

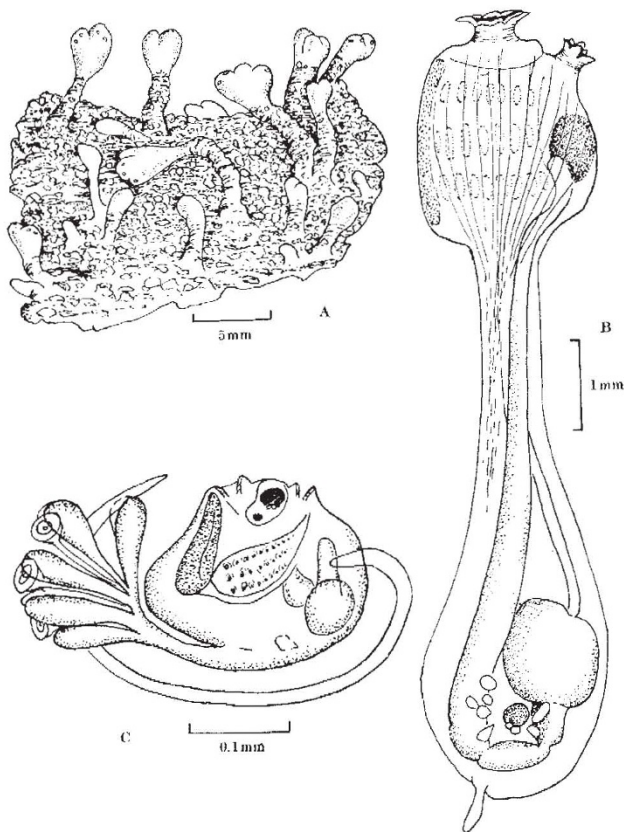
of Technology, Trondheim) insisted that many recently discovered carotenoid structures which have been in part deduced from mass spectral data must be confirmed by synthesis. Several speakers also made it clear that pathways deduced from the patterns of naturally occurring compounds of related structure can only be regarded as tentative when evidence is lacking at the enzyme level.

The notable recent increase in new structures was illustrated by Professor V. Herout (Academy of Sciences, Prague), who dealt with the sesquiterpenes: more than 100 types of carbon skeleton are known in this group, which must present a rich supply of experiments for biosynthetic work.

## MARINE BIOLOGY

### Underwater Guide

AN eagle eyed underwater zoologist who recognizes these creatures attached to a nearby rock should know that he is in the vicinity of Plymouth or North Carolina, or perhaps off the coast of France. This detail of geographical distribution he would have learnt from R. H. Millar's new handbook, *British Ascidians*, the latest of the Linnean Society's synopses of the British



fauna (Academic Press, £1 2s). The book contains keys to the families and species of ascidians to be found in British waters, as well as notes about individual species. This illustration, one of many, shows (A) part of a colony, (B) a zooid and (C) a larva of *Archidistoma aggregatum*. (Several zooids are housed within each projection on the colony.)

## THERMODYNAMICS

### Keeping Up to Date

from a Correspondent

THERMODYNAMICS still holds surprises, as delegates learnt at the international conference on this topic held at Cardiff on April 1-4, under the auspices of the Institute of Physics and the Physical Society. The organizers judged correctly that the survival value of the subject lies first in its breadth (delegates included chemists, engineers, mathematicians and physicists) and second in its adaptability. Thermodynamicists are willing to dilute the classical purity of their doctrines and open judicious doors to new recruits. For example, it is possible that they are making a take-over bid for parts of cosmology. Dr D. Layzer (Harvard) presented a fascinating account of how the cosmological "arrow of time" could be linked with thermodynamic irreversibility by arguing that initial conditions in a Friedman universe were probably such as to generate high initial information and low entropy. The subsequent increase in entropy is then linked to the growing information embodied in history. Layzer's viewpoint is epitomized in his remark: "Structure and order are tricky. We should keep to well-defined concepts like information."

Well within the classical tradition was a new sharpening of Gibbsian thermodynamics which dealt in some detail with phase changes and solution processes occurring in elastically stressed systems. This extension, by Dr A. G. McLellan (Christchurch), has been made by defining suitable extensive coordinates which describe the shape of a crystal. Successful applications have been made to the  $\alpha$ - $\beta$  quartz transition, crystal twinning and homogeneous diffusion. The work is likely to have important applications in geophysics.

The other classical topic discussed at some length was the question of axiomatics. Dr R. Giles (Kingston), who several years ago provided the first really fresh approach to thermodynamics since the time of Carathéodory, was urging a pedagogical version of his system on a somewhat unwilling audience, most of whom sympathized with the remark of Dr M. W. Zemansky (New York): "Work is anathema. In Britain, I sometimes think that heat is anathema. But work and heat are here to stay." Dr W. J. Hornix (Nijmegen) reported progress with the (axiomatically) least satisfactory aspect of thermodynamics—the treatment of chemical systems of varying composition.

Much was said about irreversible thermodynamics which has been part of the extended domain for at least twenty years. The two chief branches of this subject are the mathematical neo-Cauchy theories expounded, for example, by Truesdell, and the physico-chemical theories of relaxation and transport started by Onsager. No significant new contribution was offered at Cardiff, but it seems clear that both subjects are still moving, presumably because people have faith that their unfulfilled promise will be redeemed.

There were interesting accounts of dynamical calculations on finite models which illuminate the passage to equilibrium in isolated systems. Typical of these was work by Dr J. Ford (Atlanta) in which two or three oscillators were coupled by non-linear resonant interactions. The Arnold stability of orbits can be dramatically broken in a way which renders the motion