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RESEARCH REVIEWS

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COVER PHOTO: This pier, extending out over Lake Gem Mary in Orlando, Fla., is part of the fine new facilities of the Underwater Sound Reference Laboratory. The Laboratory, which is under ONR's technical direction, sets standards for sonar performance and tests new models before they are sent to the Fleet. (See "Testing Tomorrow's Sonar," p. 22.)

Approved by Bureau of the Budget, 13 April 1948.

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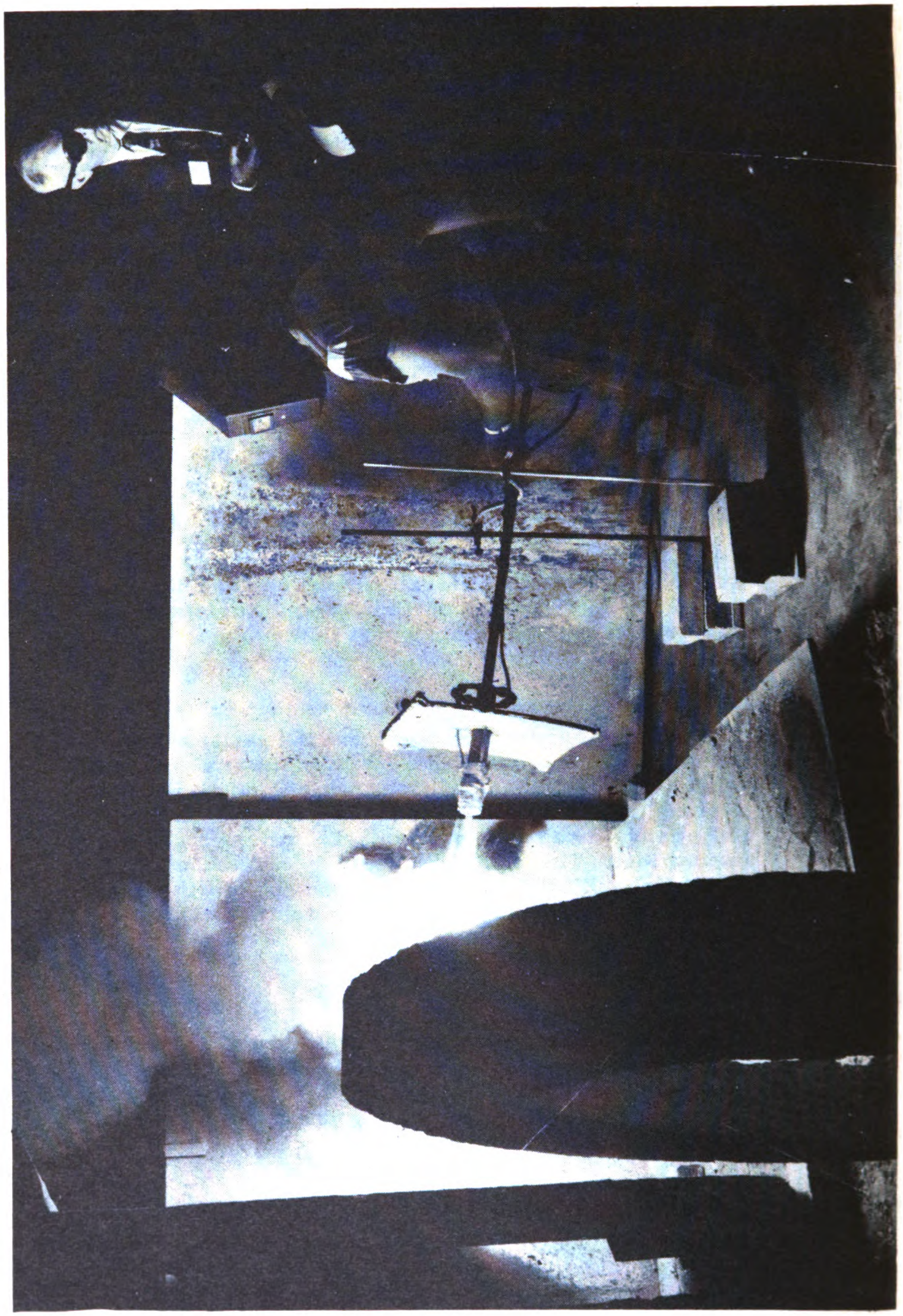

Blasting a hole in a concrete slab with a high-temperature torch.

Temperatures Unlimited

by
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Temple University

Much scientific ingenuity has been expended in recent years on finding ways of producing very high and very low temperatures. One fact is important to remember in dealing with these extremes of hot and cold: while 0° Kelvin (-273° Centigrade) is the lowest temperature imaginable, no upper limit has been set. In other words, we do not know of any maximum possible temperature; theoretical calculations have shown us that temperatures as high as one billion degrees C should be attainable. It is obvious, however, that scientists working in the high-temperature field are confronted with a problem comparable to that of the legendary chemist who found his efforts to invent a "universal" solvent frustrated by the practical difficulty that he would have nothing to keep it in. Research with extreme heats is similarly limited by the materials available for constructing furnaces.

Why are scientists concerned with the problems involved in producing higher and higher temperatures? Their interest stems from the fact that such research can be a valuable tool for progress in both basic and applied science. Industrial heating applications--to mention one practical aspect of such work--are of interest to engineers. Theoretical chemists and physicists, on the other hand, want to make use of intense heat to determine the properties of various substances at high temperatures and to study the nature of radiations produced.

Scientists have already been able to produce very hot reactions although some of the temperatures found in our solar system--the sun, for example--make such man-made temperatures seem insignificant. Table I shows the source of some high temperatures.

Chemical reactions are the means being used at Temple University to produce intensely high temperatures. To accomplish this, a chemical reaction obviously must give off a great deal of heat--or as a chemist would express it--the reaction must be highly exothermic. Moreover, the substances produced by the reaction must be very stable.

