field have had to exchange ideas and information about techniques and problems. It may lead to a permanent organization. Among the subjects discussed were problems of operation, of mounting specimens, enlarging electron micrographs, interpreting the micrographs and of using the electron microscope for electron diffraction and in the examination of bacteria, cells, rubber, synthetic rubber, cellulose, colloids, powders, clays, ores, smokes, oils, etc. The latest types of electron microscopes were exhibited. Dr. V. K. Zworykin, associate director of RCA Research Laboratories, gave a lecture on the relation of the electron microscope to chemical research.

THE Committee on Meteorological Education of the American Meteorological Society, Professor A. F. Spilhaus, chairman, recently organized a panel of readers from members of the society who are willing to review manuscripts of meteorological books for publishers who may wish to use this service of the society. The panel consists of a number of professional meteorologists, each an expert in one or more phases of the field. Publishers wishing to avail themselves of the services of the panel are asked to address inquiries to the chairman of the Committee on Meteorological Education, stating the type of manuscript to be reviewed. The committee will suggest the individual or individuals on the panel who would be best suited to make the review. In Canada this procedure will be cleared through Dr. Andrew Thomson, the Canadian member of the committee.

THE new plant for the manufacture of electronic tubes of the National Union Radio Corporation at Lansdale, Pa., was formally opened recently with ceremonies in which Army and Navy officers participated. The National Union Company was welcomed to Lansdale by Floyd B. Kulp, president of the borough council, and S. W. Muldowny responded for the company. The plant, representing the most advanced design and construction, is 40,000 square feet in area. Included in it are offices, laboratories and complete manufacturing facilities. All activities are carried out on a single level.

As of November 28, 397 staff members of the University of Illinois had entered the military and navy armed services, while 31 others had been granted leaves for the war service other than in the armed forces. These include members of the university at Urbana and of the Colleges of Medicine, Dentistry and Pharmacy at Chicago.

AT the request of the National Research Council, Washington, D. C., the department of botany of Field Museum, Chicago, is preparing manuals of plants of the tropics which are likely to be of special interest or concern to soldiers, sailors and marines at posts in Latin America. The manuals describe and figure plants which are poisonous or otherwise noxious, as well as those which are valuable as sources of food for enlarging the diet or as emergency rations. The manual on the plants of the Guianas and Brazil, of which a section on poisonous plants has already been printed, is being prepared by Dr. B. E. Dahlgren, chief curator of the department. The manual of plants of Central America is in the hands of Paul C. Standley, curator of the herbarium.

THE Yale chapter of the Society of the Sigma Xi has announced the election of 95 new members and associates who come from 20 states and Argentina and Canada. Of those chosen, 12 are faculty members and research fellows, 44 are graduate students, and 39 are undergraduates. Six undergraduates in Yale College, the School of Engineering and the Sheffield Scientific School received the extraordinary honor of election in their junior year.

DISCUSSION

THE OLD STARFISH-CLAM QUESTION

THE question as to how a starfish can open a clam so as to insert the starfish's stomach between the valves and thus digest the clam has been discussed for generations.

Any one who has tried to pry open the valves of a clam or oyster will feel sure that no starfish could force the valves apart by any sudden pull. During some recent experiments the writer tested the force necessary to open average-sized oysters and little-neck clams (*Venus*) by inserting a steel hook in a notch ground in each valve and then pulling with a large spring scale. One oyster, after having been subjected to a pull of 1,500 grams for 40 hours required 22 pounds pull with the scale before the adductor muscle was torn apart. Another oyster under similar conditions required a pull of 30 pounds. Several clams subjected to a pull of from 23 to 26 pounds were still intact when the shells broke. It would seem, therefore, that instead of being able to resist a sudden pull of 4,000 grams, as has been stated, these bivalves may withstand a pull of from 10,000 to 14,000 grams, or more. It is to be noted, also, that the hooks used in the above experiments were attached to the middle of the margin of the shells, where the greatest leverage was exerted, while only a relatively small number of

tubefeet could find attachment along this ventral margin, and many attached near the hinge would have practically no leverage.

Many of the text-books of zoology discuss this subject and several of them quote from Shipley and MacBride, as in the following, from Newman's "Outlines of General Zoology," 1936: "'It was long a puzzle how the starfish succeeded in forcing its victim to relax its muscles and allow its valves to open. It was supposed that the stomach secreted a paralyzing poison, but it has been conclusively known that this is not the case, but that the starfish drags the valves of its victim apart by main force, often actually breaking the adductor muscles. The pull exercised by the suckers is not nearly strong enough to open the valves at once, but the starfish has staying power and eventually the muscle is slowly forced open.' The secret of the unusual endurance of the starfish is that its tubefeet work in relays, some resting while others work." It will be noted that Newman ascribes the supposed great endurance of the starfish to the working in relays of the tubefeet.

In Bigelow's "Applied Biology," 1911, is given another theory which seems very reasonable. He says: "A starfish fastens its suckers on an oyster, and then the stomach covers the edge of the oyster's shell with the result that the currents of water are stopped and the animal within the shell is killed by suffocation. The shell then gaps open, the starfish's stomach pours in its secretion, the tissues of the oyster are dissolved (digested) while in its own shell, . . ."

How completely the stomach of the starfish covers the edges of the bivalve shells the writer has never noticed; but it seems likely that, at least in the case of those having well-developed siphons, it would only be necessary to cover the region where the siphons are located.

In the fifth edition (1942) of his "College Zoology" Hegner is non-committal, saying simply: "Starfish are often destructive in oyster beds since they succeed in pulling open the shells and devouring large numbers of these bivalves."

In a personal letter Thurlow C. Nelson, an oyster specialist, says: "I have always been most skeptical of the current idea that a starfish opens an oyster by main force." He says, "What I said was that a starfish can not exhaust an oyster owing to the fact that the muscle when closed automatically locks." He refers to the discussion of this locking mechanism in Bayliss's "Principles of General Physiology."

Some three dozen clams (*Venus*) and oysters were tested, by the writer, to get some idea as to their endurance. The bivalves were bought at stores in Morgantown and had all doubtless been out of the sea for considerable but varying lengths of time. The artificial sea water, mostly simply 3.5 per cent. NaCl, was usually at the laboratory temperature from 20° to 27° C. It is likely that under these rather unfavorable conditions the endurance of the molluscs was somewhat reduced. A small notch was ground, on a carborundum wheel, in the ventral edges of the valves, just large enough to insert two small steel hooks. One hook was fixed, the other was attached to a cord that ran over a pulley and had an easily changeable weight attached. The animal was suspended, ventral side up, in the salt water. The extreme ventral edges of the valves were just above the surface of the water. As the valves were forced open the gape was measured, at intervals, in millimeters. There was not much variation in the sizes of the specimens used. A considerable variation was noted in the endurance of both oysters and clams, possibly due to the differences in their individual vitality, just as some will live out of water much longer than others. For example, one clam, whose valves did not seem tightly closed, was opened and its muscles torn apart in 45 minutes by a pull of 3,700 grams; while another clam endured the same traction for 48 hours without the muscles tearing, though the valves gaped 26 mm.

Various weights from 900 to 4,000 grams were used. One oyster with a pull of 1,500 grams, which is more than the estimated strength of the starfish (however, this strength may have been estimated) at the end of 5 days had a gape of only 12 mm, wide enough, perhaps, for the insertion of a starfish stomach. Another oyster, under 1,500 grams traction, had a gape of 11 mm and required a pull, with the spring scale, of 22 pounds (more than 10,000 grams) before it could be torn apart, at the end of 48 hours. One clam, under a traction of 1,500 grams, remained tightly closed for about 45 hours, and at the end of 5 days had a gape of only ½ mm; at the end of 8 days the gape was 7 mm (rather narrow for insertion of a stomach); on the ninth day the muscles were torn apart.

In some cases the valves opened for a millimeter or two within a few minutes, but when the valves were tapped with a pencil they snapped together instantly. In general this more-or-less sudden closure of the valves when tapped occurred even after several hours or even days.

This fairly early opening to a very slight degree might lend support to the theory that the starfish secretes over its victim a paralyzing fluid, since the fluid could pass through a narrow opening that would be quite impassable for the stomach of the starfish. Of course the starfish may have unbelievable endurance, especially if it can rest its tubefeet by using them in alternate groups, as suggested above by Newman.

It would be interesting to test the strength and endurance of perfectly fresh specimens under normal, sea conditions.

