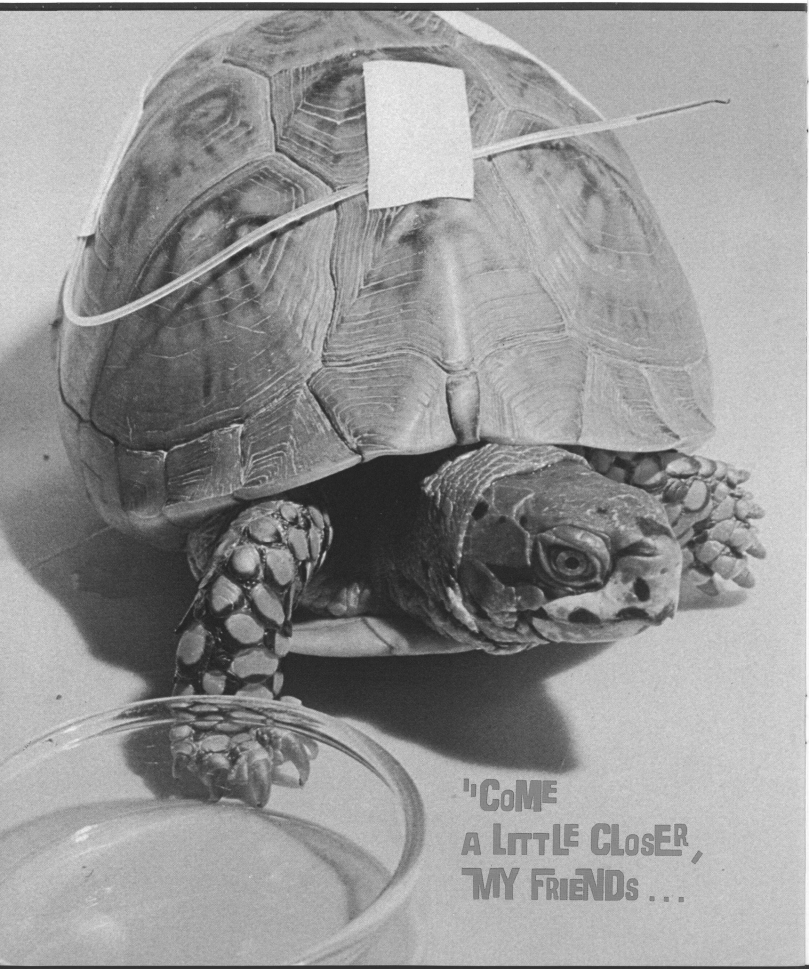
By Jill Southworth

EXPERIMENTAL PHYSIOLOGY: EXPLORING THE MECHANICS OF LIFE



. . . LET ME TELL YOU ABOUT ONE OF THE MOST MIRACULOUS DISCOVERIES OF THE MODERN AGE.!

It will bring bigger steaks to your table, revolutionize open-heart surgery, put a man into space with a 1000-year life potential and find out why that flock of chickens in your very own backyard can no longer lay a good egg." So the proverbial pitchman might bark a certain multi-disciplinary program on the Columbia Campus.

But nothing is as simple as it sounds. Even though environmental physiology holds hope in certain areas proposed by our barker friend, there is still much research to be done before those exact promises are truthfully tacked on the label.

Man in his rapid mechanization has sacrificed much. The last breath of "clean air" has disappeared from the North American continent. Certain saltwater fish carry so much mercury they are unfit to eat. Cattlemen are becoming increasingly alarmed by vehicle exhaust poisoning their herds. These environmental situations all have an effect on the physiology of living things, but to what extent is yet to be discovered. In a quest for the answer, the National Institute of Health funded the Environmental Physiology Traning Grant program on the Columbia campus. It pulls together creative, farsighted faculty members from a variety of areas to conduct individual studies, while also training scientists for the future. Medical men, agricultural experts, veterinarians, a wide range of physiologists, pathologists and engineers all contribute their talents to explore the changing balance of physiology and our environment. They will, hopefully, help man adjust to his evolving ecology and assist animal and plant life to a better existence.

There are presently eight students on the training grant under the direction of nine faculty members. However, Dr. Harold Johnson, professor of environmental physiology with the Agricultural College and grant director, strongly emphasized the wider range of students the grant members hope to reach.

"We have weekly meetings and outside speakers for seminars, and any student from any area is encouraged to meet with us. Their studies need only to be able to relate to physiology."

Physiology, roughly, is the study of the mechanisms by which living things function. For example, it explains how man is able to move, see, eat, react to heat and cold; in general, do the things necessary for day-to-day existence. The same functions may be used in physiological reference to animals such as cattle and chickens or crops such as corn — which brings us to conditions affecting animal and plant life: the environment.

Using experimental approaches, the field, and laboratory, environmental physiology students are studying temperature, humidity, solar radiation, altitude, sound, chemical factors in the air, and environmental alterations of food and water. They also are exploring combinations of these factors under the direction of the interdisciplinary grant members.

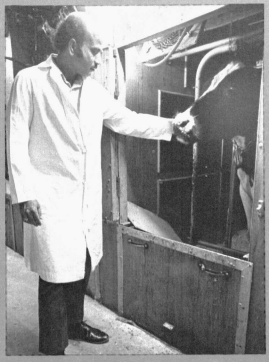
According to Dr. Johnson, "Such environmental factors as trace elements in water and food, naturally occurring or from various chemicals such as herbicides or pesticides, will be included in the training, especially as related to the development of chronic diseases."

