APPOINTMENTS

Asa S. Knowles, president, Northeastern University, to chancellor at the university. . . . **James Frank**, vice president for academic affairs, Medgar Evers College, City University of New York, to president, Lincoln University. . . . **Thomas E. Broce**, executive assistant to the president, University of Oklahoma, to president, Phillips University. . . . **Thomas R. Fitzgerald**, academic vice president, Georgetown University, to president, Fairfield University. . . . **Archie R. Dykes**, chancellor, University of Tennessee, Knoxville, to chancellor, University of Kansas. . . . **F. Carter Pannill**, founding dean, University of Texas Medical School, San Antonio, to vice president for health sciences, State University of New York, Buffalo. . . . **Philip D. Vairo**, dean, College of Professional Studies, University of Tennessee, Chattanooga, to dean, School of Education, California State University, Los Angeles. . . . **Warren S. Wooster**, professor of oceanography, Scripps Institution of Oceanography, to dean, Rosentiel School of Marine and Atmospheric Science, University of Miami. . . . **Ernest S. Kuh**, chairman, electrical engineering and computer sciences department, University of California, Berkeley, to dean, College of Engineering at the university. . . . **Max L. Williams, Jr.**, dean, College of Engineering, University of Utah, to dean, School of Engineering, University of Pittsburgh. . . . **Herman Feshbach**, director, Center for Theoretical Physics, Massachusetts Institute of Technology, to head, physics department at M.I.T. . . . **Paul S. Lykoudis**, director, Aerospace Sciences Laboratory, Purdue University, to head, nuclear engineering department at the university.

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RESEARCH NEWS

Insect Control (II): Hormones and Viruses

Insect pests are man's major competitors for food, fiber, and forest. Because control of these pests is essential, entomologists are seeking alternatives to the broad-spectrum chemical insecticides now used almost exclusively. Although these have been effective, they can also cause problems. Such insecticides are not very selective—they kill helpful as well as harmful insects and may also be toxic to birds and mammals. Of special concern is the fact that their use has resulted in the emergence of resistant insect strains that are no longer killed by the chemicals.

Thus, investigators are trying to develop more specific techniques based on inherent physiological and behavioral regulatory mechanisms of insects. The application of pheromones to insect control was discussed in a previous article (*Science*, 24 August 1973). This article is concerned with examples of the use of hormones in insect management programs and also with efforts to curb insect populations by infecting them with viruses.

Juvenile hormones (JH) and molting hormones (MH) or ecdysones are two of the major types of hormones regulating insect growth and maturation. In order to grow, insect larvae must molt —that is, they must shed their rigid cuticles and replace them with new ones. Both JH and MH are required for larval molting. However, JH secretion must cease in order to allow the larvae to develop into sexually mature adults.

Since larvae die as a result of the abnormal development that occurs when JH is present at the "wrong" time, Carroll Williams of Harvard University, Cambridge, Massachusetts, suggested in 1956 that JH and analogs of JH could be used as insecticides. One such compound, Altosid SR-10, a product of the Zoecon Corporation, Palo Alto, California, has now been registered for experimental use by the Environmental Protection Agency (EPA). According to John Siddall, Zoecon's vice president for research, Altosid SR-10 is effective against several species of flies and mosquitoes; however, its registration is for control of floodwater mosquitoes.

At present, JH insecticides can be applied only in somewhat restricted circumstances. This is because such compounds interfere with development only at specific stages of the insect's life. An insect species undergoes a characteristic number of molts as it grows; the periods between molts are called instars. At the end of the last larval instar, an insect that has a complete metamorphosis molts first to the pupa and the pupa then molts to the adult form. Insects with incomplete metamorphoses molt from the sexually immature nymph to the adult. Only these molts are disrupted by JH and JH analogs, usually with the production of intermediate forms that have both immature and mature characteristics.

These intermediates soon die. However, an insect's susceptible period may be rather brief. Thus, the hormonal insecticides must remain in the environment long enough to ensure that a large percentage of the population is exposed during its sensitive period. This is easily achieved for floodwater mosquitoes. The eggs hatch within minutes of their immersion in water—and the farmer controls the time of irrigation of his fields. This synchronizes the development of the population so that large numbers go through the sensitive period at the same time. Altosid SR-10 formulated in micro capsules retains its efficacy in water for up to 7 days—a period long enough to prevent the emergence of adult mosquito pests.

Siddall pointed out that hormonal insecticides such as Altosid SR-10 are not yet suitable for controlling malarial mosquitoes in undeveloped countries. They do not kill adult mosquitoes, the malaria carriers. Moreover, they cannot compete with DDT on the basis of cost per pound. Thus, the more conventional insecticides will still be needed in such countries, although the problem of resistant insects is of worldwide concern.

Stauffer Chemical Company, of Westport, Connecticut, is also developing JH analogs for pest control. According to Charles O. Persing, director of agricultural chemical research, and