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THE FIRST FREE-LIVING FRESHWATER JELLYFISH FROM SOUTH AMERICA

THIS past March, Mr. German Frick, an engineer residing in Santiago, Chile, was much surprised to see jellyfish moving about in a small body of fresh water in Tranque Marga-Marga, near Quilpué (Province of Valparaíso), 40 kilometers from the sea. Seeking more information about them, he took several of them to the senior author who, in turn, appreciating the uniqueness of the discovery, forwarded the specimens to the U. S. National Museum, along with a very realistic, original sketch of the animals.

A comparison with preserved material in Washington readily permits the identification of both sketch and specimens with the well-known widely distributed *Craspedacusta sowerbii* (Lankester). This species has heretofore been reported from Europe (Austria, Czecho-Slovakia, England, France, Germany, Holland, Poland and Russia), Asia (China and Japan), the Hawaiian Islands, twenty of the United States of North America, Panama (in the Canal Zone near Barro Colorado Island) and from an aquarium only at Porto Alegre, Brazil.[1] The present record, however, is the first for the free-living freshwater medusae in South America.

The medusae varied from 5 to 10 mm in diameter. They were much disintegrated after their long voyage to North America. There were at least five series (sizes) of tentacles, and probably seven in the largest specimen; the smallest specimen had only four series.

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DEFORMATION OF ROCK STRATA BY EXPLOSIONS

A RECENT note by Boon and Albritton[1] mentions the Sierra Madera Dome of western Texas as an example of a structure which might possibly have been formed by explosion from a meteoric impact.

It happens that in the course of a routine gravity survey in Pecos County, Texas, stations were made on and around Sierra Madera. The results of this work have been indicated in another connection in a paper by Hammer.[2] The gravity work indicates a positive gravity anomaly with a relief of about 3.5 mg.[3] Presumably if the geologic structure were caused by a meteoric impact, the only explanation for the positive gravity anomaly would be excess mass brought in by the meteor. The form and width of the gravity anomaly can be accounted for by a concentrated (*i.e.*, spherical) mass with its center at a depth of the order of 8500′ and with a total excess mass of the order of 4×10^{15} grams. If it were assumed that this were a sphere of meteoric iron, the required diameter would be about 3000′. The gravity anomaly is quite well centered over the topographic feature and therefore the excess mass must be substantially vertically below the surface geologic feature.

The depth and mass required to explain the gravity anomaly both seem much too large to be associated with a meteorite. Therefore, the geophysical contribution makes it seem much more probable that this feature is caused by igneous intrusion or some other more ordinary geologic processes rather than being the result of a meteoric explosion.

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SEGREGATION OF TYPE SPECIMENS

THE result of inquiries made by a committee of the Systematic Section of the Botanical Society of America and the American Society of Plant Taxonomists shows that of about 76 North American herbaria known to contain type specimens, 23 keep their types segregated from the main collections. In 8 of these, including the U. S. National Herbarium, Gray Herbarium, New York Botanical Garden, Philadelphia Academy, Rocky Mountain Herbarium and the herbaria of the Universities of Pennsylvania, North Carolina and Arizona, the segregation is in progress, but not complete. The Los Angeles Museum has its types stored in a vault in the interior of the country for the duration of the war. The U. S. National Herbarium is preparing to move its type collection to a safer location during the war, but this has not yet been accomplished. The New York Botanical Garden is in the midst of the process of segregation, and as the types are removed from the main collection, they are being sent to an institution in a safer locality.

About 20 of the collections containing types are housed in buildings which are not fireproof. This includes such important herbaria as the U. S. National Herbarium, the Bailey Hortorium and the Arthur Herbarium of rust fungi at Purdue.

What the above means is that in at least 20 American herbaria types are exposed to the risk of fire,

[1] Rudolf Gliesch, *Egatea*, 15: 145–148, figs. 1–11. Porto Alegre, Rio Grande do Sul, 1930. Gives notes on occurrence of both polyps and medusae in an aquarium at Porto Alegre; *Microhydra* is synonymous with *Craspedacusta*.

[1] J. D. Boon and C. C. Albritton, Jr., SCIENCE, n.s., 96: 2496, 402, October 30, 1942.

[2] Sigmund Hammer, "Terrain Corrections for Gravimeter Stations," *Geophysics*, 4: 3, 187, July, 1939.

[3] 1 mg. = 1 milligal = .001 cm/sec.^{2}