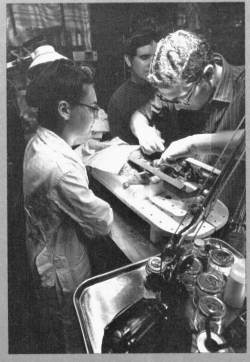
When the environmental physiology grant was established, provisions were made for studies at facilities other than Columbia. After all, Missouri's climate, delightful as it usually is, is not reflective of the whole world. Students are encouraged to visit different laboratories.

Pike's Peak, in Colorado, is good for altitude work; Alaska has cold studies, and North Carolina has special ecological facilities. In recent months there has been an increased interest in desert environments. Besides broadening research, the on-site laboratory work allows a first hand glimpse at problems or virtues in a certain environment.

The University's fine facilities also are widely used, however. The Space Science Research Center is excellent for temperature studies, as is the Atmospheric Science Center. The Climatorium is set up so a constant environment as to heat and humidity may be maintained, while the Nuclear Reactor has special facilities for studies on radiation physiology. Natural environments of various animals can be researched at wild-life conserva-

Dr. Ranadhir Mitra, bottom left, checks one of the project Holsteins in the climate laboratory. Bottom right, PhD candidate Kurt Jacobs makes incision to expose marmot brain in order that electrodes can be implanted on the skull. At right, Larry Magliola prepares a turtle for upcoming experiment to determine how environmental changes affect that creature's physiology.





tion areas and the newly established Fish Pesticides Laboratory. Bio-medical Engineering facilities and the Ecology Field and Training Stations also offer their services.

"Our strengths are temperature studies utilizing research animals," Dr. Johnson stated. "We have Dr. Frank South, who recently organized an international conference on hypothermia (cold studies). Dr. X. J. Musacchia, at the Space Center, works with radiation and low temperatures, and Dr. Wesley Platner is studying electrolyte and fatty acid adjustments during varying degrees of cold. But there is more to the world than temperature.

"Agriculturally oriented persons are extremely interested in the control of environment. Sulphur dioxide poisoning from highways and industrial outlets take their toll on crops and herds. We must measure and quantitate the environment as closely as we do the animals under study. All aspects, causes and effects must be studied."

Individuals on the grant are encouraged to explore their own diverse areas and share the results with the group. Students are strongly urged to formulate original problems for their research. Since the program is under the auspices of the Graduate School, research can lead to the doctoral degree.

First student from the group to receive his doctorate degree is Dennis Rolek, who was awarded a PhD in June 1971. His work was a thyroid study under the direction of Dr. H. E. Dale, professor of veterinary physiology. The thyroid influences a variety of substances, one of which eliminates pollutants such as DDT from the body. The same substance assists growth, milk production, adaptation to climate and reproduction.

"If too much of the substance is demanded by any one function, the others suffer," Dr. Rolek explained. "For example, if a milk cow is exposed to large quantities of pesticide she might continue to produce, but she will store the pollutant in greater and greater concentrations in her body since the thyroid product cannot handle all functions if one begins an unnecessary demand. My studies were aimed at helping that cow produce milk, raise healthy calves *and* eliminate pollutants."

Several students are directing their interests to temperature studies. One, Kurt Jacobs, happily related, "If we can figure out a method to slow

Once a week, student members of the training project meet to discuss progress and problems in their individual work. From left to right are Larry Magliola, Garth Resch, Dr. Mitra (walking in), secretary Chris Lippencott, and Kurt Jacobs. At left, three zebus being tested in the project add an exotic note to the University's Holstein farm.

down body processes with cold in research animals, then apply it successfully to man, a whole new area in open-heart surgery might open up."

Currently open-heart surgery is limited because body functions, such as blood circulation, can be stopped for only a short length of time without damage to the patient. If a safe, forced hibernation were used, slowing blood circulation without harm, doctors could increase surgery time. Too, hibernation could aid man in long distance space survival. The exact length is a scientific unknown, despite the barker's cry.

If you've seen a stooped young man collecting turtles along the road, we hope you weren't too startled. He needs specimens for an environmental study on calcium levels. The turtle doesn't move too much from one locale. It thus provides a pretty good model for changes in that environment over a long period. This student's work goes much deeper than that. It is bound up in hormonal control, the effects of various nutritional states and classical responses.

"Animal adaptation," inserted Dr. Johnson, "is very important. People have become more and more aware of endangered species such as the American eagle. But they don't want an animal adapted to a dirty environment. They want clean animals in a clean environment. That is another reason for the importance of our work."

Another group is studying mechanisms of heat and cold adaptation by studying the physiology of cold-adapted Scottish Highland cattle and the heat-resistant Zebu. Perhaps the result will be gradual selection of the perfect animal for meat production in the American Southwest, where both temperature extremes exist. Dr. Johnson views temperature as the prime factor in the evolution of our present domestic animals and, with tongue-in-cheek, considers this project as a type of forced evolution.

It is doubtful that a circus barker will ever extoll the virtues of such sophisticated, interdisciplinary scientific research. But in the approaching years when you buy a special steak or milk or hear of a spaceman bound for Mars, remember environmental physiology. □

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