We can illustrate the importance of stable reaction products very simply. If substance A combines with substance B to give compound C,

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Figure 1. Spherical furnace for burning metals in oxygen

plus heat, it is obvious that the more of A and B converted, the higher the temperature will be. But it is a well known physical principle, formulated by Le Chatelier, which says that if a system is acted upon, then the system will react in such a way as to reduce the effects of that action. Thus, a heat-producing reaction causes the system to react to reduce the temperature; this means that as the temperature increases, less and less of A and B are converted into C. Eventually a point is reached called "equilibrium" when any further increase in temperature results in a decomposition of the reaction products. It is clear that if C is stable at high temperatures, the reaction will take longer to reach equilibrium; thus more heat can be produced. Herein lies the importance of stable reaction products. Precise mathematical tables have been formulated which predict the temperatures attainable in specific chemical reactions. These are valuable guides in selecting reactions to be used as sources of high temperatures.

One method used at Temple for the production of such temperatures is the burning of substances ordinarily thought to be incombustible. One such reaction is the combustion of aluminum in an atmosphere of oxygen. This metal takes up oxygen very readily and the reaction, when carried out under the proper conditions, is characterized by a high heat

Table I - High Temperature Sources

Source	Temperature
Oxy-acetylene torch	3,100°C
Oxy-hydrogen torch	2,700°C
Langmuir atomic hydrogen torch	3,800°C
Electric arc	3,000°C to 5,000°C
Solar furnace	3,700°C
Sun, center	estimated at 27,000,000°C
Sun, surface	estimated at 5,500°C
Atom bomb	(at instant of explosion) 300,000°C
Atom bomb	(one second after explosion) 5,000°C

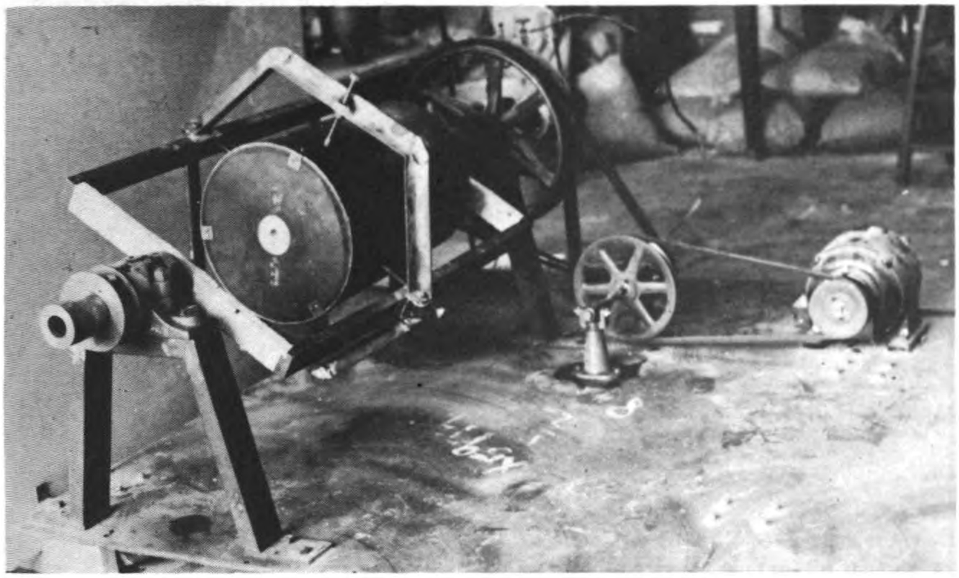


Figure 2. Centrifugal reactor for burning metals in oxygen

release and good stability of the reaction products. Some 7,400 calories of heat are produced for each gram of aluminum consumed. Calculations indicate that a theoretical temperature of 3800° K is obtainable in this manner.

The combustion of aluminum was first accomplished in specially designed spherical containers (Figure 1) constructed of aluminum oxide to minimize chemical interaction between the burning aluminum and the reactor walls. First some aluminum shavings, together with some aluminum powder, are placed in the vessel and oxygen is admitted through the line at the top. Under these conditions ignition may be brought about by throwing a lighted cigarette into the vessel. Once initiated, combustion can be maintained quite easily by feeding aluminum rods into the burning mass. These melt very quickly, forming a pool of liquid metal which, in turn, is raised to its ignition temperature in a few seconds. Combustion of the aluminum vapors takes place at the surface of this pool, giving off immense quantities of heat. The brilliance of this flaming mass is so intense that it has been termed "the skating sun." This name was selected because the pool of burning aluminum seems to be actually

Figure 3. Centrifugal reactor in action--burning aluminum in oxygen

floating about on the surface of molten aluminum oxide. "Suns" eight inches in diameter have been produced.

The photograph in Figure 1 of a spherical reactor in operation shows all the pertinent details. The oxygen feed line enters the top of the furnace and the small opening in the front of the reactor is for purposes of observation (for which dark glasses are essential) and for feeding the aluminum rods. The dense smoke which issues from the small port-hole in the reactor is a mixture of aluminum oxide and excess oxygen. High oxygen feed rates cause more rapid combustion and denser clouds of smoke.

Although the theoretical temperature of the burning aluminum has been calculated to be 3800° C actual temperatures slightly lower than this have been measured.

The combustion of aluminum has also been carried out in a centrifugal reactor, a horizontal cylindrical chamber of plain carbon steel lined with two inches of aluminum oxide (Figures 2 and 3). Sizes used range from 6 to 18 inches in diameter and from 9 to 24 inches in length. Combustion is initiated in the same way as previously described and is maintained by continuously feeding aluminum rods through a stuffing box arrangement. When the combustion has been started and seems to be stable the entire chamber is rotated at 300 rpm, throwing the molten aluminum within the furnace onto the walls by centrifugal force. Oxidation causes the walls of the reactor to be covered with one large continuous "sun". The heat produced, being confined within the rotating cylinder, is intense enough to produce aluminum vapor, which is discharged from the exit port and burns instantly with a brilliant flame. Ordinarily, the feed rate of aluminum in this type of furnace is about one pound per minute.

