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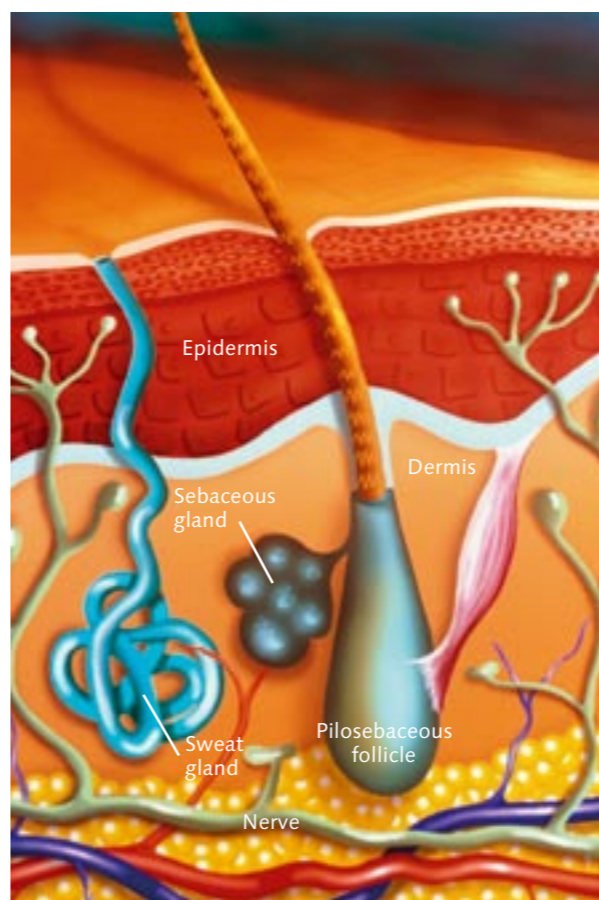
In recent months science teacher Gemma Sims has been working at the SGM to produce multimedia microbiology resources for the new Biology A-levels coming on stream in England and Wales this September. Most of her efforts have been devoted to explaining the microbial science that students will need to understand to follow the courses, but the resource also aims to have 'added value' and put microbes into the context of real life. Further information about the whole teaching pack will be available in the May issue of *Microbiology Today*.

The following article is a taster for a resource we are developing for Key Stage 4 and 5 Personal, Social Health and Economic Education (PSHE). 'What your mum might not know and probably hasn't told you' will deal with some of the health issues that affect teenagers.

Microbes and puberty: a teenager's guide

Being a teenager can be so horrible that many adults (especially teachers and parents) have wiped its ghastly memories from their minds. It is easy to feel lonely and isolated, but don't worry, you are not alone: there are over 10 times the numbers of microbes living in and on you than there are human cells in your body. You are home to a complex community of bugs such as bacteria, viruses,

fungi and protozoa. They live in your gut, mouth, skin, vagina, upper respiratory tract and urethra, and each of us has our own unique collection. They help digestion, synthesize vitamins, boost immunity and occupy niches that would otherwise be filled by pathogens. Puberty is a time of change, both physically and emotionally, and this affects your microbes too...



◀ Artwork of a cross-section through human skin. BSIP Estiot / Science Photo Library

Second, pilosebaceous follicles (each containing a sebaceous gland and a single hair) become blocked, often due to the over-proliferation of skin cells called keratinocytes. Sebum and bacteria become trapped in the follicle and the bacteria cause an inflammatory immune response, resulting in a spot.

We all produce sebum and have bacteria on our skin, so why are some people more prone to acne than others? The answer is not clear, but influential factors may include genetics (something you can blame your parents for), hormones (girls often find it is linked to their periods) and stress.

The good news is that acne is treatable and usually goes away in time (only 10% of acne sufferers still have it after the age of 25). Ask your pharmacist about an effective over-the-counter cream called benzoyl peroxide and, if this does not help, your doctor can prescribe a variety of suitable medications.

The skin

Acne

The skin is home to 10^{12} bacterial cells, the most common being *Propionibacterium acnes*. Just before puberty your body starts to release sex hormones. One of their effects is to stimulate the production of an oily substance called sebum from sebaceous glands below the surface of the skin. In some people this can lead to the most common skin disease: acne. Adults may tease you about your zits, but acne is no laughing matter. 80% of adolescents suffer from it and it can cause scarring and serious emotional distress. Inflammatory acne, with its unsightly pustules is by far the worse type.

