Free online teaching materials

It can be difficult and time consuming to develop materials for really good science lessons. Many scientific research organisations, however, provide teaching resources, often designed together with teachers. Researchers provide scientific expertise and the teachers bring years of experience in the classroom.

These materials include pictures and videos as well as ideas for scientific experiments in the classroom. Some institutes even develop computer games for an interactive learning process. **Sabrina Graß** from the European Molecular Biology Laboratory reviews some online materials to help you to enliven your lessons and excite students about science.

Resources in English

The Association for Science Education

www.schoolscience.co.uk

The UK's Association for Science Education provides many online teaching resources and links covering all science subjects and all student age groups. The interactive resources provide information and brief online tests on topics as diverse as Viagra®, the Periodic Table, and the Big Bang.

Biotechnology and Biological Sciences Research Council

www.bbsrc.ac.uk/society/engagement/schools/resources/Welcome.html

These teaching materials for primary and secondary schools may be viewed online, downloaded or ordered. They include interactive presentations, information sheets, online exhibitions and materials for running workshops. Topics covered include the structure of DNA, biodiversity, physiology, animal welfare, plants, agriculture, food biotechnology, spiders and genetics.

Cancer Research UK

www.cancerlessonplans.org.uk

These online lesson plans address the biology of cancer, ethical issues surrounding the use of human tissues in research, how to lead a healthy life, and the role of viruses in cancer and the possible impacts of a vaccine for cervical cancer. The lesson plans are tailored to the English key stage 4 (ages 14-16) curriculum, but elements could be adapted by teachers in other European countries.

CERN (English, French, German and Italian)

http://public.web.cern.ch/Public/Content/Chapters/Education/OnlineResources/OnlineResources-en.html

CERN, the world's largest particle physics laboratory, provides online lectures, games, demonstrations of experiments to do in the classroom, movies, pictures, posters, and presentations about high-energy physics. Topics include particle physics, antimatter and special relativity as well as the functioning of bubble chambers and technological applications of CERN's research. The games about CERN's Large Hadron Collider and the microcosm are available in English, French, German and Italian.

Cold Spring Harbor Laboratory

www.dnai.org

Teaching materials on the *DNA interactive* website include interactive applications, information modules, lesson plans and student worksheets. All materials relate to DNA, but cover subjects as varied as the Romanov family, DNA fingerprinting in human identification, genes and medicine, and human origins. The accompanying DVD can be purchased online.

The DNA interactive DVD was reviewed in Issue 1 of Science in School: www.scienceinschool.org/2006/issue1/dnainteractive

European Fusion Development Agreement (EFDA) and ITER

www.efda.org, www.iter.org and www.jet.efda.org

The websites of EFDA, JET (the world's largest nuclear fusion research facility), and ITER (its successor) answer many common questions about fusion. Teachers can download or order free booklets, articles, pictures, movies and interactive modules to support their lessons.

European Initiative for Biotechnology Education (German, English, French, Italian, Dutch, Estonian)

www.eibe.info

The European Initiative for Biotechnology Education, now finished, generated teaching materials for 16- to 19-year-old school students. Among the many topics are transgenic animals and plants, immunology, and the production of biscuits. The material consists of experimental protocols, practical activities, role plays, information and debates designed for immediate classroom use. Some of the material is rather out of date.

European Learning Laboratory for the Life Sciences

www.embl.de/ells

Based at the European Molecular Biology Laboratory, the European Learning Laboratory for the Life Sciences brings secondary-school teachers together with scientists in a research environment. The teaching material that they develop together is available online and includes a stem-cell game, a virtual microarray, a bioinformatics activity, and a role play about genetic testing.

European Organisation for Astronomical Research in the Southern Hemisphere (ESO) / European Association for Astronomy Education (EAAE)

www.eso.org/public/outreach/eduoff/info-solsys/

Designed for astronomy teachers and students, the *Journey across the Solar System* information sheets use diagrams, images and texts to explain the main facts about the Solar System, the Sun, planets, moons, asteroids and comets.

Astronomy Exercises: www.astroex.org

Together with the European Space Agency (ESA), ESO has also developed a series of astronomy exercises for secondary schools. They can be downloaded or ordered online.

European Space Agency (ESA)

ESA Kids (German, English, Spanish, French, Italian, Dutch): www.esa.int/esaKIDSen/

Aimed at children in primary and lower secondary school, the ESA Kids website includes information about space and ESA's activities, quizzes, competitions, and instructions for building space models.