A third and rather unique method developed for burning aluminum consists of conveying powdered aluminum by a stream of oxygen through a pipe line to a specially designed torch. The tip of this torch is equipped with a small pilot light which ignites the mixture of aluminum powder and oxygen as it issues from the mouth of the burner. The ratio of aluminum to oxygen is usually kept near the stoichiometric value, although this ratio may be varied by simple adjustments on the feed lines. The rates of oxygen and aluminum feed must be adjusted, however, to insure that the powder is properly conveyed in the pipe line and that the speed of the stream through the torch tip is sufficient to prevent flashback. Ordinarily a velocity of 50 ft/sec through the torch tip is sufficient. Nozzle diameters used vary from 1/8" to 1".

The flame produced by this means appears as a ball of fire burning about two inches away from the tip of the torch with such intensity that the operator must wear a protective asbestos suit.

The oxy-aluminum torch has been employed in cutting through concrete, granite, brick walls, ordinary fire brick, aluminum oxide brick, cinder blocks, two-inch armor plate and six inches of steel. The photograph in Figure 4 indicates the results on a slab of concrete four inches thick. This hole, about two feet in diameter, required about one hour to cut. Note the molten concrete at the base of the slab. The cut in Figure 4 is not possible with the ordinary oxy-acetylene torch

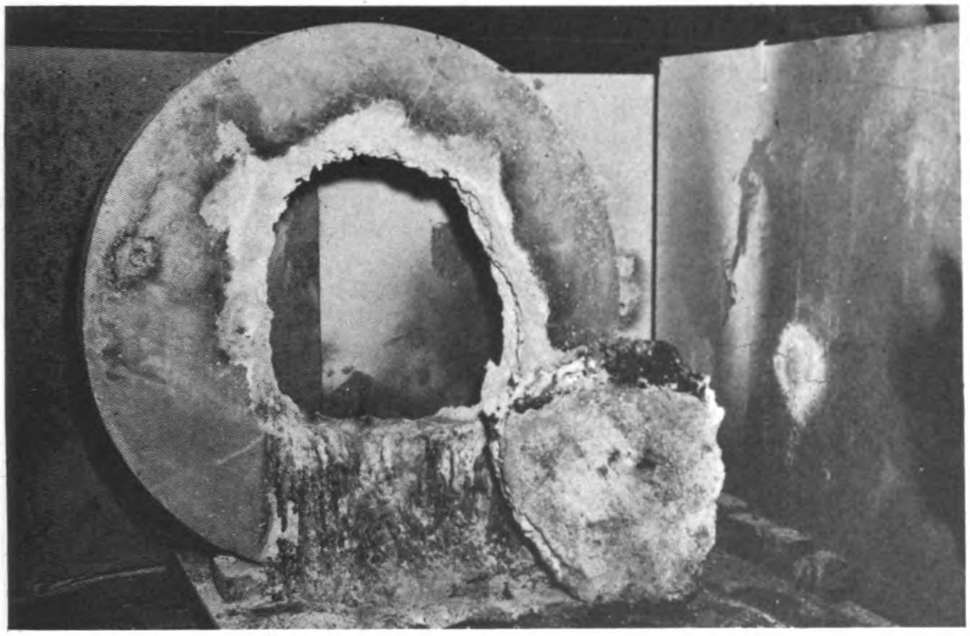


Figure 4. Concrete slab cut with oxy-aluminum torch

despite the fact that its temperature is only slightly lower than the oxy-aluminum torch.

Ordinarily the methods described are applicable to the combustion of other metals, though some precautions must be taken, depending on the inflammability and explosibility of the metal itself. Magnesium, silicon, calcium, zirconium, titanium, and sodium have been burned to date. The temperatures attained have depended, of course, on the metal used. For instance, the temperature attained in the combustion of magnesium is about 500°C lower than that attained with aluminum, while zirconium yields temperatures much higher than either of these.

Another important factor in the combustion of metals is the pressure at which the reaction is carried out. High pressures lead to higher temperatures. Experiments have been carried out in pressure reactors to produce even higher temperatures than those obtained at atmospheric pressure. Theoretically, a temperature of 6480°C or slightly over 12000°F should be possible by burning zirconium in oxygen at 100 atmospheres pressure.

Since temperatures attained in the combustion of metals can be increased if the reactors are fed with metal vapors rather than with solid metals, work is under way to produce vaporized metals in substantial quantities. In the case of magnesium the work has been very successful. A stream of magnesium vapor is continuously emitted from the boiling chamber and ignites immediately when it comes in contact with the air. The flame is very brilliant and its temperature is higher than the temperatures attained by burning solid magnesium. Small quantities of aluminum have also been vaporized and it is expected that larger quantities of aluminum vapor will soon be produced so that a torch may be fed with aluminum vapor and oxygen.

There are, of course, other chemical reactions besides the burning of metals which produce high temperatures. Various combinations of gases serve the same purpose. The reaction between hydrogen and fluorine, for example, produces a compound which is extremely stable and very high temperatures are attained. The following reaction takes place, giving off 64,000 calories for each mole of hydrogen fluoride formed:

$$1/2\ H_2 + 1/2\ F_2 \longrightarrow HF$$

A torch has been developed much like the ordinary oxy-acetylene torch except that it is fed with hydrogen and fluorine. Theoretically the temperature attained is 4300°C at one atmosphere. Once again the effect of pressure is important in raising the temperature of the torch.

