Ecology

Why do some animals live longer?

The maximum life spans of different mammals vary widely—a mouse may live three years; a dog, 18; a man, perhaps 110. So far, the biochemical mechanism that determines longevity has remained a mystery, but now I. M. Spector of the Institute of Traumatology in Kazan, U.S.S.R., has made an intriguing correlation among existing data. Longevity, he says, depends on protein turnover rate: The faster the turnover, the shorter the life span.

Spector has matched the maximum life span of a species with the time required for half of the protein in the body to be replaced by new. He finds, for example, that the "half-life" of the protein albumin in mice is only 1.2 days; in dogs, 8.2 days; in man, 15 days—a progression strikingly similar to that of the animals' longevities. Not all species fit in so nicely; cows and other herbivores have albumin half-lives greater than man's, but live, at most, about 20 years. Nevertheless, Spector believes his discovery, reported in the May 3 NATURE, may help point the way to finding the molecular basis of aging. As he points out, protein turnover rate characterizes the intensity of protein synthesis of a species, and in turn with DNA activity.

Deflowering Central America

Daniel H. Janzen, the outspoken advocate of setting aside large tracts of land as habitats to preserve endangered species (SN: 4/13/74, p. 239), chronicles the dangers of piecemeal habitat destruction in the April NATURAL HISTORY.

The most subtle danger, he says, is extinction of vital "ecological interactions" in complex, interdependent biological systems, such as the dense forests of Central America. Many tropical plants, for example, occur only rarely, separated by large distances, yet requiring cross pollination.

The task falls to specialized bees that may make round trips to plants more than 14 miles away, using well-memorized paths, in less than an hour. As forests are broken up, nest-site destruction removes the bee population and, in turn, forces out the plants that depended on them. Such pressures, Janzen says, may eventually cause extinction of various Central American orchid species, for example.

But the problem is greater than the survival of some pretty flowers. Many yet-undiscovered ecological interactions underlie the world's habitats and destruction of some of these could have vital impact on man.

Of owls and turrets . . .

For more than a century "The Castle," the Smithsonian Institution's original building on The Mall in Washington, had owls in its turrets. They were shooed away in the 1950's, but with the renewed interest in wildlife, barriers were removed two years ago in hopes they would return. None did, so the Smithsonian has now borrowed a pair of barn owls from the National Zoo to get things going again.

. . . and mice and music

As part of a high-school science project, Glenn Taylor of Avondale, Md., exposed two mice to different kinds of music. After listening to soothing violins eight hours a day, one mouse cut his maze running time from 35 down to 20 seconds. After similar exposure to a radio rock station, the other mouse could barely stagger around the maze in five minutes. Taylor and a friend were going to attempt rehabilitation when the family cat ended the experiment.

Botany

Plants and genetic engineering

It is well established that purified DNA (genetic material) can be taken up by bacteria and that the recipient cells are able to incorporate the DNA into their chromosomes and express the genes acquired. It is also possible to make genetic changes in a mammalian cell by using a bacterial virus to introduce a specific gene (SN: 10/23/71, p. 280).

Now L. Ledoux and R. Huart, biochemists at the Center of Study of Nuclear Energy in Mol, Belgium, and M. Jacobs, a plant geneticist at the University of Brussels, report in the May 3 NATURE that thiamine deficiency in the flowering plant *Arabidopsis thaliana* can be corrected by bacterial DNA and that this correction can be inherited.

Ledoux and his colleagues found some strains of *Arabidopsis* that were not able to synthesize thiamine and hence could not grow and reproduce if they were not given supplements of thiamine. They then treated the plants with bacterial DNA and found that the plants could grow and reproduce without thiamine supplements. The plants were able to produce progeny that were not deficient in thiamine.

It appears, then, that the bacterial DNA provided the plants with the missing thiamine gene and that this genetic correction was somehow passed on to the next generation.

Why zinnias aren't roses

Since there is a link between DNA content and the length of the cell-division cycle of plants, some plant biologists have assumed that low DNA content might determine the brief life spans of annuals. Botanist W. Nagl of the University of Vienna decided to see if other factors may be involved.

Nagl studied the nuclear DNA content, the cell-cycle duration and the amount of heterochromatin in eight types of plants: three perennial species, three annual species with a lower DNA content and two annual species with a lower DNA content than the related perennials. Heterochromatin is DNA mixed with protein; it lines chromosomes.

He reports in the May 3 NATURE that in all annuals tested, the cell-cycle time was shorter than in the related perennials, in spite of the greater DNA content in three of the annual species. But these three species had a proportionately greater amount of heterochromatin than their perennial relatives. The percentage of heterochromatin within a given cell nucleus might, therefore, along with nuclear DNA, control the duration of the cell cycle.

Plant growth and cyclic AMP

Cyclic AMP is a chemical that regulates various activities in cells, often at the prompting of hormones outside the cells. It is known to be involved in the regulation of growth in bacteria and higher animals (SN: 2/23/74, p. 118). There is evidence that cyclic AMP also regulates the growth of higher plants. But there has been no firm biochemical evidence that any of the proteins in higher plant cells, nor any of the enzymes in these cells are controlled by cyclic AMP.

Now an enzyme has been purified from wheat seedling leaves that is inhibited by cyclic AMP. G.M. Polya, a biochemist at La Trobe University in Melbourne, Australia, reports the work in the April PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES.

Since cyclic AMP appears to help regulate growth in plants, negative control of this enzyme may be "a significant component of growth regulation," Polya suggests.