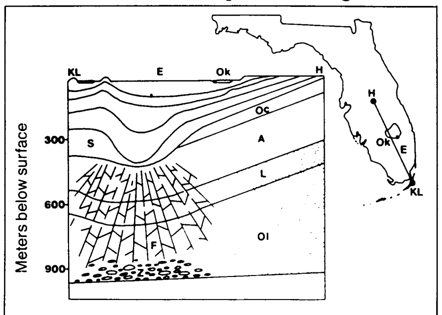
rocks. Petuch argues that had an asteroid bombarded the carbonate rocks under Florida, carbon dioxide and calcium oxide would have been produced. And since calcium oxide grains are water soluble, any trace of them at the Eocene-Oligocene layer would have long ago dissolved, leaving only the iridium dust.

While Shoemaker has no quarrel with Petuch's scenario from the growth of the coral reefs onward, he doesn't think there is evidence for an impact. He argues that



George Valcarce/Fla. International Univ.

At right, dark ridges surround the oval-shaped Everglades. The stippled area represents the missing Eocene layer. Petuch thinks an asteroid hit near the Everglades' southern tip, creating the fracture zone and leading to the sedimentary patterns shown in the cross section above. (Letters refer to geologic formations and geographic locations.)

the proposed asteroid would have deposited material outside the crater and would not have wiped away the Eocene layers. He also contends that chunks of asteroids are never found buried beneath craters and that the magnetic anomaly in Florida is not consistent with the way impacts are known to alter the magnetic fields of rocks.

Petuch says he welcomes other theories explaining the Florida magnetic anomaly, but he thinks the impact idea is the only plausible one now in the running. "This is the last place in the world you'd expect to see such an anomaly, because the nearest igneous rock [that would have a magnetic signal] is over 5 miles straight down through solid limestone," he observes. Moreover, he argues that the bulk of impact research to date has focused on craters in continental crust and that the record of an impact may look considerably different in carbonate rocks. The Florida impact could represent "a whole class of craters to itself, completely different from any other one known," he says.

If Petuch is proved wrong, he has, at the very least, raised some tantalizing questions about the geology of Florida—questions that he hopes will inspire more field work. And if he is right, he should expect standing-room-only crowds for some time to come. *—S. Weisburd*

Switching-on genes in development

Studies of the simplest gene system in plants and animals are drastically changing scientists' ideas of how genes work in complex organisms, Donald D. Brown of the Carnegie Institution in Baltimore reported last week at the National Institutes of Health in Bethesda, Md. Whether these genes are active or silent, he has found, depends both on the folding of DNA with proteins into its characteristic "chromatin" structure and on the stable binding of particular proteins to a site in the center of the gene. This mechanism of gene control is quite different from that of bacteria, which previously was the only such mechanism described at this level of detail. Gene regulation is a basic puzzle of modern biology, with implications for all aspects of how organisms function.

Brown and his colleagues studied two families of genes found in the African clawed toad, *Xenopus laevis*. Each gene encodes a small RNA molecule, called 5S ribosomal RNA, which is part of the cellular organelle that makes protein. The two families of genes are called the oocyte (egg cell) genes and the somatic (body) genes. The families differ in about six positions among the 120 nucleotides that make up each gene.

In the toad egg cell, or oocyte, all of the 5S ribosomal RNA genes are active. But because there are 20,000 oocyte genes and only 400 somatic genes, the oocyte form of 5S ribosomal RNA predominates. In contrast, in somatic cells of the toad, the somatic genes are 1,000 times as active as the oocyte genes.

A two-tiered system governs the activity of the oocyte gene, Brown reports. The top tier involves chromatin, the natural chromosomal structure in which the DNA is condensed with proteins called histones. Brown's team has developed a new test that measures the activity of chromatin, rather than just naked DNA. When the chromatin from somatic cells is dipped into a solution containing all the required components, the somatic genes are expressed and the oocyte genes remain repressed, as in the intact cell.

The scientists next disrupted the chromatin structure, dissociating the DNA from the histone H1. The result was a massive synthesis of the oocyte form of 5S ribosomal RNA. Brown concludes that the repressed state of this gene and others is maintained by the interaction between DNA and histone H1.