There are many advantages to the use of burning metals as sources of high temperatures. The equipment is simple and easy to operate and the metals are, for the most part, inexpensive. Furthermore, they provide a plentiful source of material for such experimentation. It seems clear that research along these lines is bound to be productive of some further interesting and useful results.

New Memory Cells Increase Powers of Electronic Computers

As the result of a project sponsored by the Office of Naval Research at the Massachusetts Institute of Technology, a new gadget has been devised to improve the "memory" of high-speed electronic computing. Of course a "memory" system is indispensable in any high-speed computing machine, because it stores numbers until the machine is ready to perform the calculations demanded.

The invention consists of a cube of minute magnetic cells designed to "remember" by means of less than 200 wire connections, thousands of pieces of information which have been coded for use in a computing machine.

The cells in the proposed machine are arranged in a special way in a little box in the following manner: The cube may be 32 cells high, 32 cells wide and 32 deep. Thus, a total of 32,768 cells are packed into a box which measures approximately two feet on a side. Although only 193 control wires run into the cube, it can, because of this arrangement, store or "recall" the information in any cell in a few millionths of a second.

The individual cell has a ring-shaped magnetic core only a fraction of an inch in diameter. None of its parts move. Scientists point out the similarity of the magnetic cells to the workings of the cells in a human brain.

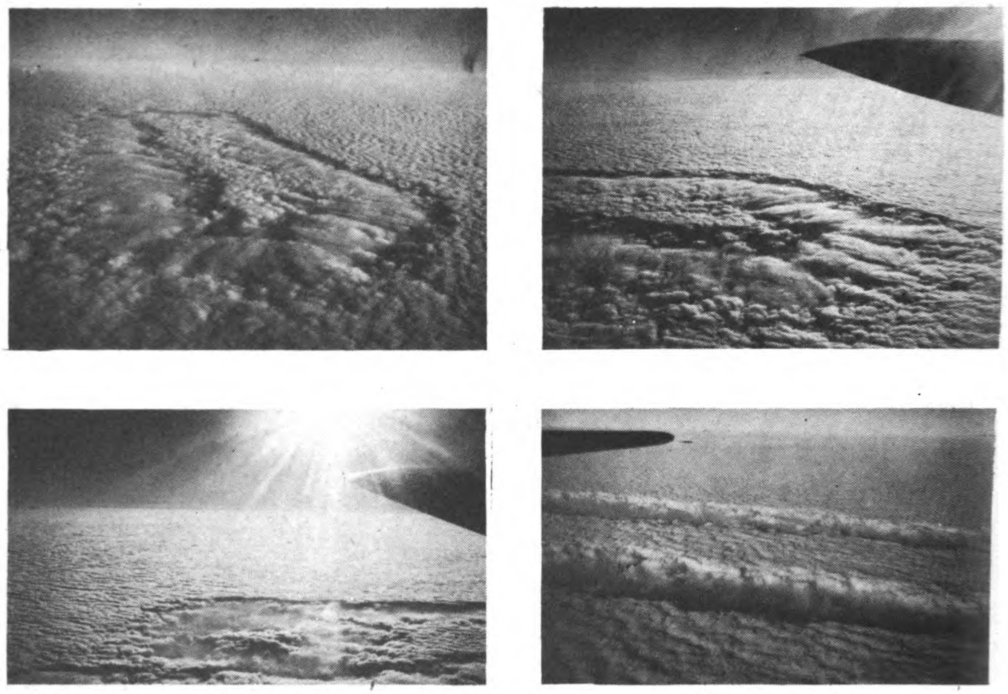
Figure 1. Cloud as it appears 24 minutes after being seeded with dry ice.

"Seeding" The Clouds

Most of us are accustomed to thinking of the weather as a mood of a temperamental Mother Nature. Jokes about the weather man have become a staple of conversation, reflecting the widespread view that rain, snow, sleet or sunshine "just happen" and must be enjoyed or endured as they come along.

Actually speculation on weather has often been far from a joke during crop-destroying droughts. And in modern military situations involving transport, air operations, communications and radar the prediction and knowledge of meteorological conditions are serious matters. That is why the Armed Services are supporting Project CIRRUS, an investigation in cloud physics sponsored by ONR and the Army's Signal Corps, in consultation with General Electric. Scientists, naturally, do not hold the view that wind, rain, and fog "just happen"; they believe that by studying the formation, growth and dissipation of clouds they can reach an understanding of the physical processes in the atmosphere that we call "weather".

The fundamental theory on which much modern meteorological research is based is that of T. Bergeron and W. Findeisen which postulates that ice crystals present in clouds are the centers around which are formed water droplets big enough to fall as rain. The ice crystals, in turn, were formed around nuclei which scientists believe are small natural particles such as dust. This is the basis upon which artificial "rain-making" is founded. General Electric scientists discovered methods for injecting artificial nuclei into clouds rapidly and efficiently (a process called "seeding"), thus opening an entirely new area for military research and possible exploitation.



Figures 2-5. Intermediate stages in formation of "racetrack" pattern characteristic of seeded cloud.

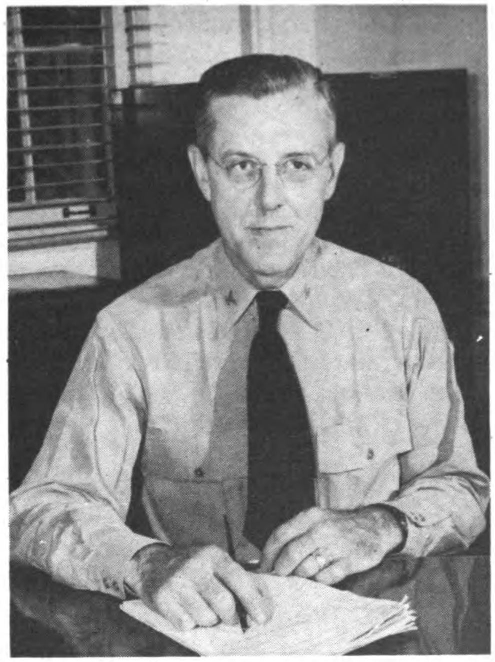
Much misunderstanding has arisen on the results of some of the experiments conducted. Though we know now that artificial means can actually be used to make it rain, this does not mean that control of weather conditions is now within man's grasp. For one thing, the rain-making experiments were successful only under certain favorable atmospheric conditions. Furthermore we do not know how much of a downpour can be obtained in this way or if it would be sufficient, for example, to relieve a drought-parched area.

