



Journal Club Abstracts

An Entomopathogenic Fungus for Control of Adult African Malaria Mosquitoes

Scholte E.-J., Ng'habi K. (2005) Science 308: 1641-1642

Presented by

Terhi Oja

Department of Biochemistry and Food Chemistry, University of Turku

Biological control of malaria mosquitoes in Africa has rarely been used in vector control programs. Recent developments in this field show that certain fungi are virulent to adult *Anopheles* mosquitoes. Practical delivery of an entomopathogenic fungus that infected and killed adult *Anopheles gambiae*, Africa's main malaria vector, was achieved in rural African village houses. An entomological inoculation rate model suggests that implementation of this vector control method, even at the observed moderate coverage during a field study in Tanzania, would significantly reduce malaria transmission intensity.

Understanding Noncovalent Interactions: Ligand Binding Energy and Catalytic Efficiency from Ligand-Induced Reductions in Motion within Receptors and Enzymes

Williams, D. H., Stephens, E., O'Brien, D. P. and Zhou, M. (2004) Angew. Chem. Int. Ed Engl. 43: 6596-6616

Presented by

Juha Määttä

Institute of Medical Technology, University of Tampere

Noncovalent interactions are sometimes treated as additive and this enables useful average binding energies for common interactions in aqueous solution to be derived. However, the additive approach is often not applicable, since noncovalent interactions are often either mutually reinforcing (positively cooperative) or mutually weakening (negatively cooperative). Ligand binding energy is derived

(positively cooperative binding) when a ligand reduces motion within a receptor. Similarly, transition-state binding energy is derived in enzyme-catalyzed reactions when the substrate transition state reduces the motions within an enzyme. Ligands and substrates can in this way improve their affinities for these proteins. The further organization occurs with a benefit in bonding (enthalpy) and a limitation in dynamics (cost in entropy), but does not demand the making of new noncovalent interactions, simply the strengthening of existing ones. Negative cooperativity induces converse effects: less efficient packing, a cost in enthalpy, and a benefit in entropy.

Autonomous artificial nanomotor powered by sunlight

Balzani, V., Clemente-León, M., Credi, A., Ferrer, B., Venturi, M., Flood A. H. and Stoddart, J. F. (2006) PNAS. 103:1178-1183

Presented by

Anni Kauko

Turku Centre for Biotechnology

Light excitation powers the reversible shuttling movement of the ring component of a rotaxane between two stations located at a 1.3-nm distance on its dumbbell-shaped component. The photoinduced shuttling movement, which occurs in solution, is based on a "four-stroke" synchronized sequence of electronic and nuclear processes. At room temperature the deactivation time of the high-energy charge-transfer state obtained by light excitation is 10 μ s, and the time period required for the ring-displacement process is on the order of 100 μ s. The rotaxane behaves as an autonomous linear motor and operates with a quantum efficiency up to 12%. The investigated system is a unique example of an artificial linear nanomotor because it gathers together the following features: (i) it is powered by visible light (e.g., sunlight); (ii) it exhibits autonomous behavior, like motor proteins; (iii) it does not generate waste products; (iv) its operation can rely only on intramolecular processes, allowing in principle operation at the single-molecule level; (v) it can be driven at a frequency of 1 kHz; (vi) it works in mild environmental conditions (i.e., fluid solution at ambient temperature); and (vii) it is stable for at least 10³ cycles.

What's in a picture? The temptation of image manipulation

Rossner M., Yamada K. M. (2004) Journal of Cell Biology 166:11-15.

Presented by

Pasi Kankaanpää

MediCity Research Laboratory, University of Turku

Images are elemental in conveying the results of scientific studies, and in the end all image handling is done electronically. Image processing programs like Photoshop offer endless and easy possibilities to adjust and modify images, and this article deals with the difficult question of when such manipulations are acceptable, and when they constitute scientific misconduct. General principles as well as specific issues regarding blots, gels and micrographs are presented. The article is a feature written by editors of JCB, but of everything I have read recently it stands out as the most striking, because it addresses such a 'hot' issue and contains rather controversial statements!

The topic certainly applies to every single one of us; we all do image processing with computers. I have noticed that people have very different ideas regarding what is acceptable image manipulation, and also very different levels of expertise in the field. Yet this is a highly important question in science today, and there is an evident need for common guidelines. This article attempts to establish some, and although it makes certain good points, I for one feel that the authors have perhaps insufficient knowledge of the field and draw somewhat questionable conclusions...

When I have been teaching microscopy and digital imaging recently, I have gone through some of the issues raised in this article. Unusually lively discussions with the students have followed, and many have shared their concerns and differing opinions regarding some of the claims made in the paper. For instance, should the background in blot scans be adjusted white, is it acceptable to 'clean up' unwanted background, are you allowed to combine several microscopic fields into one?

Separation of Liquid Phases in Giant Vesicles of Ternary Mixtures of Phospholipids and Cholesterol

Veatch S. L., Keller S. L. (2003) Biophysical Journal 85:3074-3083

Presented by

Jenny Björkqvist

Department of Biochemistry and Pharmacy, Åbo Akademi University

We use fluorescence microscopy to directly observe liquid phases in giant unilamellar vesicles. We find that a long list of ternary mixtures of high melting temperature (saturated) lipids, low melting temperature (usually unsaturated) lipids, and cholesterol produce liquid domains. For one model mixture in particular, DPPC/DOPC/Chol, we have mapped phase boundaries for the full ternary system. For this mixture we observe two coexisting liquid phases over a wide range of lipid composition and temperature, with one phase rich in the unsaturated lipid and the other rich in the saturated lipid and cholesterol. We find a simple relationship between chain melting temperature and miscibility transition temperature that holds for both phosphatidylcholine and sphingomyelin lipids. We experimentally cross miscibility boundaries both by changing temperature and by the depletion of cholesterol with beta-cyclodextrin. Liquid domains in vesicles exhibit interesting behavior: they collide and coalesce, can finger into stripes, and can bulge out of the vesicle. To date, we have not observed macroscopic separation of liquid phases in only binary lipid mixtures.

Dance reveals symmetry especially in young men

Brown et al. (2005) Nature 438:1148-1150

Presented by

Susanna Repo

Department of Biochemistry and Pharmacy, Åbo Akademi University

Dance is believed to be important in the courtship of a variety of species, including humans, but nothing is known about what dance reveals about the underlying phenotypic - or genotypic - quality of the dancer. One measure of quality in evolutionary studies is the degree of bodily symmetry (fluctuating asymmetry, FA), because it measures developmental stability. Does dance quality reveal FA to the observer and is the effect stronger for male dancers than female? To answer these questions, we chose a population that has been measured twice for FA since 1996 in a society (Jamaican) in which dancing is important in the lives of both sexes.

Motion-capture cameras created controlled stimuli (in the form of videos) that isolated dance movements from all other aspects of visual appearance (including FA), and the same population evaluated these videos for dancing ability. Here we report that there are strong positive associations between symmetry and dancing ability, and these associations were stronger in men than in women. In addition, women rate dances by symmetrical men relatively more positively than do men, and more-symmetrical men value symmetry in women dancers more than do less-symmetrical men. In summary, dance in Jamaica seems to show evidence of sexual selection and to reveal important information about the dancer.