bacteria are infected with viruses⁹, and that titres of viral pathogens to specific hosts are highly variable (our unpublished results) emphasize the dynamic interactions of host-virus systems in the sea. But the role of host resistance is likely to be limited, because marine virus and phytoplankton communities are generally diverse with only a small proportion of the total numbers made up of any given pathogen or host. So the low probability of a virus encountering a suitable host minimizes selection for host resistance relative to other factors.

We would also like to point out that we did not conclude that viruses caused the observed decreases in photosynthetic rates.

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Original mud

SIR — The recent illustrations¹ of our proposed chordate ancestors demonstrate remarkable morphological similarities to the class Rotifera, whose contemporary members inhabit both fresh and saline waters. The figure shows the close resemblance between the fossil carpodid, mitrate and hemichordate on the left-hand side, and several species of rotifera on the right. There are particular

parallels between the rotifer tail, which has several flexible segments and a neural ganglion at its base, and that of the fossils. Rotifera use these caudal appendages to creep over or fasten onto surfaces when they are not free-swimming.

There are considerable differences in size between these creatures, however: the fossilized species are of the order of 1–3 cm long, whereas rotifera seldom exceed 0.5 mm in length. Their respective habitats differ too: the carpodids and mitrates inhabited marine mud, and probably seldom moved freely in open water, but the rotifera illustrated here live predominantly on top of such muddy surfaces. One might explain this coincidence of structure as a case of convergent evolution, as the fossil species had more sophisticated organs and cuticular development. Could this example of convergent evolution therefore be attributed to the rotifer's adaptation to water's greater relative viscosity (as defined by the Reynold's number²), leading to the development of similar structures as observed in larger creatures living in thick mud?

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Formation of membranes

SIR — The interest of theoretical physicists in biomembranes has yielded new understanding in this important field, where on the one side so much is known and on the other so little is understood^{1,2}. But despite their successes in explaining various phenomena, thermodynamic approaches provide mainly an overall, static picture of the systems.

For understanding the mechanisms, transformations and other dynamic phenomena on the molecular scale these approaches should be combined, I think, with the kinetic ones. These, I believe, originate predominantly in the 'structural paradox' of the aggregates: because of the aggregates' topology, only some of the molecules are exposed to the changes in the exterior; while these (surface) molecules are trying to minimize their free energy they prevent the molecules in the interior of the structure in doing the same. Because permeability rates can be very low this imposes various gradients (hydration, temperature, pressure, concentration of some solutes which can all influence the area of polar head groups, relative mobility of hydrocarbon chains and therefore expansivities of monolayers in a bilayer³, or in stacks of smectic bilayers), which, in turn, dictate the spatial and temporal evolution of the system.

Larger surface areas and/or expansivities of the outer monolayers (or layers in an aggregate) induce nonzero curvature which causes not only the shape fluctuations of cells or vesicles³, but is also the driving force for the formation of vesicles. Simply, in various vesicle/liposome preparation methods, the curvature is induced either in the polar or nonpolar part of the bilayer, or on the rim of bilayered fragments by various treatments of amphiphile film, dispersion, emulsion or solution. It seems that these gradients allow the systems to be brought over energy barriers into metastable states, as vesicles are generally thermodynamically unstable due to their curvature^{1,2,4}. In other words, due to these gradients some of the energy, which can be released into the system by an exothermic process and which would normally dissipate as heat, can be stored as conformational free energy in the particle.

With passing time these gradients dissipate and a homogeneous liposome colloidal solution transforms into a heterogeneous dispersion of fully hydrated aggregates with large curvature radii in excess water⁴. These transformations are again a consequence of the interplay of thermodynamic and kinetic factors — I believe that for the thorough understanding of the behaviour of amphiphiles in aqueous solutions as well as vesicle formation in living cells, both approaches should be taken into account.

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Cannibalism in the Neolithic

SIR — Bahn in his News and Views article¹ suggests that cannibalism did not occur at the Neolithic site of Fontbrégoua in southern France, arguing that secondary burial practices involving defleshing of partly decomposed bodies can produce the same results as alleged cannibalism. But the burial hypothesis does not adequately account for all the evidence from this site.

Throughout the fifth and fourth millennia BC Fontbrégoua was used as a temporary habitation site by small groups of hunters who kept herds of sheep in pens inside the cave. Most of the butchering was done in the cave and bones were discarded in small piles². Sixteen bone clusters have been excavated, each representing an episode of butchery and discard and containing the remains of one domestic sheep, or several wild animals or several humans (see, for example, ref. 3).

The carcasses were all butchered using the

Fossil species (left) and rotifera (right). a, *Ceratocystis*, a cornute carpodid; b, *Brachionus* spp, rotifer; c, *Mitrocystella*, a mitrate; d, *Colurella* spp, rotifer; e, *Rhabdopleura*, hemichordate, single individual from a colony; f, *Rotaria* spp, single, individual rotifer from a colony. Scale bars: left-hand side, 1 cm; right-hand side, 100 μ m.