Yet in spite of these limitations, many practical results have come from Project CIRRUS. In certain experiments it has been possible to create holes in clouds so that the ground beneath could be observed. This would obviously be useful to both military and commercial air-craft for making landings or parachute drops through an overcast sky. Moreover, some engineering data, useful for the design of military radar weather equipment, have been obtained. Besides this, numerous equipment and technique developments have resulted that have value beyond the immediate applications of the project.

Of course, in the search for practical applications, the value of the project to fundamental knowledge must not be forgotten. Much has been learned about the basic mechanism of raindrop formation and precipitation which may someday prove useful in unexpected ways.

Many meteorologists believe that a complete answer to the problems under study will come only after several years of careful experimenta-tion. Only through more complete understanding of the complex natural phenomena can the questions of potential military and economic useful-ness be finally answered. Results to date amply justify the necessity for continued efforts in this field.

Who's Who In Naval Research



A glance at the record of CAPT Clifton Garvin Grimes is sufficient to show that the new Deputy and Assistant Chief of Naval Research is a man who has plenty of know-how when it comes to applying the results of research to practical Navy developments.

A quiet-spoken man with a pleasant, friendly manner, CAPT Grimes grows serious when he speaks of some of the vital developments with which he has been connected during his Navy service. And well may he look serious--for these were matters of historical consequence. One of CAPT Grimes' outstanding achievements was the work he did as Head of the Interior Communications and Fire Control Section of the Bureau of Ships. He was responsible not only for the design, procurement, and distribution of all interior communications and BuShips fire control equipment for all naval vessels under construction, but also for improvements in such systems already in service. For his part in this work CAPT Grimes received the Legion of Merit, accompanied by a citation which reads, in part, "...CAPT Grimes carried out the varied and complex duties of his assignment with sound judgment and fine professional skill and, in addition, participated directly in the development of Combat Information Centers, thereby contributing materially to the early provision of vital equipment to vessels at sea and to the combat efficiency maintained by our Fleet in battle."

Of course a lot of valuable scientific and Navy experience had gone into the record of an officer who was able to render service like this at a crucial time. After graduating from the Naval Academy in 1925, CAPT Grimes had joined the USS Pennsylvania and three years later transferred to the USS Barker. During service in the latter ship he was commended by the Secretary of the Navy for performance of duty in connection with the vessel's battle efficiency. After detachment he went to the Postgraduate School at Annapolis and later continued his training at Columbia University, where he received a Master of Science Degree in Electrical Engineering.

Subsequent developments proved that this was time well spent, for CAPT Grimes' record shows several commendations for his part in important technical developments. One, which came while he was serving in the USS New Mexico, was from the Commander Battle Force for development of a fire control instrument and for the design and development of a portable air-purifying apparatus.

After detachment from the New Mexico he was assigned until 1938 to the Bureau of Engineering and then became Executive Officer of the USS Maury. A letter of commendation from the Chief of Naval Operations was the result of this service. In 1939 he assumed command of the USS Welles until 1940.

After the war his knowledge and experience made him an obvious choice for the post of Chief of the United States Technical Mission to Japan, a capacity in which he served until July 1946, when upon completion of the Mission's work he joined the staff of Commander Battleships-Cruisers, U. S. Pacific Fleet. In April 1948 he became Executive Officer and Assistant Director for Laboratories of the Navy Engineering Experiment Station, Annapolis and later was assigned duty at the New York Naval Shipyard.

This broad background of Navy-scientific experience makes CAPT Grimes the kind of officer who is ideal in the ONR set-up--a man who understands the complexities of scientific research and also its implications for practical use in the Fleet.

ONR Dental Program

Of the 864 million dollars spent in 1948 on the dental health of our Nation, over 100 million was spent for dental materials. Naturally it is upon the quality of the materials employed and the skill exercised by the dentist in using them that the success of dentistry depends.

The War Department in 1919 ran into the problem of evaluating dental products purchased by the Armed Services, and they appealed to the Bureau of Standards for help. The Bureau, in response to the plea, established a broad research program on dental materials. In the last 30 years this work has aided greatly in the solution of dental problems.

A relatively recent outgrowth of the Armed Forces' interest in dental materials is the cooperative training program set up in 1947 between the Bureau of Standards and officers of the Navy, Army, Air Force and Veterans' Administration Dental Services Division. These officers go to the Bureau on a guest-worker basis to receive training and do research in the dental material field for a period of two or more years. Out of the ten dental corps officers who have participated in this program since 1947, four have been Navy personnel from the Bureau of Medicine and Surgery.

Necessary to the work of such a program is the solid support of fundamental research. Alert to this need, the Office of Naval Research in 1947 appointed Dr. W. T. Sweeney, at that time with the University of Michigan, principal investigator on a project concerned with dental materials. Dr. Sweeney is now engaged in this work at the Bureau of Standards while the ONR-sponsored research at University of Michigan continues under the capable guidance of Dr. Floyd Peyton.

Such a program is evidence of cooperation between research groups which makes for the most effective use of laboratory findings. This training not only effects a pooling of scientific manpower but also a dissemination of acquired dental knowledge. Such a concerting of effort will hasten the solution of present-day dental problems of interest not only to the Armed Forces but to the civilian populace as well.

