

'Pill' Gives Inside View

Animals from lizards to humans are swallowing tiny radio transmitters giving scientists data on basic body functions—By Patricia McBroom

► ON ANY ONE day in the United States some 200 to 300 animals are running around free and unencumbered while they give off radio signals from tiny transmitters in their stomachs.

The animals have no discomfort. Their lives are normal. They have simply been made to swallow a "radio pill," enabling scientists to gather round-the-clock recordings of heart beat, body temperatures, blood pressure and other physiological measurements.

In rough terms this is the scope of the nation's current program in biomedical telemetry, a 10-year-old science by which biologists are gathering previously unobtainable facts on animals and even humans.

Among the animals that have taken radio pills are snakes, rabbits, iguanas, dogs, monkeys, a 400-pound Galapagos turtle—and humans.

Dr. Samuel McGinnis, a dedicated telemetry scientist from California State College, Hayward Calif., recently traveled to San Blas, Mexico, to monitor body temperature in the green iguana, *Iguana iguana*. Dr. McGinnis used a large transmitter the size of a finger in order to obtain a radio range up to 300 feet. He had to implant it rather than put it down the animal's throat. He and his team then camped out under a tree to listen. Among other things, they discovered that "if you're a tropical lizard, the only way to cool off is to get in a thunderstorm." In a storm the iguana's body temperature might drop to 64 degrees F. (Normal range is 64 to 108).

A lizard common to the U.S. Southwest, on the other hand, hibernates every night, said Dr. McGinnis. His temperature hits a low of 53.6 F.

Dr. McGinnis was one of several hundred international and U.S. representatives who attended an intensive four-day course on biomedical telemetry, sponsored by the Smithsonian Institution and the American Institute of Biological Sciences.

Conducted by Dr. R. Stuart Mackay, the conference made clear that radio pills have medical usefulness, apart from their job in broadening scientific knowledge.

A number of drugs affecting intestinal contractions could have been tested in no other way, said Dr. Mackay. Once swallowed, the radio pills picked up blood pressure changes due to peristalsis.

Another use is in mapping the pattern of stomach spasms in healthy people, to compare to those with ulcers.

Dr. Mackay, a physicist from the University of California at Berkeley, is building a transmitter that will sense the site of internal bleeding.

Considering the ease and economy of using the radio pill which passes naturally out of the body, astronauts might be expected to make a veritable meal of them before a flight. This would eliminate many contraptions they now carry into space. So far, however, the method has not been adopted.

Dr. Mackay said his primary interest is the physiology of diving. To this

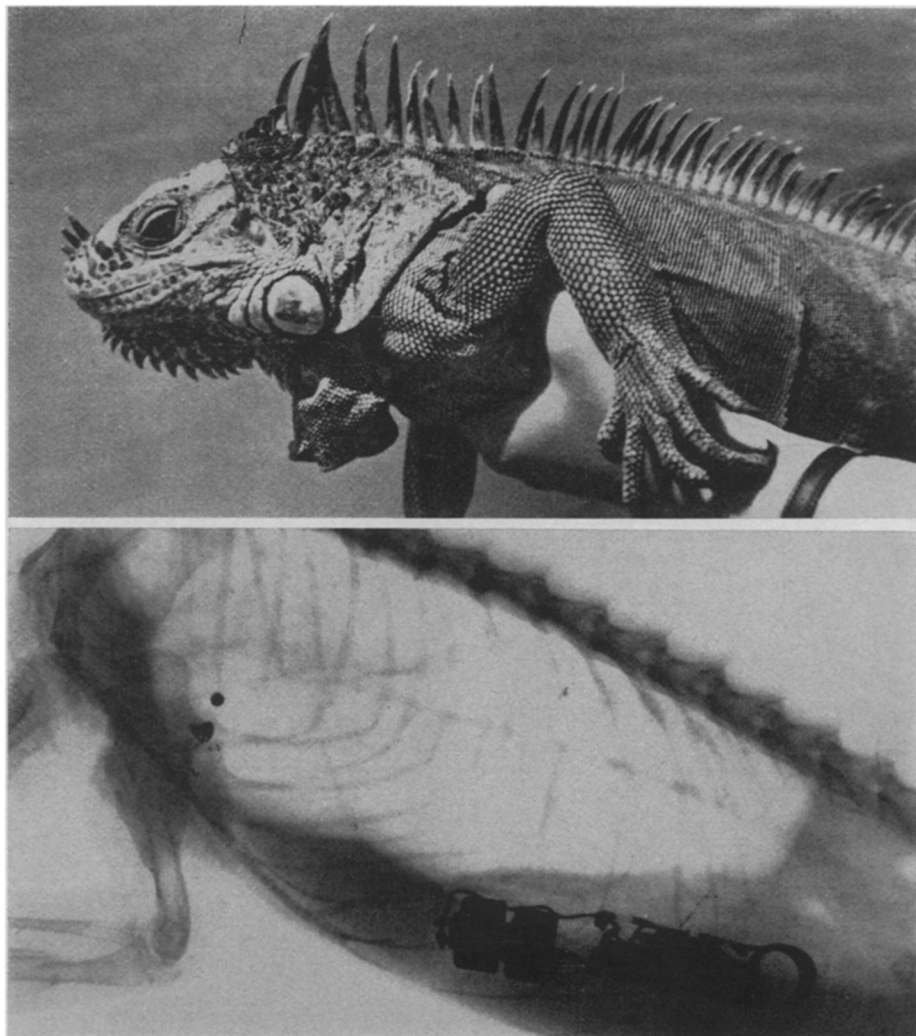
end, he is charting the dolphin's system at Point Mugu in California.

He has discovered that the dolphin seems to have an economical way of conserving oxygen during a dive. As the mammal swoops down holding his breath, his heart rate slows down. The apparent reason, Dr. Mackay said, is to pump blood only to vital places—the brain and the heart. Tissues can get along for a while on little oxygen; the brain cannot.

The human heart also slows down slightly in a dive, Dr. Mackay noted, but the change is not nearly so obvious.

Perhaps the most delicate telemetering is done not from a swallowed transmitter, but from one implanted in the eye. This has been done experimentally on animals. The wound heals and the animal sees as before, while the scientist finds out something about eye pressures.

Pointing at his audience of some 300, Dr. Mackay said that five in that group would go blind in their lifetimes. With more information on pressure changes, he said, this blindness may be avoided.



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THE IGUANA AND THE 'PILL'—A fairly large transmitter, the size of a finger, was implanted in the stomach of this green iguana or *Iguana iguana*.