The second tier of gene control relies on three proteins that Brown calls transcription factors A, B and C. These proteins must bind to the center of the gene, forming a "transcription complex," before the enzyme called polymerase III begins making new RNA.

The surprising finding about this transcription complex is its stability. It remains in place for many rounds of RNA synthesis. Somehow the complex avoids being knocked off the DNA as the polymerase works its way along the gene. "The polymerase goes through the transcription complex as if it were butter," Brown says.

In recent experiments, Brown and his colleagues demonstrated that the presence of a transcription complex underlies the specific activity of the oocyte gene. In the region where the factors bind, the oocyte and somatic genes differ by three nucleotides out of 50. The A factor, they find, binds more strongly to the somatic than to the oocyte gene. This discrimination is most evident in situations where there is limited factor. In the oocyte there are 10,000,000 factor A molecules per 5S ribosomal RNA gene, but in the somatic cell there is only one factor A molecule for every five of these genes.

The intriguing question now is whether the transcription complex is the "memory" that maintains the activity state of the gene from one cell generation to the next. If so, it might be the basis by which—as an organism differentiates — various cell lines become committed to expressing different patterns of gene activity.

—J.A. Miller

Paying attention at many levels

An animal is continuously bombarded with sensory input — all the sights, sounds, smells and skin sensations delivered by the environment. Somehow the brain selects from this barrage the relatively few stimuli important for the animal's immediate behavior. This essential screening occurs at many levels within the brain. But surprisingly, scientists now report, the screening process begins before the signals reach the brain's complex processing centers, perhaps even before they reach the brain.

"The screening occurs right when information comes into the central nervous system, not as some higher function of the cortex," Mary C. Bushnell of the University of Montreal reported last week in Dallas at the meeting of the Society for Neuroscience. The new data stem from scientists' increased ability to study awake animals trained in particular tasks.

In their recent experiments, Bushnell and Ronald Dubner of the National Institute of Dental Research in Bethesda, Md., trained monkeys to press a button to begin a trial, to wait for a cue and then to release the button to get a juice reward. Each monkey learned to recognize two cues—a light signal and small increase in heat from a heating element on its face.

The scientists recorded the electrical activity of nerve cells that receive input from the face's pain receptors. These cells are in a lower brain area called the dorsal horn of the medulla, but are comparable to cells found in the spinal cord that respond to pain elsewhere on the body.

In each test, whether the monkey was to respond to the heat or the light cue, the scientists applied the same amount of heat to the monkey's face. But the response of the dorsal horn cells differed according to the cue relevant to the monkey's current task. When the monkey was instructed to respond to the heat cue, its dorsal horn cells showed increased activity after the heat increment. But when the monkey was instructed to respond to the visual cue, the dorsal horn cells responded to the heat increment with half this activity or less.

The dorsal horn cells receive the message instructing whether or not to pay attention to the pain input from higher brain regions, but the scientists do not yet know what brain areas are involved. The magnitude of the dorsal horn response reflects how well the animal can detect a small change in stimulus, Bushnell reports. The animal is better able to analyze an expected stimulus than an unexpected one. The scientists expect to find the same sort of early screening in cells of the spinal cord. They have recently trained monkeys to respond to heat on their hands, but have not yet recorded the activity of the spinal cord cells. —*J.A. Miller*

A brain-damage advantage for lefties?

For an as yet unexplained reason, people who are predominantly left-handed apparently are able to withstand moderate brain damage with relatively few of the motor problems observed in right-handed victims of brain damage.

Studies of a limited number of brain-damaged left-handers also indicate that they have a quicker and superior recovery of other functions, such as language and visual-spatial processing, than do their right-handed counterparts, says neuropsychologist Jordan Grafman of Walter Reed Army Medical Center in Washington, D.C.

"You can speculate that more transfer of information and shared information processing between left-handers' brain hemispheres might allow for their better recovery after brain damage," observes Grafman. "But so far there is no evidence for this theory."

Grafman and his colleagues chose subjects from a group of left-handed Vietnam veterans who suffered brain wounds without paralysis about 15 years ago. The study sample was composed of 13 men with right-hemisphere damage, 11 with left-hemisphere damage and 13 healthy, non-brain-damaged veterans. The researchers administered eight tests of simple motor functions, including grip strength, finger dexterity (manipulating pegs on a pegboard), coordination (finger tapping and movement tasks) and reaction time (pressing a button as rapidly as possible after seeing a brief flash of light).