Death from Shock—
Still a Medical Mystery

by
Fred E. D'Amour and Donn L. Smith
University of Denver

A screaming of brakes, the crash of grinding metal, and once again an all-too-familiar tragedy of the American highway has been enacted. After listing the dead, the newspaper report of the accident frequently states: "Another victim died <u>in shock</u> while being transported to the hospital." It is with this victim that we are concerned.

Had we come upon him lying on the highway immediately after the crash, we would not, perhaps, have considered his condition very alarming. He may have been bleeding very little or not at all; no bones were broken, and he was conscious. One would say that he had escaped serious injury, in spite of the crushing and bruising of his tissues--the "trauma," or injury, from which this type of shock takes its name. We would have noticed, however, that his pulse was fast, but weak and thready; his breathing was rapid and shallow; he was grey and pallid, sweating profusely, and cold to the touch. In such a case we would not make any of the mistakes which the well-meaning but misinformed bystander so frequently makes; we would not administer artificial respiration, thereby adding to his already precarious state by further rough manipulation; we would not jacknife him into the nearest car for transport to the hospital, but would wait until a stretcher was available; we would not give him anything to drink in spite of his pleading, because he would quickly vomit. By observing these precautions we might well have saved his life--but again we might not, and, in spite of all our care, the newspaper report might still end with the familar phrase: "Another victim died in shock."

This is traumatic shock as encountered in civilian life. In its main features, it resembles the "battle case," although the latter is more frequently complicated by hemorrhage, broken bones, or burns, which greatly aggravate the condition. Yet even here the amount of blood loss and degree of injury is not, in itself, sufficient to explain the fatal outcome. These victims do not bleed to death; they do not die of broken limbs; pain does not kill them; they simply die of "shock." So we confront the question: What does this crushing, this laceration, this "traumatization" of skin, muscles and underlying tissues <u>do</u> to a human being to make him die?

<u>Fred E. D'Amour</u>, professor of zoology at the University of Denver, received his B.S. and M.S. degrees from that University and his Ph.D. from the University of Chicago. For the past 20 years he has taught and conducted research in physiology at the University of Denver.

<u>Donn L. Smith</u> (B.S. and M.S., University of Denver, Ph.D., University of Colorado) served for several years with the field artillery in the European theatre. He now teaches and conducts research in pharmacology at the School of Medicine at the University of Colorado.

The almost universal symptom in shock is the fall in blood pressure to such an extent that the flow of blood is inadequate to supply the body, particularly the brain, with its necessary requirement of oxygen. It is therefore customary to consider the low blood pressure as the cause of death; consequently most theories are concerned with the question of what is responsible for the fall in blood pressure.

The maintenance of a normal arterial blood pressure depends upon three factors: the strength and rate of the heart beat, the degree of resistance which the blood encounters in the peripheral arteries (arterioles), and the volume of blood in the body. Examination of the heart of a "shocked" animal shows that, although the organ is beating strongly, its output is greatly reduced. The collapsed condition of the great veins indicates this is caused by the failure of blood to return to the heart. Since no hemorrhage occurred, it is clear that no blood has been lost outside of the body; therefore, the loss must have been inside.

This then introduces the "fluid loss" theory. There are two ways in which such fluid loss might be brought about: First, widespread capillary dilatation would permit a "pooling" of a large volume of blood. It has, in fact, been shown that, though capillaries and small veins normally contain only about 24 percent of the total blood volume, in shock they may contain as much as 61 percent. Plasma leakage through the walls of the distended capillaries is the other possible explanation for the fluid loss found in shock. There is little doubt that such leakage takes place at the site of the injury, but there is no proof that it occurs in other capillaries in other regions. One investigator believes that the reduced return of blood to the heart (and consequent fall in blood pressure) can be entirely accounted for on the basis of leakage at the site of the injury. He finds, for example, that the increase in weight of the traumatized hind leg of a dog was equivalent to from 1/3 to 1/2 of the dog's total blood volume.

Accepting fluid loss as the immediate cause of the low blood pressure, we must next explain how injury produces these effects. For this we also have two theories: One (called the neurogenic theory), holds that nerve impulses arising at the site of injury, permit the enlargement of blood vessels and the previously-mentioned "pooling" of blood. Another possible explanation (the humoral or toxemia theory) is that destruction of tissue, particularly muscle, produces chemical substances, resembling histamine, which enter the blood stream and produce expansion of the blood vessels.

There is considerable evidence supporting the latter theory. For example, the use of a tourniquet, preventing the return of venous blood from an injured arm or leg, is thought by many to postpone shock. This idea is supported by work of an investigator who showed that injury of a dog's hind leg did not produce shock as long as the returning blood vessels were shut off (even though the nerve supply remained intact); however, shock promptly followed release of the ligatures. But since other workers have not always been able to verify this finding, the theory is not universally accepted. One bit of evidence that does support the theory that chemical substances cause shock is the fact that injection of histamine into some animals produces effects that resemble this condition.

These theories are concerned with the cause of the fall in blood pressure and leave the question open as to whether this decrease is the actual cause of death. Even this question cannot yet be positively answered, although it seems certain that a blood pressure as low as that occurring in shock (50 to 60 mm systolic) would eventually result in death from oxygen starvation. There is some evidence, however, that the fall in blood pressure is not an adequate explanation of the cause of death. In fact, cases of "shock", typical in other respects, have been reported with a normal blood pressure. Moreover, administration of oxygen has not been reported to be of much benefit and maintenance of blood pressure by mechanical means, although lengthening the survival time, does not accomplish recovery.

