Progress in Parasitology

The success of parasitism as a survival strategy is evidenced by the fact that parasitic organisms far outnumber non-parasitic ones. Humans, for example, host over a hundred kinds of eukaryotic parasites alone. In recent years understanding of the biology of parasites has grown enormously, particularly (but not exclusively) at the molecular level. These advances, the focus of this issue of Science, are important not only for their intrinsic scientific interest but also because they open up a range of new possibilities for therapeutic strategies against parasitic diseases. The victims of parasitic disease are primarily the populations of developing countries, so the successful application of new therapies is crucially dependent on policy decisions, both in the developed countries where most of the research is carried out and in the countries where the results are applied. A second focus of this special issue, therefore, is analysis of the societal and economic impact of parasitic disease and the politics of parasitological research.

A feature of recent work has been the elucidation of many alternative solutions that parasites have found to the problems of survival and proliferation. In Perspectives, Borst and Rudenko discuss some of the unique mechanisms of gene transcription in parasites, as seen in the rapid and diverse antigenic variation in trypanosome coat glycoproteins; Simpson and Maslow describe how parasites can store genetic information as incomplete cryptogenes that are filled out by RNA editing; and Nilsen reviews the use of trans-splicing to assemble complete mRNA molecules from separate protein-coding and translational control modules.

There have also been notable contributions to the understanding of host physiology. In their Perspective, Capron and Capron mention how several of the current paradigms in cellular immunity, including the powerful concept of T helper subpopulations, originated and were verified in experimental models of parasitic disease. Another well-known example is the interaction of malaria with sickle cell anemia, which led to a greater understanding of red cell physiology, the genetics of human populations, and the biochemical response of hemoglobin to oxygen. The study of parasites has also spurred new ideas in mathematical ecology. The Article by Anderson discusses specific advances in the population biology of disease, and, more broadly, insights into the interaction of populations that illuminate both parasitism and competition for ecological niches.

The diseases caused by parasites in humans are many and varied. A major killer, malaria, is the subject of an Article by Miller, Good, and Milon, who weave together the exciting recent findings from the laboratory (for example, the identification of ligands and receptors for red cell invasion) and from the field (such as the increased severity of the disease during pregnancy) to provide a comprehensive overview of pathogenesis. Developments in vector ecology and biology, which raise the possibility of taming malaria through control of the mosquitoes that transmit Plasmodium species, are described in the Perspective by Collins and Besansky.

However, malaria is by no means the only parasitological problem. The six major tropical diseases—malaria, schistosomiasis, filariasis, African trypanosomiasis, Chagas disease, and leishmaniasis—together account for more than 1 million deaths annually and are the cause of morbidity in hundreds of millions more. Consequently, as Evans and Jamieson explain in a Policy Forum, these diseases contribute in no small measure to the economic difficulties of developing countries. Those most affected are typically the poorest people in the poorest countries who, of course, have the poorest health care facilities.

In spite of the advances in basic biology and of the potentially enormous benefits to mankind in controlling the dread parasitic diseases, funding for research in parasitology, whether for primary research or for product development by industry, is not healthy. The current crisis in research funding is highlighted in the News section, and a bold new approach to collaboration between national research agencies and industry is outlined in the Policy Forum from Godal.

Parasitology is at a crossroads. The continuing rapid pace of research puts parasite biology at the cutting edge of basic science, but the coming challenge is now to translate that scientific knowledge into therapeutic strategies to tackle disease worldwide. It is to be hoped that the threat of shrinking research budgets will not prevent us from meeting that challenge.

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