a root tip squash</p> <p>http://www.nuffieldfoundation.org/practical-biology/preparing-anther-squash meiosis in an anther squash</p> <p>http://www.nuffieldfoundation.org/practical-biology/comparing-flower-structure-different-angiosperms dissection and comparison of different flower structures</p> <p>http://www.saps.org.uk/secondary/teaching-resources/770-microscopy-looking-at-xylem-and-specialised-cells xylem cells, trichomes</p> <p>http://www.saps.org.uk/secondary/teaching-resources/1325 phloem and xylem</p> |
| use qualitative reagents to identify biological molecules | <p>http://www.nuffieldfoundation.org/practical-biology/quantitative-food-test-protein-content-powdered-milk establishing the quantity of protein in powdered milk – can use a colorimeter in this practical</p> |
| separate biological compounds using thin layer/paper chromatography or electrophoresis | <p>http://www.saps.org.uk/secondary/teaching-resources/181 thin layer chromatography for photosynthetic pigments</p> |
| safely and ethically use organisms to measure: <ul style="list-style-type: none"> - plant or animal responses | <p>http://www.nuffieldfoundation.org/practical-biology/microscale-investigations-catalase-activity-plant-extracts catalase activity in plants</p> <p>http://www.nuffieldfoundation.org/practical-biology/how-do-plants-and-animals-change-environment-around-them#node-2978 investigating levels carbon dioxide produced by animals and plants in light and dark conditions</p> <p>http://www.nuffieldfoundation.org/practical-biology/investigating-response-worms-soil-improvers investigating the behaviour of animals to different soil conditions</p> |

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| <p>- physiological functions</p> | <p>http://www.nuffieldfoundation.org/practical-biology/using-choice-chamber-investigate-animal-responses-stimuli animals response to stimuli</p> <p>http://www.nuffieldfoundation.org/practical-biology/investigating-response-calliphora-larvae-light larvae response to light</p> <p>http://www.nuffieldfoundation.org/practical-biology/using-spirometer-investigate-human-lung-function using a spirometer to measure lung function</p> <p>http://www.nuffieldfoundation.org/practical-biology/investigating-factors-affecting-breathing-rate-locust investigating the factors that affect breathing rate</p> <p>http://www.nuffieldfoundation.org/practical-biology/investigating-factors-affecting-heart-rate-daphnia investigating factors that affect heart rate</p> <p>http://www.nuffieldfoundation.org/practical-biology/observing-effects-exercise-human-body effects of exercise on humans</p> <p>http://www.getinthezone.org.uk/ Practical activities (kits were delivered to free to all schools in 2012) with link to online database for analysis</p> |
| <p>use microbiological aseptic techniques, including the use of agar plates and broth</p> | <p>http://www.nuffieldfoundation.org/practical-biology/aseptic-techniques standard practice for aseptic techniques</p> <p>http://www.nuffieldfoundation.org/practical-biology/incubating-and-viewing-plates standard practice for viewing and incubating agar plates</p> <p>http://www.nuffieldfoundation.org/practical-biology/making-nutrient-agars making up nutrient agars</p> <p>http://www.nuffieldfoundation.org/practical-biology/pouring-agar-plate how to pour agar plates</p> |

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| <p>safely use instruments for dissection of an animal organ, or plant organ</p> | <p>http://www.nuffieldfoundation.org/practical-biology/looking-heart heart dissection, looking at structure of organs</p> <p>http://www.nuffieldfoundation.org/practical-biology/dissecting-lungs lung dissection tissue and organ structure</p> <p>http://www.nuffieldfoundation.org/practical-biology/comparing-flower-structure-different-angiosperms dissection and comparison of different flower structures</p> <p>http://www.saps.org.uk/secondary/teaching-resources/1325-a-level-set-practicals-dissection-and-microscopy-of-a-plant-stem dissection of plants</p> |
| <p>use sampling techniques in fieldwork</p> | <p>http://www.nuffieldfoundation.org/practical-biology/observing-patterns-distribution-simple-plant patterns in plant distribution</p> <p>http://www.nuffieldfoundation.org/practical-biology/biodiversity-your-backyard using quadrats to measure biodiversity</p> <p>http://www.biology-fieldwork.org/woodland/woodland-plants/fieldwork-collecting-vegetation-data.aspx Sampling strategies and use of quadrats for sampling ground vegetation in woodlands</p> <p>http://www.biology-fieldwork.org/woodland/woodland-invertebrates/fieldwork-sampling-woodland-invertebrates.aspx Sampling strategies and capture techniques for sampling woodland invertebrates.</p> <p>http://www.biology-fieldwork.org/woodland/woodland-invertebrates/investigation-sampling-snail-populations.aspx Use of mark-release-recapture and Lincoln Index for estimating the size of populations</p> <p>http://bigpictureeducation.com/video-whats-buttercup Wellcome Trust video and accompanying data for field work</p> <p>http://bigpictureeducation.com/animation-surveying-populations Animation shows sampling methods in different environments</p> |

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| | <p>http://www.saps.org.uk/secondary/teaching-resources/258 http://www.saps.org.uk/secondary/teaching-resources/127 http://www.saps.org.uk/secondary/teaching-resources/768 online activities to practice sampling techniques before you get into the field, looking at measuring abundance, random sampling and distribution of a species across a footpath</p> |
| use ICT such as computer modelling, or data logger to collect data, or use software to process data | <p>http://www.dnadarwin.org/ explore the molecular evidence for evolution through practical bioinformatics activities that use data analysis tools and molecular data.</p> |

Additional links to teaching resources

Society of Biology www.societyofbiology.org

Society of Biology and Nuffield Resource <http://www.nuffieldfoundation.org/practical-biology>

Field Studies Council <http://www.biology-fieldwork.org/>

British Ecological Society <http://www.britishecologicalsociety.org/education/>

Biochemical Society <http://www.biochemistry.org/Education/Teachers.aspx> and www.sciberbrain.org and http://www.biochemistry.org/Portals/0/Education/Docs/Biochem_Booklet_web.pdf

Science and Plants for Schools <http://www.saps.org.uk> and

<http://www.saps.org.uk/secondary/teaching-resources/1304-a-level-set-practicals> (a collection of new practical resources to support the practical endorsement)

Society for General Microbiology <http://www.sgm.ac.uk> and <http://www.microbiologyonline.org.uk>

Wellcome Trust www.wellcome.ac.uk/education

Resources contributed by:

