intakes, though low, were not reduced to the minima. Repeatedly we[2,6,7] have pointed out that mixtures of purified amino acids, compounded in accordance with the quantitative needs of the cells for each component, may prove to be the most efficient type of nitrogen ever devised for the uses of the animal organism. For some time investigations have been in progress[7] to establish the lowest intakes of such preparations which are capable of maintaining nitrogen equilibrium in the rat and in the dog. The results will be reported later. Inasmuch as the successful use of synthetic mixtures of amino acids in nutrition studies was made possible by the discovery of threonine in this laboratory, it seems not inappropriate to expect that a reasonable period of time will be allowed for the consummation of the program outlined above before similar studies are undertaken by others.

WM. C. ROSE
ELDON E. RICE
UNIVERSITY OF ILLINOIS, URBANA

SCIENTIFIC APPARATUS AND LABORATORY METHODS

DEEP-SEA PHOTOGRAPHY

INTEREST in deep-sea animals had led me to assemble an automatic camera mechanism in a pressure chamber[1] capable of withstanding two miles of depth in the sea, two tons per square inch, with a considerable safety factor. In this self-contained device, two six-volt storage batteries supply the current to run the motor (12 volts) for a 16 mm moving picture camera, a 50 candle power headlight with reflector (8 volts), and a timing motor (4 volts). The light shines through one "herculite" glass window, while the camera takes pictures through another. A pressure gage with electric contacts, which can be set for any depth, activates the mechanism by means of a lock relay. This starts the timing motor whose contacts turn on the movie camera and light (each through a separate relay) for 1.2 second and then turn them off for 11.1 seconds, when the process is repeated. The camera is set to take 16 pictures a second, and the films when developed show 20 light frames between 3 dark ones, since the filament takes some time to reach incandescence and the motor some time to stop. In 100 feet of film, there are about 170 chances of photographing something. Since the pictures are taken in the zone of perpetual darkness, a lure is hung 4 feet in front of the pressure chamber and the camera with stop f 1.5 focused on it. This lure is a wooden fish resembling a deep-sea fish, with rows of photophores painted on it with self-luminous zinc sulfide paint.

In June, through the kindness of Dr. J. F. G. Wheeler, of the Bermuda Biological Station for Research, I had the opportunity of testing the camera, which was let down from the ketch, *Culver,* permanently stationed in Bermuda for oceanographic work under the auspices of the Royal Society of London. Five descents were successfully accomplished in the region 5 to 10 miles southeast of Bermuda, where Beebe[2] has made over 1,500 hauls with nets and many descents with the bathysphere. Three 100-ft rolls of super XX panchromatic film were taken at 500 fathoms, one at 800 fathoms, and one at 1,320 fathoms (1½ miles). In the latter, the chamber touched bottom (although the chart indicated plenty of depth), knocking off a support and turning the camera out of position so that nothing appeared on this film. The other four films showed the lure clearly but no fish or large organisms. However, 17 small creatures, the largest about one centimeter in diameter, too small to be identified, moved across the beam of light in the 300 feet of film taken at 500 fathoms, the depth where Beebe obtained most material in his hauls with the nets. The film at 700 fathoms only showed two small creatures.

Since the lens angle of the camera subtended a rectangle 8×11 inches at 2.5 feet and 20.5×26 inches at 6 feet, the depth of focus for f 1.5 stop, we can think of the camera as sampling a frustum of about 7 cubic feet or one fifth of a cubic meter. Because of the drift of the boat, 510 samples were made in the three films exposed at 500 fathoms and 17 organisms photographed. This is one medium-sized organism per 30 samples or 210 cubic feet (6 cubic meters) of sea.

While no striking photos were obtained of deep-sea fish attacking the lure or one another, the experiments show that deep-sea photography is quite feasible and might be developed into a method of estimating the density of organisms at different depths.

E. NEWTON HARVEY
PRINCETON UNIVERSITY

A GLASS ELECTRODE VESSEL FOR THE DETERMINATION OF BLOOD pH

THE Beckman pH meter may be employed effectively in estimating the pH of whole blood under anaerobic conditions through the use of a special glass electrode assembly. The determination can be made directly on

[6] W. C. Rose, *The Harvey Lectures,* 30: 49, 1934–35.
[7] W. C. Rose, *Proc. Inst. Med. of Chicago,* 12: 98, 1938.
[1] It gives me great pleasure to acknowledge the advice of Dean Greene and Dr. Moody, of the Engineering Department of Princeton University, in the design of the pressure chamber, which was a most acceptable gift of Mr. Owsley Brown, president of the Springfield Boiler Company, manufacturers of the chamber. To Mr. Charles Butt, research assistant in physiology, I am grateful for skilful arrangement of the wiring mechanism.
[2] Wm. Beebe, "Half Mile Down," Harcourt, Brace and Company, New York, 1934.