It is, of course, possible that any of the three factors present in shock might cause death in ways other than by their action on the blood pressure, and that the latter is merely coincidental. Thus, leaking of plasma from capillaries would cause increased thickness of the blood, which would then overload the heart. Or the influence of nerve impulses from the site of injury might result in fatigue of vital centers in the brain. Another possibility is that poisons presumably resulting from muscle breakdown might affect structures other than blood vessels, such as the heart, brain, or kidneys. From the point of view of treatment, the latter consideration is important, since measures designed to improve the blood pressure might, by improving the circulation, actually hasten the "poisoning" process.

Besides these possible explanations of death from shock, there are a number of other theories which we will not discuss here. And since multiplicity of theories usually indicates a paucity of fact, it is evident that our knowledge of shock is very incomplete. This is not due to lack of diligence on the part of investigators, but to a number of difficulties inherent in the problem. Great variations exist between different species of animals, and results obtained with one are not necessarily transferable to another. Moreover, investigators have used varying methods of producing shock, a situation which has no doubt led to much disagreement over findings. The use of anaesthetics is a necessity, and this may further obscure the issue. For these and other reasons, it is not surprising that the experimental study of shock has yielded inconclusive and often contradictory results.

Thus, in attacking the problem we were first of all concerned with developing a method for inflicting a reproducible type of injury upon a reproducible animal. For the latter purpose we consider the rat ideally suited, because its availability in large numbers permits animals of the same age, sex and genetic background to be used throughout many experiments. Our development of a technique for recording the rat's blood pressure made possible the use of this animal for shock studies. After a considerable amount of preliminary work, we decided upon traumatization of a part of the large intestine (the cecum) as being a reproducible method which had certain anatomic advantages. In brief, the procedure employed is as follows: The rat is anaesthetized with Nembutal, and blood pressure is recorded from the carotid artery. The abdomen is then opened and the cecum drawn through the incision. By means of a hemostat (an instrument for compressing blood vessels) the cecum is pinched with considerable force at a rate of 150 pinches per minute for 15 minutes. With some practice the investigator is able to inflict approximately the same degree of injury each time (as indicated by the relative constancy of the survival time in a large group of control animals).

The first phase of our study was concerned with evaluating the relative importance of a number of factors producing incurable shock. The factors studied were: low blood pressure, carbon dioxide decrease in the blood, the neurogenic factor, the toxemic factor, and fluid loss. The underlying principle was to control or alleviate each factor in turn and compare the effect upon the survival time with that of the control animals.

In spite of the doubt that the low blood pressure is the cause of death from shock, we felt that if the blood pressure could be restored to normal and maintained there, the animal would survive. In a recent study we used the Thunberg respirator. Although the efficiency of the device as a respirator is not outstanding, it had the effect of greatly improving the animal's blood pressure. We therefore applied this observation to our present study by placing the animal, immediately after injury, in such a chamber. Air, under a pressure of 150-200 mm was alternately introduced and withdrawn at a rate of 60 times per minute. This subjects all soft parts of the body to pressure, forcing the blood which may have stagnated in the capillaries and small veins, back to the heart. With this treatment, the blood pressure rose promptly to approximately normal levels but we were disappointed to find that the survival time was prolonged by only about 30 percent because the animal's blood pressure eventually fell back to shock level. We had hoped that the method, if successful, could be used in naval vessels where men in shock could be placed in such chambers until combat had been broken off and medical care was again available. Such use might still be worthwhile, for it must be remembered that our experimental rats were in a state of extreme shock, and for a battle casualty even a prolongation of life for an hour might make the difference between life and death. From the theoretical point of view, our experiment was significant, indicating that maintenance of normal blood pressure does not result in survival, the final collapse occurring in spite of measures which insure a normal return of blood to the heart. It does not, however, affect the validity of the "fluid loss" theory, for a higher blood pressure might cause even more fluid to be lost than ordinarily; the toxemia theory also remains intact for, as we pointed out previously, the pickup and distribution of toxins might be hastened by better circulation.

At present, the fluid loss theory appears the more tenable, since, by tying off the arteries to the cecum much of the local loss is prevented and animals so treated showed a greatly increased survival time. But since this operation also largely prevents any toxic substances formed at the site of injury from being carried into the blood stream, it does not tell us conclusively whether toxins or fluid loss cause death from shock. We were unable to prolong the survival time at all by blocking the nerve supply from the cecum with procaine, and therefore consider the neurogenic theory, at least in this type of injury, to be invalid.

We are continuing our experiments along lines which will separate the "fluid loss" and the "toxemia" factors more sharply. In times of war or emergency the question of treatment becomes paramount, but the rationale of the treatment depends upon accurate knowledge of cause. If fluid loss is the cause, the treatment is obviously transfusion, but in experimental work on trauma, transfusions are of little help. (As previously stated, many battle cases are accompanied by hemorrhage, and for such cases transfusions are, of course, indicated.) Should the toxemia theory prove true, chemical isolation and identification of the toxin might well lead to chemical methods of neutralizing its action.

In the meantime, a second division of study, a pharmacologic attack, has been instituted. There are many drugs having circulatory effects, and it is possible that one may be found which will prevent the dilatation of peripheral vessels and the consequent "pooling" of blood. Also, just as the antihistamine drugs are now available to combat the action of histamine, so it may be possible to find one which will combat the action of the toxic factor involved here.

Important as the shock problem is in times of peace, its frequency among battle casualties renders it one of the most serious problems of military medicine. In spite of an enormous amount of work, from which numerous theories have evolved, the cause of death from shock is not as yet definitely known, and consequently treatment is not satisfactory. We have made some progress toward finding the basic causes of the condition, and it is hoped that further studies will contribute in some degree toward the eventual solution of the problem.

Cheap Production of Titanium Promised by ONR-Sponsored Research

The answer to many an engineer's dream appears to be provided by the recent development, under ONR contract, of a cheap method for producing titanium. For a long time construction men--both military and civilian--have been looking for a plentiful metal that would combine the desirable qualities of aluminum and steel--strength plus light weight.

