OxyR: A molecular code for redox-related signalling
Sung Oog Kim *et al.*
Cell, 2002, **109**, 383–396.

OxyR, a transcriptional activator of *E. coli*, belongs to the LysR family of helix–turn–helix motif proteins. This protein can exist in oxidized or reduced form depending on the oxidative stress sensed by the bacterium. The experiments in this paper describe a systematic biochemical modification of the thiol groups to ascertain their critical roles in DNA binding and transcriptional activation. *In vitro* transcription and primer extension, in addition to gel mobility shift assays were utilized to map the functional activities of the protein. The post-translational modifications at the cysteine residues were determined with the help of MALDI–TOF mass spectrometer. Traditionally, redox regulation had been viewed as a two-state 'on–off' switch; this paper addresses the finer points in redox regulation through cooperative allosteric interactions.

Cultivation of *Spirulina* in gas-induced photo-bioreactor and isolation of phycobiliproteins
H. H. Kshirsagar, M. S. Revankar, M. Y. Kamat and Smita S. Lele
Indian J. Biotechnol., 2002, **1**, 255–262.

Spirulina is a rich source of microalgal protein, vitamin and phycobiliproteins. Traditional methods of cultivation of *Spirulina* are not commercially viable since cultures in open ponds yield poorly (about 100 g dry algal biomass/m^2/day). The authors explored a newer design of 'gas-induced mechanically agitated photo-bioreactor' (GIMAP), leading to simultaneous mixing and self-induction of gases. The GIMAP in this work was made from a 2 l flat-bottom Borosil reactor with illumination from fluorescent tubes (2.2 W/m^2) and illuminated area to volume ratio of 0.38 cm^2/cm^3. The impeller speed was kept constant at 10 rev/s. This arrangement facilitated recovery of phycobiliproteins without cell lysis, in addition to yielding 2.3 times higher growth rates over the traditional method.

Involvement of DARPP-32 phosphorylation in the stimulant action of caffeine
Maria Linskog *et al.*
Nature, 2002, **418**, 774–778.

Caffeine, the primary psychostimulant in coffee, tea, and cola, is known to block signalling at the adenosine A_{2A} receptors. The authors demonstrate that caffeine increased, in an intact mouse, the state of phosphorylation of the 32 kDa dopamine- and cyclic AMP-regulated phospho-protein (DARPP-32). The phosphorylation of a specific threonine residue was enhanced indirectly through the inhibition of PP-2A catalysed dephosphorylation. In addition, a knockout mouse devoid of DARPP-32 through a genetic deletion experienced a markedly-diminished effect of caffeine on its motor activity. These experiments indicate the phosphorylation status of DARPP-32 as the mechanistic basis of stimulant action of caffeine.

Imaging of RNA in bacteria with self-ligating probes
Shinsuke Sando and Eric T. Kool
J. Am. Chem. Soc., 2002, **124**, 9686–9687.

Fluorescent-labelled oligonucleotide probes have found extensive application in molecular microbiology. The authors report a new class of distinct green-coloured DNA probes, the QUAL probes, that lead to loss of quenching concomitant with a non-enzymatic self-ligation reaction. This class of synthetic probes was used to target ribosomal RNAs in *E. coli* K12 strains.

Identifying the transition between single and multiple mating of queens in fungus-growing ants
Palle Villesen, Takahio Murakami, Ted R. Schultz and Jacobus J. Boomsma
Proc. R. Soc. London, 2002, **B269**, 1541–1548.

All 'attine' genera of ants share the unique characteristic of obligate dependence on symbiotic fungus gardens for food. Among the two distinct groups of fungus-growing ants, namely lower attines and higher attines, the latter are invariably multiply mated, whereas the former have singly-mated queens. The authors use microsatellite DNA analysis to provide unambiguous evidence for a single to obligatory multiple mating to correlate the transitions with other evolutionary innovations.

Employing *Escherichia coli* to functionally express, purify and characterize a human transporter
Matthias Quick and Ernest M. Wright
Proc. Natl. Acad. Sci. USA, 2002, **99**, 8597–8601.

Understanding of mammalian membrane proteins is limited by their availability of ample quantities in purified form to study biochemistry and structure. The authors attempt expression of a recombinant human transporter (hSGLT1), a central protein for the homeostasis of glucose, salt and water, that contains 14-α helical transmembrane domains with the N- and C-termini located on the extracellular side of the membrane. Use of an *E. coli* strain defective in the outer-membrane protease OmpT, incubation at a temperature below 20°C and an IPTG-inducible, tightly regulated lac-promoter are crucial to reduce proteolytic degradation. Purification through affinity chromatography yields about 1 mg of purified protein per 3 l of bacterial culture. Sugar-uptake kinetic studies confirmed the functionally active form of the protein.