

Now, where did we lose Kingdom Fungi ...?



The one place it's difficult to find fungi is in the National Curriculum (NC). Although we're surrounded by, and dependent on, fungi every hour of every day of our lives, the Qualifications and Curriculum Authority (QCA) doesn't seem to know they exist. The word 'fungus' does not appear in the 87-page NC Programme of Study for Science, which is the statutory instrument that defines the curriculum for Key Stages 1-4 (ages 5 to 16)(1999), and the same applies to the revised 2006 curriculum. But it's not just the case that the NC ignores fungi; rather they seem to be actively excluded right across the age range.

The ignorance starts at Key Stage 1, which instructs that "...Pupils should be taught...to relate life processes to animals and plants found in the local environment." Continues to KS2: "Pupils should be taught...to make links between life processes in familiar animals and plants and the environments in which they are found." At KS3, teachers are instructed, under 'Cells and cell functions' to teach "...that animal and plant cells can form tissues, and tissues can form organs... and ... the functions of chloroplasts and cell walls in plant cells and the functions of the cell membrane, cytoplasm and nucleus in both plant and animal..." And so it goes on into KS4 and towards GCSE; the National Curriculum instructs that in Double Science (GCSE examinations taken by over one million pupils in 2004), "... Pupils should be taught: (a) about similarities and differences in structure between plant and animal cells; ... [and] ... (c) to relate ways in which animals and plants function as organisms to cell structure and activity."

The closest we get to fungi is in instructions that pupils should be taught "that micro-organisms ...are often too small to be seen, and that they may be beneficial [for example, in the breakdown of waste, in making bread] or harmful [for example, in causing disease, in causing food to go mouldy]..." (KS2 'Micro-organisms'). In later years we find, at best, the same old stories about yeast fermentations (bread and alcohol) and the discovery of penicillin. Admittedly, these are important aspects of fungal biotechnology, but penicillin was discovered in 1928 and indus-

trialised in the mid-1940s. How many other aspects of the Science curriculum are so firmly embedded in what must be seen as 'the distant past' by the pupils?

The fact that fungi are not plants, not animals, and not bacteria, is not even mentioned in current GCSE specifications. Instead, the National Curriculum persists with comparisons between animals with plants, and by so doing fails to show the pupils that fungi have their own unique cell biology, their own unique developmental biology, their own unique life style, and a crucial place in every ecosystem and in every food web on this planet.

Despite the NC, though, with a little bit of thought, fungi can be used for teaching many areas of the current curriculum specifications and in cross-curricular activities. Fungi are not just mushrooms, yeast and moulds.

Fungi digest the grass eaten by cows (and all other herbivores) and by so doing indirectly provide the milk for our breakfast and the steak for dinner.

Fungi make plant roots work (more than 95% of all terrestrial plants depend on mycorrhizal fungi) and, even leaving aside the effect of this (and the lichen symbiosis) on the evolution of terrestrial flora, by so doing mycorrhizal fungi help today to provide the corn for our cornflakes, as well as every other crop plant, and even oxygen for our daily breath.

The fungal life style is to secrete enzymes into the environment to digest nutrients externally; and we harness this feature in our biotechnology to produce enzymes to start our cheese-making, clarify fruit juices, and even distress denim for 'stone washed' jeans, as well as, conversely, providing conditioners to repair day-to-day damage to our fabrics in the weekly wash.

Fungi also produce a range of compounds to compete with other organisms in their ecosystem; when we harness these for our own purposes we create products like cyclosporin, which prevents organ rejection by suppressing the immune response in transplant pa-



tients, the statins, which keep so many people alive these days by controlling cholesterol levels, and even today's most widely used agricultural fungicides, the strobilurins.

The British Mycological Society has recently published a range of teaching resources, including:

an integrated set of class sheets, quizzes and question sheets dealing with cells and cell biology, which ensure proper representation of both yeast and filamentous fungus.

a series of five ready-made KS4 lessons comprising an introductory *Welcome to the World of Fungi*, *Reproduction and Conservation*, *Favourite or Nastiest Fungus*, *Fungi and Industry* and *Fungi and Disease*. All of these lesson packages include class sheets for pupil and teacher, the latter including references to supplementary materials carefully chosen from articles previously published in British Mycological Society publications.

an integrated series of class sheets that describe 15 different 'What's your favourite fungus?' stories from which the pupils extract important points, a pack of playing cards that mirror the class sheets and can be used to play a variety of games (and all the time the players are holding cards that each carry a different 'fungal fact'), and a 'name-game' starter exercise.

These materials have all been classroom tested with groups of pupils ranging from year 8 through to year 11 and were all well received by the pupils and successfully increased their knowledge base. These resources, and the experience we have had with them, show that pupil understanding and pupil awareness of fungi can be improved with as little as one to five hours of 'fungus-oriented' lessons.

The resources are highly adaptable, allowing the teacher to include parts of them in other lessons. They can be mixed in a variety of ways and also work well as resources for plenary events or when used for the 'theoretical' background for a workshop featuring some practical activity (school foray, food science investigation, industrial visit, etc.).

The Key Stage 4 resources have been printed as a package that is available for distribution (free) from David Moore (address below), and all work-sheets and classroom materials (ranging in suitability from primary to post-16) can be downloaded (free) from the British Mycological Society website at

<http://www.fungi4schools.org/>.

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Useful Web Addresses

<http://fungi.fvlmedia.dk/> This is one for the teachers and all those Interactive Whiteboard/PowerPoint presentations. This site can give you any image you might ever need of fungi. Photographs are arranged by scientific names and images are good quality even if you do need to have at least some basic knowledge of common names

<http://www.myfg.org.uk/fungus.htm>. The Mid Yorkshire Fungus Group has an interactive and fun site with games and quizzes. You can get in a little cross curricular benefit with the fungi in literature page, use the body parts section to help your students identify fungal structures and test yourself on basic fungi facts. The site is easy to use and navigate. There is enough on the site to keep most students entertained for a good half hour.

<http://www.doctorfungus.org/> This site will allow your students to read up on all the possible fungi diseases they may have. It's site aimed primarily at older students although some aspects are generally useful.



Starters and Plenaries:

The Fungi Name Game

Instructions

The object of this activity is to pick the true names from the fake fungal names. Students are encouraged to shout out names to find the real names, which form a path of touching squares from the top of the grid to the bottom.

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|---------------------------|---------------------------------|----------------------------------|---------------------------------------|----------------------------|
| COFFEE HUMP | EARPICK FUNGUS | DINGY TWIGLET | BUBBLE PUFF | HAIRY STINKWEED |
| WASP CRABTREE | TURTLE TRUFFLE | PLUMS AND CUSTARD | SQUARE PORE | WAXY SHEEP |
| DEADLY SPIDER | SILKY PIGGYBACK | TURKEY TAIL | WITCHES' BUTTER | SMOOTH TALON |
| DOUBLE JEWEL | LEMON DISCO | FLUTTER DEVIL | SLIMY DONKEY | BOOTY MOULD |
| MOTTLED FAIRY | FROSTY FUNNEL | LAWYER'S WIG | DRUMSTICK TRUFFLE CLUB | BLUELEG BROWNIE |
| PEACOCK OYSTER | CHALK AND CHEESE | RABBITS TAIL | MOUSEPEE PINKGILL | CHERRY BONNET |

This activity is provided courtesy of Stephanie Roberts, David Moore and the British Mycological Society. A full lesson plan and worksheets are available through the website www.fungi4schools.org.

Answers: available from www.fungi4schools.org