In the current reports[1,2], the crystal structures at the onsets of the non-metallic states of lithium and sodium have not been definitively established. Ma *et al.*[2], however, used extensive quantum-mechanical calculations and structural-refinement techniques to predict that sodium adopts an unusual "distorted double-hexagonal close-packed" structure (see Fig. 4a on page 184) at high pressures. This structure is in fact shown to be an insulator at low temperatures. Nevertheless, one cannot yet say with certainty that dense sodium takes this form, because the calculations predict structures at a temperature of absolute zero, whereas Ma and colleagues' measurements were made at room temperature. The calculations also assume that the core structures are infinitely massive. In fact, both lithium and sodium are light elements, and so quantum effects of the atoms associated with their lattice dynamics might well be important for determining the actual structures adopted by the dense metals.

The results[1,2] are not entirely unheralded, as significant changes in the optical characteristics and conductivity of sodium[7] and lithium[8] have previously been noted at pressures not too far from those now described. Nor are the results without some theoretical precedent: about ten years ago it was predicted[9] that lithium might well depart from its simple crystal and electronic structures at higher densities. And predictions for sodium soon followed suit[10]. But what the present results most assuredly demonstrate is the importance of pressure in revealing the limitations of previously hallowed models of solids and their associated electronic behaviour. Furthermore, it is clear that the structures adopted by solids (and even liquids) under pressure will provide stringent tests[11] of our ability to predict both the forms and thermodynamic behaviour of condensed states of matter. ■

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CELL BIOLOGY

Detached membrane bending

Hélène Barelli and Bruno Antonny

Cells use various protein complexes to remodel membrane-bound organelles. *In vitro* reconstitution of the activity of one such complex, ESCRT-III, shows that it promotes membrane bending in an unconventional way.

Many transmembrane proteins — including those that span the cell membrane — are degraded within cellular organelles called lysosomes once their work is done. Reaching the lysosomes is not simple, however, and involves several membrane-vesicle trafficking steps[1]. On page 172 of this issue, Wollert *et al.*[2] elucidate the role of the components of the ESCRT-III protein complex in one stage of this process. The authors' results are of interest not just for the insights they provide into the processes of intracellular trafficking and protein degradation, but also because ESCRT proteins mediate the budding of certain viruses, including HIV-1, as well as the separation of the two daughter cells at the end of cell division.

So what is the itinerary for the journey of a cell-membrane protein to the lysosomes? First, small portions of cell membrane invaginate and become detached to form organelles called endosomes, incorporating the proteins. The endosome further invaginates internally into its own lumen to form several intraluminal vesicles (ILVs). Endosomes with their ILVs are called multivesicular bodies, and eventually fuse with lysosomes, where ILVs and their contents are degraded by the cocktail of lysosomal enzymes.

Compared with other membrane-deformation events that occur in the cell, ILV formation is puzzling (Fig. 1). Vesicles generally bud from organelles (such as the Golgi complex) in the opposite direction to ILV formation: a protein coat assembles on the cytoplasmic side of the organelle membrane to form an outer shell and impose deformation towards the cytoplasm[3]. Once the vesicle has become detached from the membrane, the protein coat disassembles and is reused for another round of budding.

Given the opposite topology of ILVs, budding away from the cytoplasm, could it be that ESCRT-III sculpts the membrane from inside the bud? After all, induction of curvature from the inside has precedents: some proteins with

50 & 100 YEARS AGO

NATURE

50 YEARS AGO

A Congress was held in Singapore during December 2–9 to celebrate "the Centenary of the formulation of the theory of Evolution by Charles Darwin and Alfred Russel Wallace and the Bicentenary of the publication of the tenth edition of the 'Systema Naturae' by Linnaeus". It was particularly fitting that this Congress should have been held in Singapore for ... it directed special attention to the work of Wallace, who was one of the greatest biologists ever to have worked in south-east Asia ... Prof. Haldane then delivered his presidential address ... The president emphasised the stimuli gained by Linnaeus, Darwin and Wallace through working in peripheral areas where lack of knowledge was a challenge. He suggested that the next major biological advance may well come for similar reasons from peripheral places such as Singapore, or Calcutta, where this challenge still remains and where the lack of complex scientific apparatus drives biologists into different and long-neglected fields of research.
From *Nature* 14 March 1959.

100 YEARS AGO

On Monday evening Dr. M. A. Stein read before the Royal Geographical Society a paper on his geographical and archaeological explorations in Chinese Turkestan in 1906–8 ... He was greatly desirous of examining a secret store of ancient manuscripts which had been accidentally discovered by a Taoist priest in the Caves of the Thousand Buddhas ... These were piled up without any sort of order to a height of 10 feet, and comprised not only written documents, but fine paintings on silk and cotton, ex-votos in all kinds of silk and brocade, and streamers in various fabrics. Dated documents showed that the chamber must have been walled up about 1000 A.D., but some of the records dated back so far as the third century A.D.
From *Nature* 11 March 1909.