Zoology

Muscle movements in chicks

An embryonic chick's muscle movement may be responsible for its skeletal development, G. E. Sullivan of the University of Sydney concludes in the AUSTRALIAN JOURNAL OF ZOOLOGY (22:429). In an experiment designed to link a chick's bone growth with its movement inside the shell, Sullivan paralyzed six-day-old chick embryos, then recorded their skeletal development. His results confirm what scientists had suspected: Unless the embryo exerts counteracting muscle pressure against the fluid in the amniotic sac, its joints will freeze, or even fuse, resulting in such distortions as rigidity of the neck, bowed bones and twisted vertebrae. Fifty-six of 61 experimental chicks (dosed on day six) had their heads tucked to the right, disproving previously held theories that chicks don't tuck their heads until day 17, in preparation for hatching.

Whether a chick's reaction to the pressures of an egg can be compared with those of a mammalian fetus in the womb is another question, but there is evidence, Sullivan notes, that a lack of amniotic fluid can deform unborn infants, even if nerve and muscle functions remain normal. The correlation to chick eggs could foster research into such human deformities as club foot, wry neck and scoliosis.

Pulling hair: Cycles of replacement

Pulling your hair probably won't leave you bald, but neither will it make room for longer, thicker locks, at least if rat experiments are any indication of human experience. Patricia A. Hale and F. J. Ebling, both zoologists at the University of Sheffield, England, pulled hairs out of rats and in several related experiments gave them thyroxine and estradiol growth hormones to test their influence on making new hairs grow. Although interrupting the growth cycle of hairs by pulling them out may rephase the cycle, it does not affect the length, rate or duration of growth of the hairs that subsequently sprout, either in untreated or hormonally treated rats, the scientists say. Thyroxine shortened the rest stage of the hair-growing cycle, and increased the growth rate, so that new hairs "caught up" with the cycles of adjoining hairs. Estradiol shortened the active growing phase, and consequent growth rate, but neither drug influenced the ultimate length of new hairs. Pulling hair is like resetting an alarm clock, Hale and Ebling say—the time at which the alarm goes off (or new hair appears) can be changed, but the growth and length of hair can't.

Without olfaction, hamster sex stops

An animal's sense of smell may not be as vital to its sex life as scientists thought, J. Bradley Powers and Sarah S. Winans, neuroscientists at the University of Michigan, say in the March 14 SCIENCE. Instead, its vomeronasal canals, those nasal tubes that relay nerve impulses, via an accessory olfactory bulb, to the brain, may trigger copulation. Experimenting with male hamsters, the scientists discovered that even when a hamster can't smell the female's vaginal odor it mates normally. When a hamster's olfactory nerves are severed, it may or may not cease copulation altogether. But a hamster who loses both the sense of smell and use of his nerve endings, or has his olfactory system removed altogether always ceases copulation. The experiment for the first time clearly demonstrates the importance of the vomeronasal tubes, and their importance in carrying messages to the hypothalmic regions of the brain, which influence sex behavior.

Botany

The underwater life of rice

Most rice species, if one is in the right frame of mind, can be thought of as amphibious. They grow, as do many other swamp-loving plants, both in and out of the water. And, like frogs or newts or axolotls, they seem perfectly happy in both environments. But how do the roots, while surrounded with water, get enough oxygen to support the plant's metabolic needs? Three Australian agronomists explore this question in the AUSTRALIAN JOURNAL OF PLANT PHYSIOLOGY (1:513).

C. D. John, V. Limpinuntana and H. Greenway of the University of Western Australia wondered whether enough oxygen is absorbed by the leaves of rice plants, the world's most important crop, to supply the plant's metabolism or whether there are other adaptive mechanisms. They sprouted rice seeds and raised plants in a nutrient solution. At four weeks, they flushed nitrogen gas through the solution to make it anaerobic, then measured different types of metabolic activity. They found an increase in oxygen transportation from the shoots to the roots, and a shortening and increased branching of the roots. This structural change probably allows for easier transportation of the oxygen.

But they also found marked differences in the way the roots take up and absorb nutrients. An oxygen-depleted environment inhibits the uptake of potassium, phosphorus and chlorine ions, they found. This is counterbalanced by the roots' increased capacity to absorb the ions they take up. The team will continue to study the various adaptive mechanisms in "amphibious" plants, but for now, they conclude, increased oxygen transport is not the only answer.

Evolving with blue-green persuasion

Nature moved a step forward in its grand design about a billion years ago when eukaryotic cells appeared. These cells, the type found in almost all plant and animal tissues, have a higher internal order than the more ancient prokaryotes. Now, only bacteria and blue-green algae carry forth the prokaryotic heritage of primitive internal structure. Most scientists believe eukaryotes evolved from prokaryotes in some way, but billion-year-old evidence is hard to find. Biochemical evidence in living cells is easier.

Molecular biologist R. P. Ambler of the University of Edinburgh and chemist R. G. Bartsch of the University of California at San Diego looked for the similarities in the amino acid sequences of an enzyme found in both prokaryotic and eukaryotic plant cells. The enzyme, cytochrome *f*, is a carrier molecule that helps a plant store energy during the day for its nighttime tissue-building activities. The team compared the sequence of cytochrome *f* in blue-green algae with the sequences from three other types of algae and a photosynthetic protozoan, all eukaryotes.

They found the blue-green cytochrome *f* to be as similar to each of the eukaryotic versions as they are to each other. The scientists, in a NATURE report (253:285), pose three explanations on the basis of these facts. 1) All the genes in the eukaryotic cells may have come originally from a prokaryote related to blue-green algae. 2) The genes for the photosynthetic machinery (including cytochrome *f*) may have come from a blue-green relative but the rest were derived from other ancestors. 3) The cytochrome *f* genes only were transfered from blue-greens to eukaryotes or vice versa somewhere during the course of evolution.

It is not going to be easy to choose one of these alternatives, they state, but they are planning more sequencing experiments now with this in mind.