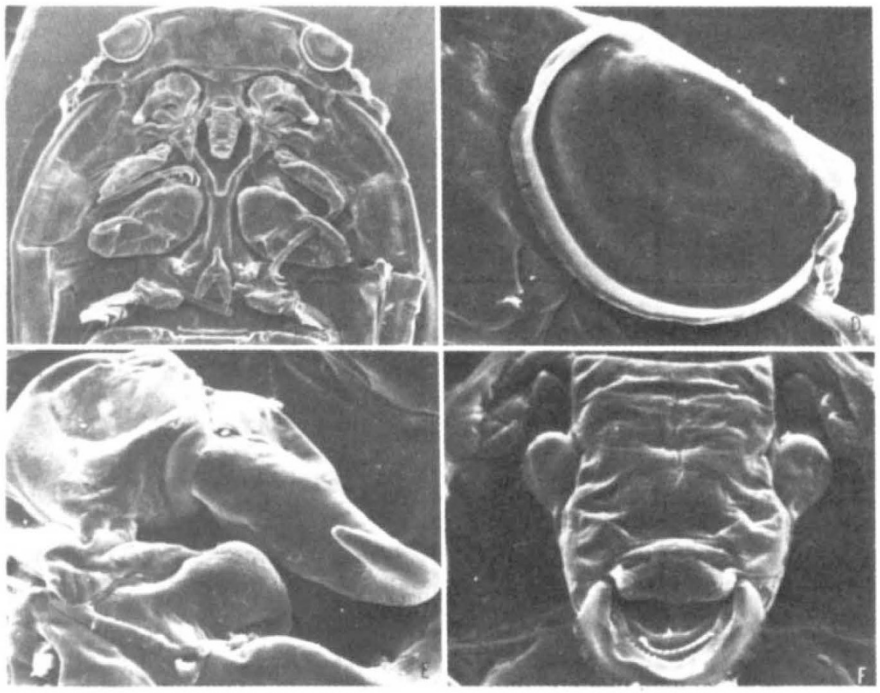

Caligus coryphaenae Steenstrup and Lütken, female: top left, cephalon, ventral (30X); top right, frontal lunule (200X); bottom left, second antenna (200X); bottom right, a happy mouth tube (280X).

from R.J. Roberts

A recent Smithsonian Contribution to Zoology* by Cressey & Cressey has made a major contribution to resolving many of the problems of copepod taxonomy. There are more than a 1,000 known copepod species with very wide ranging structural diversity and the same hallowed, often inaccurate, drawings have appeared in text after text. The copepods are parasites of the economically important mackerel and tuna fish groups and when they occur in large numbers they can be a source of significant financial loss.

The scanning electron microscope pictures from the report, reproduced alongside, show various features of a parasite of the tunny. The bottom right-hand plate, which they designate "the happy mouthtube" shows something that parasitologists have long suspected — that copepods enjoy life even if their hosts do not.

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*Roger Cressey & Hilary Boyle Cressey *Parasitic Copepods of Mackerel- and Tuna-like Fishes (Scombridae) of the World* Smithsonian Contributions to Zoology 311 (Smithsonian Institution Press, City of Washington, 1980).

tract epithelium, whereas other glycolipids and monosaccharides do not.

N. Sharon (Weizmann Institute, Rehovoth) reminded the symposium that bacterial adhesion may be inhibited by simple sugars, particularly mannose in the case of various strains of *E.coli* and salmonella. This has suggested that mannose or mannose-like residues on the host cell form part of the receptor for the bacteria which attach to them. There is considerable evidence, said Sharon, that many strains of bacteria contain a lectin-like substance, specific for mannose, which may take the form of fimbriae or flagella or may be embedded in the outer membrane. (Adhesion mediated by CFA/I and/II, K88 and K99 is insensitive to mannose, while that due to type 1 fimbriae is sensitive.) He said there is good reason to believe that the mannose-sensitive attachment plays a role in pathogenicity, and he has found that α methyl-D-mannoside diminishes infection of the urinary tract of mice by virulent strains of *E.coli*.

Adhesion, often of a more transitory nature, is an obligatory step in the infection of cells by mycoplasma. S. Razin (Hebrew University of Jerusalem), describing work done in conjunction with W. Bredt (University of Freiburg), said that adhesion, chiefly in the respiratory tract, enables toxic products of mycoplasma metabolism, such as ammonia and hydrogen peroxide, to reach concentrations sufficient to damage the cells. He said that sialic acid residues form the receptors of the cells, while the binding sites on the mycoplasma are apparently membrane proteins. Adhesion seems to depend on the metabolic state of the mycoplasma, with the electrochemical ion gradient across the membrane also being influential.

Another parasite, the protozoan responsible for amoebic dysentery, has come under closer scrutiny as a health problem of the developing world. The trophozoite stage of *Entamoeba histolytica* begins the infectious process by adhering to intestinal epithelial cells, and from there can penetrate into the circulation, adhering to red blood cells and phagocytosing them. D. Mirelman (Weizmann Institute) reported that a lectin found in the trophozoite is apparently involved in the adhesion. He thinks the lectin is separate from the amoeba's toxin, for the two activities can be demonstrated in different fractions obtained from the trophozoite.

For the merozoite stage of the malaria parasite, adhesion to red blood cells is an essential part of the cycle of invasion, multiplication, release and reinvasion that produces characteristic symptoms of anaemia and fever in the host. Adhesion seems to be mediated by specific receptor molecules on merozoite and red cell — evidence includes the specificity of each species of merozoite for either young or old red cells of certain host species and for a particular blood group antigen. R.J. Howard (National Institute of Allergy and Infectious Diseases, Bethesda), discussing work with *Plasmodium vivax* and *Plasmodium knowlesii*, pointed out that characterization of the molecules involved in recognition is hampered because the morphological changes occurring during the cycle are likely to affect the receptors.

D.F.H. Wallach (Tufts-New England Medical Center, Boston) recalled that after invasion, a merozoite matures and multiplies within a vacuole. At the same time the host red cell's cytoskeleton is destroyed and its surface membrane is altered by modification of component proteins and insertion of others synthesised by the parasite. The new proteins are immunogenic in the host, and two of them are involved in protective immunity and have antigenic features common to several species of *Plasmodium* that cause malaria in mammals. This lack of species specificity should make such proteins an attractive target in the search for a vaccine against malaria.

Although the details of adhesion and its relationship to pathogenicity are likely to be hard won, the potential rewards in terms of prevention and treatment of disease are clearly considerable. Vaccines are an obvious outcome to hope for, but other approaches are possible. E.H. Beachey (University of Tennessee College of Medicine, Memphis) reported that small, sublethal concentrations of various antibiotics can disrupt the adhesion of some *E.coli* and *Streptococcus pyogenes*. Especially effective are antibiotics that act on the ribosomes or the cell wall, and Beachey presumes that they interfere with the synthesis or assembly of the fimbriae. This suggests the possibility of combating bacteria with doses of antibiotics sufficient to prevent adhesion but not necessarily to kill them; such low doses would avoid problems of toxicity. As the details of adhesion become better understood, more such relationships should emerge.

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