But what causes it?

Three factors conspire: first, there is an over-production of sebum.

Acne myths

- Acne is not caused by poor hygiene ('blackheads' contain the pigment melanin, not dirt).
- Acne is not linked to any specific foods, e.g. chocolate.
- Wearing makeup is OK (and is sometimes necessary for your self confidence), but make sure you use non-greasy ('non-comedonal') products and that you remove it fully.

To squeeze or not to squeeze?

If there is an obvious white 'head' that resembles an erupting volcano then a gentle squeeze is fine. But remember, your hands can be a source of infection (wash them first) and incorrect squeezing can push the sebum further into the follicles, exacerbating the inflammation and leaving a scar.

Body odour

During puberty hair starts to grow in your armpits and, as if this isn't bad enough, body odours start wafting around. BO is caused by volatile waste products released by bacteria such as *Corynebacterium jeikeium* that feed off the dead cells, sebum and sweat that stick to the skin and hairs. The problem can easily be alleviated by daily washing and the use of deodorants (which are often antibacterial).

Fungi

Fungi can also colonize the skin, generally causing no harm, but some species can cause infections such as 'athlete's foot'. This can cause itchy and cracked skin, but can easily be treated with an antifungal cream. The fungi are spread by direct contact and they particularly like the warm, moist, sweaty bits between your toes, so make sure you dry them thoroughly, wear clean socks and avoid sharing towels. The fungus *Malassezia globosa* lives on the scalp and can cause dandruff, but don't worry, an antifungal shampoo will soon clear it up. Ask your pharmacist for advice about suitable products.

The vagina

Before puberty the vagina is alkaline and contains bacteria such as enterococci and coliforms, but during puberty the environment of the vagina changes. Secretions of sticky mucus encourage the growth of the bacterium *Lactobacillus acidophilus* which feeds on glycogen and produces acidic waste. This results in a vaginal pH of 4 which deters other bugs, but if the natural flora of the vagina is disrupted (e.g. after taking antibiotics), less welcome visitors can thrive. Vaginal thrush, for example, is caused by the fungus *Candida albicans*. Symptoms include a burning or itching sensation and a

thick yellowy-white discharge. It is extremely common (75 % of women get it) and it can be easily treated by over-the-counter antifungal drugs. The volume and consistency of mucus changes throughout the menstrual cycle, and each woman is different. If you notice secretions which are different for you, especially if they are accompanied by an unpleasant odour, itchiness or pain, then see your doctor immediately. These could be symptoms of thrush, bacterial vaginosis, a sexually transmitted infection or a forgotten tampon (yes, it does happen!).

The urinary tract

The urethra (the tube that carries urine from the bladder) contains bacteria such as staphylococci, enterococci and corynebacteria. Sometimes other bacteria invade, causing the condition cystitis (urethritis). Sorry girls, but you are more likely to suffer than males. Women have a shorter urethra and because its opening is close to the anus it is easily infected by faecal bacteria. To put it bluntly, the symptoms feel like you are weeing concentrated sulfuric acid while a herd of elephants tap dance on your



bladder. You also need to urinate frequently (but not much comes out), your urine may be dark or bloody and you could have a fever and pain in your lower back or pelvis. The immune system usually clears the infection, but your pharmacist can give you medication to ease the symptoms and drinking cranberry juice really does work (there is evidence that it prevents bacteria sticking to the walls of the urethra). If it is your first attack of cystitis or if symptoms last more than 3 days, you must see your doctor. If not treated the infection could move up to the bladder or kidneys.

Preventing cystitis

Girls

- After a poo, wipe from front to back (to avoid spreading faecal bacteria);
- Don't let yourself become dehydrated – drink 2 litres of water per day;
- Avoid perfumed hygiene products that can irritate the urethra;
- Urinate after sex (as soon as is polite!) to 'flush out' any bacteria.

Boys

- You can get cystitis too, but it is less common. It could be linked to dehydration or a problem with the urinary system. Go to the doctor!