Instructions for building yet more models – this time of ESA spacecraft – can be downloaded here: http://sci.esa.int/science-e/www/object/index.cfm?fobjectid=35013

ESA Education (English and other European languages): www.esa.int/esaED and www.esa.int/esaHS/education.html

ESA provides a range of online materials for primary and secondary school, developed in collaboration with teachers. Including lesson plans, facts sheets, ideas for projects, satellite images, animations, analytical software, movies, exercises, games, quizzes and cartoons, they can be used to enliven geography, biology, physics, chemistry and mathematics lessons.

Some topics covered are Earth observation (water, volcanoes, atmospheric pollution, satellites, major disasters, weather and agriculture), the Universe and our Solar System, and humans in space (the International Space station, Newton in space and human physiology).

Howard Hughes Medical Institute (HHMI)

www.hhmi.org/biointeractive/

To support biology teachers, the HHMI has developed *Biointeractive*, an extensive website with animations, slide shows, videos and lectures by leading research scientists. The lectures can be downloaded as podcasts or ordered on DVD, and are supported by lesson plans and activities for the classroom – all developed together with secondary-school teachers. Online slide shows cover evolution and medicine, RNA interference, human origins and many other topics. Also online are interactive biomedical laboratory simulations including a bacterial identification lab, a cardiology lab and a neurophysiology lab.

Institute of Physics

www.iop.org/activity/education

The UK's Institute of Physics (IOP) provides online ideas and resources for teaching advanced physics to students aged 16-19. For younger students, there are interactive games (SimPhysics), with advice for teachers on how to use the games in lessons. Readers can also order a series of CD-ROMs to support non-specialists who teach physics to 11- to 14-year-olds (note that these materials are not free of charge).

The IOP also (co-)produces several other good websites:

- physics.org, with online games and physics experiments, career information and much more: www.physics.org
- Practical Physics, for physics teachers to share their skills and experience of making experiments work in the classroom: www.practicalphysics.org
- The Joint Earth Science Education Initiative supports non-specialists teachers of earth sciences by providing classroom resources for students aged 11-16. Instructions for practical experiments, teachers' notes, student materials and video clips can all be downloaded. See www.esta-uk.org/jesei/
- Secondary Online Science provides online games together with suggestions for incorporating the games into science lessons for 11- to 14-year-olds.

Montana State University

http://btc.montana.edu/ceres/

Scientists from Montana State University have worked with secondary-school teachers to create a library of online and interactive education materials for teaching astronomy. These web-based lessons incorporate online NASA resources, data and images.

National Aeronautics and Space Administration (NASA)

NASA Education: http://education.nasa.gov

The US National Aeronautics and Space Administration provides educational material for all student ages and a broad range of subjects: earth science, history, life science, mathematics, physical science and space science, technology and engineering. Materials include podcasts, videos, classroom activities, posters, pictures, puzzles and instructions for building models of space shuttles and gliders. The materials can be browsed by student age or science subject.

NASA Space Place (English and Spanish): http://spaceplace.nasa.gov/en/kids/

For primary-school children, this website offers online games, animations and facts about space. The 'teacher's corner' includes ideas for classroom activities, podcasts, posters and high-resolution images.

National Human Genome Research Institute

www.genome.gov/Education/

This website provides materials for secondary-school teachers in the form of videos, animations, articles, classroom activities, lesson plans and games about the genome and the Human Genome Project.

An online education kit, *Understanding the Human Genome Project*, examines genetic variation and what it means to be a human, how a genome is sequenced, the ethical implications of the Human Genome Project, and much more. There is also a detailed guide to using the website *DNA from the Beginning*: www.dnaftb.org

Science in Public Areas (English, French, German, Italian, Spanish, Portuguese, Arabic, Chinese and Bulgarian)

www.scienceinpublicareas.org

Why is the sky blue? Why does the setting Sun appear to be red? The European Physical Society asks 50 questions related to physics and relevant to everyday situations. The online answers are short, informative and scientifically correct and therefore suitable for children in both primary and secondary schools. The website can be used as it is, or posters with the questions and answers on can be ordered online.

Science Learning Centres

www.sciencelearningcentres.org.uk

The Science Learning Centres not only offer many courses for UK teachers, they also provide nearly 500 teaching resources on topics as diverse as biology, chemistry, ethics, earth science, ICT, general science, physics and psychology. Resources are available for all ages of school students, and include podcasts, teaching ideas, websites with background information, and films. You need to register to download the resources, but registration is free of charge.