Left-handed veterans with damage to either hemisphere performed almost as well as the healthy controls and displayed no severe motor problems, report the investigators in the October PERCEPTUAL AND MOTOR SKILLS. The size of a brain wound, language comprehension and preinjury intelligence scores were not related to motor performance, they note. Curiously, says Grafman, patients with left-hemisphere damage were more likely to have received both physical and occupational therapy, although the reasons for this are unclear.

In an unpublished study conducted by the same scientists, substantial deficits in motor functioning on the same tests appeared among right-handed veterans who suffered damage to either brain hemisphere, compared with a control group.

There are some data suggesting that left-handers have a more equitable distribution of motor and cognitive skills across brain hemispheres than right-handers (SN: 8/17/85, p. 102), as well as indications that left-handers are more likely to have allergies, myopia and learning disabilities, and, paradoxically, are more likely to be intellectually gifted (SN: 4/27/85, p. 263). "It's not clear if left-handers have a developmental disadvantage [compared with right-handers] and an advantage in adapting to brain damage," says Grafman. One reason he is reluctant to interpret his data is that it was not possible to conduct handedness tests on brain-damaged veterans before their injuries occurred. Also, it is not known if healthy left-handers have somewhat poorer motor skills than healthy right-handers across a critical range of performance affected by brain damage; if this were the case, explains Grafman, deficits would appear more pronounced in right-handers because they have more motor ability to lose.

"Unfortunately," he notes, "there is a lack of studies on left-handers, and it's hard to develop an animal model of handedness." —*B. Bower*

Arid land: Sheep may safely graze

Very often goats are the last domesticated animals seen grazing on severely degraded, arid rangelands, like those covering so much of the African Sahel. Overgrazing by livestock — especially by the goats and sheep of subsistence herders — is often blamed for the desertification of these dry lands and the famine that follows (SN: 5/4/85, p. 282). But a new study calls into question this apparent cause-and-effect relationship.

Focusing on the Ngisonyoka people in northwest Kenya, a team of ecologists and anthropologists from Colorado State University in Ft. Collins and The State University of New York in Binghamton studied how use of arid-land resources by nomadic subsistence herders affects the dry-range ecosystem they inhabit. And contrary to what had been assumed for decades by many authorities, the scientists found that traditional subsistence herding practices "may be cornerstones of [ecological] stability and sustainable [agricultural] productivity rather than prescriptions for degradation and famine."

For roughly four years, the researchers studied 9,650 herders and their livestock: 85,200 sheep and goats, 9,800 cattle, 9,800 camels and 5,300 donkeys. Their goal was an "energy flow" analysis of the ecosystem: a quantitative picture of how much of the energy contained in native vegetation was being extracted — primarily through grazing animals — to feed and shelter the nomad community. An account of their findings appears in the Nov. 8 SCIENCE.

Milk — more than half of which came from camels—accounted for 80 percent of the nomads' livestock-derived diet; meat and blood each contributed another 9.5 percent. Livestock accounted for three-fourths of the total nomad diet, more than twice its percentage in the typical U.S. diet, according to Michael Coughenour of Colorado State. Most of the rest came from food purchased with livestock products.

The overall effect of this "flow" amongst the land, animals and nomads, the researchers conclude, was that subsistence herding did not degrade the ecosystem. One reason for this is that the primary human staple, camel's milk, is ultimately derived from the plentiful, hardy, woody plants.

Not only does this traditional subsistence pastoralism (livestock agriculture) apparently preserve the fragile arid ecosystem, the scientists found, but also "it appears that the negative effects of drought, including famine, could be lessened if development policies and procedures recognized the appropriateness of pastoral ecosystems in these environments."

Research on subsistence pastoralism in Brazil and northern Peru by James Phister, a Texas Tech University range scientist based in Lubbock, shores up that conclusion. Since subsistence herders tend to be "in harmony with environmental fluctuations," Phister says, it's unlikely their animals will overgraze — unless outside subsidies, such as water (for irrigation), fertilizer (for cultivation) or money (for food and animals), encourage the herders to settle in one place. — *J. Raloff*