Continued from page 55
smoking, like tobacco smoking, may be related to lung cancer (though the relationship has not been documented).

Increased risks of lung cancer and other respiratory problems associated with smoking have led researchers to seek alternate methods of administering marijuana. One method being investigated is the delivery of THC in aerosol form. Tests show that this method has a more pronounced effect than smoked marijuana. Even so, because of possible side effects (including legal as well as psychological implications), it is not likely that marijuana will become a medically recommended therapy for asthma or other respiratory ailments in the near future. □

A sloth and a moth deserve each other

Three-toed sloth: Snout moth habitat.

The dung-eating snout moth and the three-toed sloth may be two of the grubbiest animals on earth. Their eating habits and life cycles are guaranteed to decrease the appetite and to offend polite people of all political and moral persuasions. But they are, nevertheless, first-rate examples of symbiosis and the adaptibility protoplasm is famous for, and are, moreover, the subject of a recent study.

The three-toed sloth is a primitive mammal that lives—very quietly—in the forests of Central and South America. It is known, of course, for its extreme lethargy, hence, its common name. It hangs in the forest canopy, and reaches out occasionally to pluck leaves from three favorite tree species, and is thus classified an ''arboreal folivore'' (a tree-dwelling leaf eater).

It is no surprise then, considering this classification, that a Smithsonian Institution mammalogist who specializes in arboreal folivores and is stationed at the Smithsonian's laboratory in the Panama Canal Zone, should choose to study the three-toed sloth. G. Gene Montgomery and his student Jeffrey K. Waage from Princeton University, decided to look more closely at a favorite entomological legend—the moth that lives on the three-toed sloth.

The insect is a member of the large snout moth group and lives in the sloth's fur. That fur is practically a self-contained ecosystem: Two species of blue-green algae grow on the long, thick hairs and provide the sloth with protective coloration as it hangs, back toward its predators. The algae, in turn, have a handy substrate on which to grow, and also feed the sloth moth.

Before the Smithsonian study, biologists thought the moth lived out its entire life cycle—from egg to imago (adult)—on the sloth's back. They also thought the moths lived on eye and nasal secretions as well as algae. By careful observation and laboratory work, however, the team was able to predict what is probably the moth's actual life cycle in the July 7 SCIENCE.

Pregnant female moths probably climb off the sloth's back and lay eggs in sloth dung as it is deposited on the forest floor. Larvae grow and feed there, then, as young adults, find a new sloth and nestle into its fur. There, they eat sebaceous secretions from the hair roots and maybe some trapped rainwater enriched with skin secretions and algae by-products.

The moth isn't really a parasite, they state, but derives three advantages from its slow-moving habitat: a good nutritious place to lay its eggs, a place to hide from birds and other predators and an enhanced diet. Advantages to the sloth are unknown but the ecological microcosm of sloth-fur-algae-moth-dung makes a good—albeit a touch distasteful—study in natural adaptation. □

The multiply-spinning proton

Spin is a basic characteristic of physical particles. The peculiarities in the way that one particle's spin interacts with another's and with the force fields that surround them, play a determining role in the structure of atoms and atomic nuclei. These structures are low-energy phenomena. In them, the small energy differences derived from spin effects are important, but physicists had generally thought that in high energy phenomena, these small differences would have an increasingly negligible effect.

A recent experiment at Argonne National Laboratory seems to show the contrary. Spin appears to be at least as important and possibly even more important in high-energy phenomena as in low-energy ones. The experiment was done with protons, and one of the particular things it appears to show is that different parts of the proton spin at different rates—at high energies at least. Alan Krisch, K. Abe, R. C. Fernow, T. A. Mulera and K. M. Terwilliger of the University of Michigan and W. DeBoer of the Max Planck Institute in Munich did the experiment with a beam of polarized protons from Argonne's 12-billion-electron-volt Zero Gradient Synchrotron.

Polarization is the key to the experiment. When two spinning particles strike each other and scatter apart, the orientations of their spins will have some effect on just how they scatter. (This can be verified on a billiard table.) What kept physicists thinking for years that the spin-spin interaction between two colliding particles at high energy didn't have much effect was that they could not sort out the spin-spin effect, and it didn't seem to matter much that they couldn't.

The reason for that is that in the usual high-energy accelerator, the protons in the beam come out with their spins randomly oriented. In collision experiments the spin effects went every which way and tended to cancel or wash each other out. If one could get a polarized beam, a beam in which all the spins were going in the same direction, then all the spin-spin effects would go the same way, and it might be possible to find out what they were at high energy.

In recent years technological improvements have enabled Argonne to provide such a thing. The ZGS can accelerate a beam of polarized protons, and they happen to be the highest energy polarized protons in the world.

The data from the present experiment show a parallel to those of an experiment done ten years ago, in which Krisch was also involved, one that appeared to find a layered structure in the proton. The older experiment investigated the proton's structure by scattering probe particles of ever-increasing energy off it. As the energy of the probes went up, two points were found at which the probability of scattering (the cross section) jumped up in a suddenly discontinuous manner. These points can be interpreted as boundaries within the proton and as evidence for a layered structure inside it.

In the present experiment, the spin-spin effects show abrupt changes at the same boundaries, and the interpretation of that is that the different ''layers'' of the proton spin at different rates. The results also seem to indicate that the effect of the spin of the inner core of the proton grows as the energy goes up, while the outer layer seems to spin more slowly.

The results are expected to have an important bearing on the understanding of the forces that hold atomic nuclei together. Exactly what changes theorists will make in the theory of high-energy interactions is not yet clear. Meanwhile, according to a spokesman, similar studies of the proton's partner in nuclear structure, the neutron, are contemplated. □