

Biotechnology

Spot the single bacterium

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Xiaojun Zhao and colleagues have devised a rapid detection system that can spot a single bacterium lurking in a sample. The system, which uses ‘nanoparticles’ loaded with fluorescent dye, produces a result within 20 minutes and could be used to check food and drinking water, make medical diagnoses, and combat bioterrorism.

The system is faster than other bacterial sensors because the particles contain thousands of dye molecules, for identifying bacteria through signal amplification, as opposed to the handful used in previous systems, say the authors. The particles are attached to specific antibodies that latch on to a target bacterium, producing a glow that can be seen under the microscope without the need to further amplify the signal.

Zhao and co-workers tested their design by spiking hamburger meat with the *Escherichia coli* strain O157:H7. As few as ten bacterial cells can cause illness, and this strain has caused several fatal outbreaks in Britain and elsewhere in recent years. The researchers could identify just one or two bacteria in a beef sample. What’s more, by including a range of antibodies and dyes in the mix, they believe that the particles could be used to detect several different bacterial species in a single test.

Michael Hopkin

Cell biology

A question of size

Genes Dev. doi:10.1101/gad.1228804 (2004)

Biologists have long puzzled over how growing cells decide when they are big enough to divide. Paul Jorgensen *et al.* have found that, for budding yeast, this decision is heavily influenced by the rate of production of ribosomes — the cellular protein-making machines.

The authors had previously identified mutations in two genes, *SFP1* and *SCH9*, that cause cells to become particularly small. Now, Jorgensen *et al.* show that the *Sfp1* and *Sch9* proteins dictate the production of ribosomes. They find that concentrations of *Sch9* in the cell and the movement of *Sfp1* into the nucleus are tightly controlled by the quality of nutrients available to the cell. When concentrations of nutrients are high, *Sfp1* and *Sch9* are active and cells delay division until they have grown large and assembled a copious number of ribosomes. When nutrients are scarce, the activity of *Sfp1* and *Sch9* is low, causing the cell to compensate for the nutrient shortage by reducing the size and ribosome requirement for cell division.

Helen Pearson

Musical acoustics

Bach in tune with the times

J. Acoust. Soc. Am. **116**, 2416–2426 (2004)

You don’t need to retune your piano to play Bach properly. Even though the title of his *Well-Tempered Clavier* suggests that the pieces were written for the ‘well-tempered’ method of tuning commonly used during the Baroque period, Michael F. Page concludes that the ‘equal temperament’ tuning method used for keyboards today is quite suitable for performing these works.

There is no perfect way of tuning a piano so that all the consonant musical intervals in an octave correspond to simple frequency ratios, and various compromises have been adopted at different stages in the history of music. Equal temperament imposes a constant spacing between each half-tone of the musical scale. The Baroque era was a time of change and experimentation in tuning systems, and the system most appropriate to Bach’s ‘well-tempered’ pieces — perhaps the Werckmeister III tuning popular at the time — has been hotly contested.

Page now shows that, by taking into account not only the mathematical ‘purity’



of intervals but also human perceptual responses, equal temperament generally works better than three other historical systems, including Werckmeister III. When the analysis is applied specifically to three preludes from the *Well-Tempered Clavier*, weighting each interval by the number of times it appears, equal- and well-tempered methods both perform strongly.

Philip Ball

Developmental biology

Junk no more?

Dev. Cell **7**, 597–606 (2004)

More than one-third of the human genome, previously thought to be non-functional, may in fact help to regulate gene expression, according to a study of mouse eggs and early embryos.

Anne E. Peaston *et al.* analysed sections of DNA that, when expressed, can make copies of themselves and jump into different positions within the genome. These chunks of DNA, known as retrotransposons, have generally been considered to be ‘junk’ because they seem to have no specific function.

The authors found, however, that certain retrotransposon sequences are surprisingly highly expressed in mouse eggs or early embryos — and that retrotransposon expression drove the expression of many genes. This seems to occur because the retrotransposons contain promoter sequences, DNA sections that trigger gene expression. Thus, they may provide a source of promoters that enable particular genes to be expressed specifically in eggs and at early stages of development. By inserting copies of themselves back into the genome, the retrotransposons might also, the authors suggest, generate gene mutations that promote genetic diversity.

Peaston *et al.* think that retrotransposon activity during early mammalian development might help to ‘remodel’ the

genome as necessary — affecting, for instance, the way in which different stretches of DNA are packed.

Mark Peplow

Biomedical materials

Eyeball glue

J. Am. Chem. Soc. **126**, 12744–12745 (2004)

Cataract removal by surgery could be made much less traumatic if a glue is used to seal the wound, Michel Wathier *et al.* report. Currently, the incision made in the eye’s cornea to remove the clouded lens and replace it with a synthetic one is either sealed with nylon sutures or left to self-seal. Suturing can cause inflammation and other problems, and the stitches must subsequently be removed; self-sealing, meanwhile, runs the risk of fluid leakage from the eye and the development of infections.

The researchers have devised a biocompatible glue consisting of highly branched (dendritic) peptide molecules that can be chemically crosslinked at room temperature to form a viscoelastic, transparent hydrogel. Gelation occurs within minutes of mixing the peptide dendrimers and the crosslinking agents.

In tests on excised eyes, this type of repair prevented leakage of fluids pumped into the eye’s anterior chamber at pressures more than three times greater than those that caused leakage from sutured incisions, and more than ten times greater than the normal pressures experienced in the eye.

Philip Ball