Science on Stage

www.esa.int/SPECIALS/Science_on_Stage or www.scienceonstage.net

In a series of national events culminating in an international science teaching festival, Science on Stage offers European teachers the chance to exchange successful and innovative teaching methods and materials. Details of many of the best teaching ideas presented at the festivals - covering all areas of science – can be downloaded or viewed online.

Seeing Science

www.seeingscience.cclrc.ac.uk

This website, by the UK's Science and Technology Facilities Council, provides interactive resources to support science teaching at key stage 3 (11- to 14-year-olds) and key stage 4 (14- to 16-year-olds). They include teachers' notes (with links to original research), lesson plans, student worksheets, video clips, animations and images. Topics include anthrax, the history of astronomy, nanotechnology, chocolate manufacture and nuclear radiation. A supporting CD-ROM can be ordered online free of charge.

Resources in German

Deutsches Elektronen Synchrotron (DESY)

KworkQuark: www.kworkquark.net

DESY's KworkQuark portal explains research topics in particle physics with aid of information pages, an online encyclopaedia and games.

Media catalogue for physics teachers:

http://zms.desy.de/arbeiten__lernen/schueler__lehrer/medienkatalog/index_ger.html

From the *Medienkatalog für Physiklehrer*, you can download overhead transparencies about particle physics, particle accelerators, photon research and other topics.

Deutsches Zentrum für Luft- und Raumfahrt (German and English)

www.dlr.de/Desktopdefault.aspx/tabid-634/1061_read-1451/

The German Aerospace Centre *School Information on Space* booklets are aimed at students and teachers in primary and secondary schools. Topics covered include 'the dream of flights', German astronauts and the Solar System. The booklets can be downloaded or ordered online. English equivalents of the materials are available on the ESA Education website, see page 69.

European Particle Physics Outreach Group (German)
http://www.teilchenphysik.org/schulmaterial.htm

The teaching material *Teilchenphysik in der Schule* provides interactive animations, quizzes, videos, experiments and lessons for secondary-school teachers on physics topics such as particle physics, radioactivity and matter.

Helmholtz Gemeinschaft

www.helmholtz-campus.de

From the 'student campus' (*Schülercampus*), you can download games about scientific topics, including magnetism, glaciers, radiation, the nervous system, fusion energy, volcanoes, bacteria and virtual scientific laboratories.

The brochure *Involvement in Helmholz School Laboratories* (*Broschüre zur Machmit-Aktion der Helmholtz-Schülerlabore*) describes some scientific experiments to carry out with easily obtainable resources, for example how to measure acidity using red cabbage or how to build a thermometer. The brochure can be downloaded or ordered online.

The Helmholtz Gemeinschaft consists of several research institutes working in different scientific fields. Some of these research institutes provide their own additional teaching material. See www.helmholtz.de/de/Allgemeines/Zielgruppen/Schueler_und_Lehrer/Ergaenzende_Angebote_fuer_Lehrer_und_Schueler.html

Examples include:

- The National Research Centre for Environment and Health (*GSF-Forschungszentrum für Umwelt und Gesundheit*), which organises a 'transparent laboratory' (*Gläsernes Labor*) offering laboratory courses for school students. The protocols of some of the experiments carried out can be downloaded online: www.gsf.de/neu/gsf-lab/experimente.php
- The German National Research Centre for Geosciences (*GeoForschungsZentrum*), which provides teaching material in the form of overhead transparencies, texts and flyers. See http://schule.gfz-potsdam.de
- The Hahn-Meitner-Institute provides online resources to support the teaching of materials science in secondary schools. Topics include cryomagnets, neutrons and solar panels. See www.hmi.de/bereiche/info/index.html

Max Planck Gesellschaft

The Max Planck Society provides three German-language publications (Biomax, Techmax and Geomax) that present recent science findings in an understandable manner, and link them to the senior secondary-school curriculum. They can be downloaded or ordered online, and additional materials for teachers are available here: www.max-wissen.de

Resources in French

Palais de la Découverte

www.palais-decouverte.fr

The Palais de la Découverte is a science museum which provides online teaching materials.

Centre National de la Recherche Scientifique

www2.cnrs.fr/multimedia

The Centre National de la Recherche Scientifique (National Centre for Scientific Research; CNRS) is a research centre which provides online teaching materials.

Why not tell other readers about your own favourite online teaching resources via the new *Science in School* online discussion forum: www.scienceinschool.org/forum

To suggest other types of websites that you would like us to review, email editor@scienceinschool.org. In the subject field of the email, please include the text 'Website review'.