Conclusion

Despite the fact that your microbes can cause embarrassing and irritating conditions, most of the time their presence is beneficial. If you are concerned about any health matter, don't suffer in silence and hope it will go away: talk to someone! Your GP, pharmacist or school nurse will know what to do and the links on the right may be useful.

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▲ The thrush fungus, *Candida albicans*.
Eye of Science / Science Photo Library

◀ False-coloured transmission electron micrograph of *Escherichia coli*. Dr Linda Stannard, UCT / Science Photo Library

Taking it further

Eady, A. & Bojar, R. (2001). Spotting the onset of puberty – the secret's in the skin. *Microbiology Today* 28, 178–181. (www.sgm.ac.uk/pubs/micro_today/pdf/110104.pdf)

Spinney, L. (2007). Bugs R Us. *New Scientist* 2617, 34–38.

Websites

General health:
www.nhsdirect.nhs.uk
www.embarrassingproblems.co.uk

Acne:
www.stopspots.org

Cystitis and urinary problems:
www.cobfoundation.org

Sex and sexual health:
www.brook.org.uk
www.ruthinking.co.uk
www.mariestopes.org.uk

Summer in the city

To foster the interest of young people in science and to encourage their study of microbiology, 15 talented A-level students were invited to take part in a three-week Summer School at The University of Manchester. **Sue Crosthwaite** describes the event.

Students investigated the 'one gene–one enzyme' model organism *Neurospora crassa*, a key eukaryotic microbe that plays an important role in elucidating gene function. By monitoring and recording the growth, morphology and colouration of 100 *Neurospora* strains for which genes of unknown function are deleted, the students contributed to a community effort that aims to characterize phenotypically all available *Neurospora* knockout strains. Excitement grew when several of the strains displayed interesting and unexpected phenotypes. The students captured images of the colonies as well as high magnification pictures of the hyphae, which occasionally revealed stunning changes in morphology. All the data were uploaded to The BROAD Institute database, from where they now can be accessed worldwide.

The practical work was accompanied by lectures on various topics revolving around fungal biology. Dr Geoff Robson (Manchester) introduced the students to the use of microbes in biotechnology and showed some

astonishing pictures of enormous fermenters in which *Aspergillus niger* is grown for the production of citric acid. This was followed by a memorable talk given by Dr Christian Heintzen (Manchester) centred around the use of model organisms in basic research, in particular the use of *Neurospora* for the study of circadian clocks. A highlight was a visit from Professor Nick Read (Edinburgh) whose presentation on *The Dynamic Hypha* included some stunning movies of modern molecular imaging techniques and the use of laser tweezers in the study of cell–cell communication.

Dr Jayne Brookman's *Bioscience for Business* talk on fungal disease, which incorporated some particularly unsavoury images of the symptoms of fungal infections, was especially well-received! The lectures concluded with a talk from Dr Eileen Paul (Northbank Communications) on the role communicating science to different sectors of society can play in promoting the success of biotechnology and life-science-based industries.

Judged by the students' comments and from the highly reproducible data obtained during the 3 weeks, the summer school was a great success. The young scientists enjoyed learning about fungi, carrying out a project that would help and inform other scientists and, perhaps most importantly, meeting like-minded students. To keep their interest burning, the SGM sent each of the students an information pack on careers in microbiology, and a copy of the latest issue of *Microbiology Today*.

The project was supported by the National Institute of General Medical Sciences (USA), Leica Microsystems UK Ltd and The University of Manchester.

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In brief

Education Show

Birmingham NEC, 28 February–1 March 2008

SGM will be showcasing some new resources at the Education Show this year. Representatives from member schools must be sure to visit Stand U29, where a warm welcome will await. There will be something for everyone, with a completely new version of *The World of Microbes* for KS 2 and 3 available to take away and demonstrations of the multimedia A-level microbiology teaching pack. To register for the event, see www.education-show.com

Science in School

The latest issue of this quarterly European magazine, supported by the EU, is now available.

It is published by EIROforum and based at the European Molecular Biology Laboratory in Heidelberg. The content includes teaching materials, cutting-edge science, education projects, interviews with scientists, resource reviews and much more. The print version is in English, but multilingual versions are available online. Subscriptions are free at www.scienceinschool.org