circulate in these animals for as long as 30 days. There was also some indication that the hagfish lacked homograft immunity. Adult lampreys were somewhat more capable of making antibody as judged by a limited primary response. The tests of the secondary response could only be carried out in a few animals because the spawning lamprey does not survive long enough to permit extended observation. The investigators also studied the response of the holostean fish, *Amia*, and the guitarfish, a primitive elasmobranch. Variable degrees of competence exist in these fishes and the secondary response was usually more vigorous than the primary. The hagfish appears to lack lymphocytopoietic tissue. Hagfish serum has no globulin of gamma mobility, but the lamprey serum contains a small amount of component comparable to mammalian gamma globulin. The thymus appears to be totally lacking in the hagfish and only an epithelial thymus is present in the larval lamprey. In sharp contrast, elasmobranchs and teleosts possess lymphopoietic tissue, circulating lymphocytes, gamma globulin, and a thymus. These fishes are also immunologically competent with respect to antibody production and homograft rejection. On the basis of these findings, it was concluded that adaptive immunity developed in parallel with phylogenetic development of the thymus and lymphoid system.

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Cell Life Cycle: Macromolecular Aspects

A symposium on the macromolecular aspects of the cell life cycle was the subject of the annual symposium sponsored by the Biology Division of the Oak Ridge National Laboratory and the Division of Biology and Medicine of the Atomic Energy Commission at Gatlinburg, Tennessee (8–11 April).

The major emphasis throughout the meeting was placed on mechanisms controlling the initiation and maintenance of DNA replication and the regulation of DNA function in relation to other events of the cell life cycle. The discussion of both DNA polymerase and the conversion of non-primer DNA to the primer state, with respect to the initiation of DNA synthesis, pointed up the current gap in information about

the biological control of this central event of the cell cycle. In the case of calf thymus DNA polymerase, no primer occurring naturally has yet been detected in cells, and the existence of such primer may be an extremely transient event in the cell. It is perhaps significant that hypotheses proposing control of DNA synthesis through regulation of precursor pools was not mentioned during the discussions.

Although the main emphasis was on the relation of DNA synthesis to the cycle, several speakers dealt in whole or in part with such problems as growth in dry mass during the cell cycle and the control of cell division by specific compounds. Papers dealing with proteins associated with chromosomes led to the generalized conclusion that all proteins of the chromosome, including histones, are normally turning over or being replaced continuously in the chromosome. The recent demonstrations of greater heterogeneity among histone molecules have produced more vigorous consideration of the question of control of genetic activity by these proteins. Histone heterogeneity so far demonstrated is still far short of the amount required by such a thesis. It was also pointed out that a stretch of DNA was insufficient information to specify the synthesis of its own histone and that these proteins must have their origin in a limited fraction of the genome.

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Nucleon Structure

More than 400 physicists from twenty countries attended the recent international conference on nucleon structure at Stanford University, Stanford, California (24–27 June). Of principal interest was the present experimental evidence concerning the theory of elementary particles based on analyticity principles and Regge poles. The latest results on K-meson-proton scattering experiments at the Brookhaven Alternating Gradient Synchrotron, reported by Lindenbaum, are very similar to the π meson-proton scattering results previously reported and thus are quite different from the behavior of proton-proton scattering cross section as a function of energy. In the analyticity theories, all strongly interacting particles are taken as composites involving