EDITORS' CHOICE

edited by Gilbert Chin

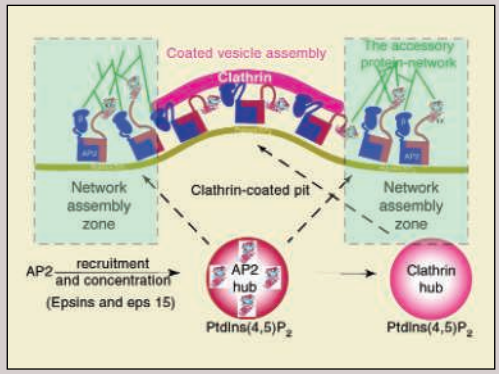
CELL BIOLOGY

Endocytosis at the Hub

In clathrin-mediated endocytosis, a network of proteins assembles on the cytoplasmic surface of the plasma membrane and promotes the pinching off of a membrane-bounded clathrin-coated vesicle. Together, the proteins select cargoes that are carried either inside the vesicle or in its membrane, modify the shape of the membrane, and drive invagination, vesicle scission, and eventual uncoating. A key player in this process is the AP2 clathrin adaptor protein, which is involved in concentrating selected cargo in the newly forming clathrin-coated pits.

In protein interaction networks, hubs are proteins that have disproportionately high numbers of interaction partners; in biological processes, hubs provide a temporal or spatial ordering to protein interactions. Praefcke *et al*. treat clathrin-mediated endocytosis as a module of a network and show how the α-appendage part of the AP2 protein works as an interaction hub. Only after being concentrated at sites of endocytosis do the appendages provide a multivalent binding platform (hub) for interaction partners (i.e., endocytic cargoes or other cargo adaptors). Thus, the partners will then be represented according to their relative affinities and concentrations in endocytic clathrin-coated pits and vesicles, even though any individual interactions will have been transient. — SMH

EMBO J. 10.1038/sj.emboj.7600445 (2004).

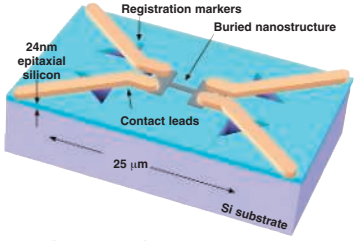


Interacting partners.

APPLIED PHYSICS

Registering Nanostructures

The manipulation of atoms using scanning tunneling microscopy (STM) has long promised the ability to fabricate nanometer- and atomic-scale electronic device structures. However, the realization of robust devices has been a difficult goal to attain simply because of the engineering problem of making electrical contact to the fabricated structure. The problem is that once the sample is removed from the ultrahigh vacuum where the STM atomic manipulation has taken place, the actual location of the structure is lost, particularly those regions that are buried under several layers of epitaxially grown semiconductor material. Ruess *et al*. have used a registration technique that allows the alignment of macroscopic electrodes to the nanoscale device elements buried underneath. The registration markers are etched into the substrate before the STM manipulation stage and so should be a general method for bottom-up fabrication of other nanoscale device structures. — ISO



Schematic showing contacts (yellow) to a buried 90-nm-wide quantum wire.

Nano Lett. **4**, 1969 (2004).

GEOLOGY

Taking Inventory

An enormous amount of methane, an important greenhouse gas, is stored in sediments in the ocean basins as icy methane clathrate and as gas trapped by this ice and by sediments. Catastrophic release of methane from this warehouse has been suggested to have caused abrupt climate change (warming) in the past, and there are concerns that a warmer future climate may destabilize this reservoir, which would enhance warming further.

To assess the amount of clathrate stored and to evaluate its stability, Buffett and Archer developed a mechanistic model for clathrate dynamics based on experimental and theoretical data on its stability and on factors affecting its formation and release, such as the supply of carbon to sediments and its diagenesis, storage, and oxygen content. Application to the current ocean basin implies that the global inventory is on the order of 10^{18} g of carbon stored as methane gas and clathrate. The modeling results imply that increasing temperature would likely deplete this inventory considerably; rebuilding would take several million years. The model also reveals that unless the oxygen content of the deep oceans was lower than at present, not enough methane would have been stored to account for the carbon isotope shift and the abrupt warming at the Paleocene-Eocene boundary, about 55 million years ago. — BH

Earth Planet. Sci. Lett. **227**, 185 (2004).

IMMUNOLOGY

Three in One

Vaccines are designed to generate robust immunity through the coactivation of the adaptive and innate arms of the immune system. This is achieved by steering tripartite responses to antigenic epitopes by helper T (T_H) cells, antigen-presenting dendritic cells (DCs), and antibody-producing B cells or the cytotoxic lymphocytes (CTLs) that ultimately execute pathogen clearance. However, the poor inherent immunogenicity of peptide epitopes favored in some vaccine formulas dictates the need for including complex and potentially toxic adjuvants that stimulate the essential priming activity of DCs.

Jackson *et al*. have refined this approach by synthesizing structures containing T_H epitopes coupled to B cell or CTL target epitopes. These were linked via a lipid moiety, which served to activate DCs through binding and activation of the innate signaling receptor TLR2. With different epitope

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