Finding such a metal may sound like a knotty problem. Actually it wasn't. Metallurgists had long known that silvery-looking titanium would fill the bill, for it is only 70 percent heavier than aluminum, but six times stronger, while its tensile strength compares favorably with that of steel. Moreover, in corrosion resistance, particularly to salt water, titanium surpasses both of these metals.

The difficulty was that production of the sponge metal cost $5 per pound--a prohibitively high price for a construction material. Now Horizons, Inc., of Cleveland, Ohio, after five years of work under ONR contract, has reached the pilot-plant stage in the production of titanium at a cost which is less than one-fifth of its previous price.

For shipboard use the properties of titanium made it highly suitable for valve seats, heat exchangers, condenser piping systems, exhaust mufflers for submarine diesel engines, pump shafts, small propellers and propeller shafts, steam turbine blading and other similar components. In jet and gas turbine aircraft the metal has proved highly satisfactory for firewalls, for it has successfully withstood the effects of temperatures of 2000°F for at least 15 minutes. Other uses can be made of it in shrouds, baffles, and diaphragms, since its light weight gives it an advantage over steel. The same characteristic would also make it valuable in compressor blades and discs in gas turbines.

Eventually civilian uses will be made of the metal since its low cost will make it extremely attractive to manufacturers.

Taste - a Monitor of Diet ?

by
Carl Pfaffmann
Brown University

In the hierarchy of man's senses, taste occupies a lowly position. Vision and hearing, the best known of the "higher senses", have been described as our main channels of communication with the external world. These are distance receptors which provide not only a rich variety of sensory experience, but also a wealth of perceptual detail basic to much aesthetic appreciation. Because of this, research on these senses has been pursued actively for many years and our knowledge has reached an advanced level. Such is not the case with taste, a so-called "lower sense". It is called a contact receptor, because taste stimuli must actually be placed upon the receptive sense cells. Its range of sensory qualities is limited and its function restricted largely to the more primitive reflexes and simple habits concerned with eating. Since research on taste is being carried out in relatively few laboratories, our knowledge and theory of tasting is relatively undeveloped.

What we refer to here is the "true sense of taste" and should not be confused with taste as we employ the word to describe the flavor of food in everyday parlance. Flavor is usually the combined result of stimulating not only the true sense of taste but also the sense of smell, located in the upper nasal passages, and the senses of touch, temperature and pain. The true taste qualities are limited to salty, sour, bitter and sweet. These sensations, or combinations of them, are elicited when solutions like sodium chloride (for salty), cane sugar (for sweet), quinine (for bitter) and citric acid (for sour) are applied to the tongue or throat region. Only those regions of the mouth containing the specialized receptors, the taste buds, respond to these stimuli. Figure 1 shows a magnified cross-sectional view of a cluster of the flask-like taste buds containing the sensitive receptor elements.

Although it has been recognized in a general way that taste plays a part in the selection of food, its role until recent years has been minimized. The studies of Dr. C. P. Richter at the Johns Hopkins Hospital have emphasized that in many instances taste is a guide to the selection of foodstuffs required for the well-being of the organism. The most dramatic instance cited is that of a small boy brought to the Hospital for observation. Several weeks after admission, the child died of an undiagnosed ailment. Subsequent examination showed that he had suffered from a tumor of the adrenal gland. One function of this gland is to control the salt (sodium chloride) content of the body fluids. Disease or removal of the gland may prove fatal as a result of the loss of sodium chloride from the body. In this particular instance, further study of the case history showed that, prior to the admission, the child had developed a perverted

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Carl A. Pfaffmann, Associate Professor of Psychology at Brown University, earned his doctorate from Cambridge University on a Rhodes Scholarship. Naval research is nothing new to him, since he was aviation psychologist with the Navy from 1942 to 1946. He is a Fellow both of the American Psychological Association and of the AAAS.

taste preference. He displayed an inordinate craving for salt and, on more than one occasion, gulped it by the handful. It is presumed that under the more strict dietary supervision of the hospital there was no opportunity for a "salt binge". A condition of salt depletion then developed.

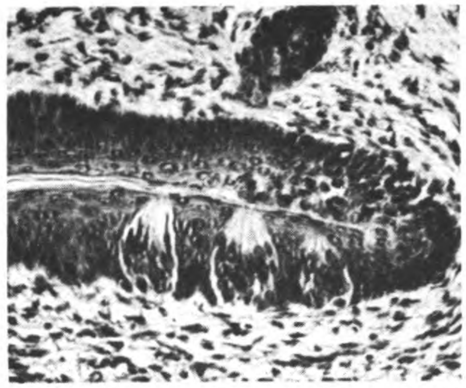

Figure 1. Enlarged microscopic view of three taste buds in cross-section. Each flask-like bud contains several receptive elements. These three buds lie in a crevice of a rat's tongue from which the tissue was taken.

Laboratory tests by Dr. Richter, and later by others, gave results of a similar nature. The laboratory rat can be made salt-deficient by surgical removal of the adrenal gland (adrenalectomy). When placed in a cage containing two drinking tubes, one with water and one with salt (Figure 2), the adrenalectomized rats increased their intake of salt to such a degree that they could survive for long periods. Without salt the animals rapidly succumbed. Animal studies of such behavior can be carried out in individual living cages fitted with two or more graduated drinking cylinders as shown in Figure 2. Water is placed in one cylinder and salt solution in the other. The intake from each cylinder can be measured at the end of each 24-hour period. A preference is indicated if the animal takes more salt solution than water, an avoidance, if more water than salt solution. Figure 3 is a graph showing the effect of adrenalectomy upon the intake of sodium chloride solutions.

One theory for such behavior suggested that the salt deficiency caused by the adrenalectomy actually induced changes in the taste buds themselves, rendering them more sensitive. The taste buds, it must be remembered, are chemically sensitive endings, bathed by the body

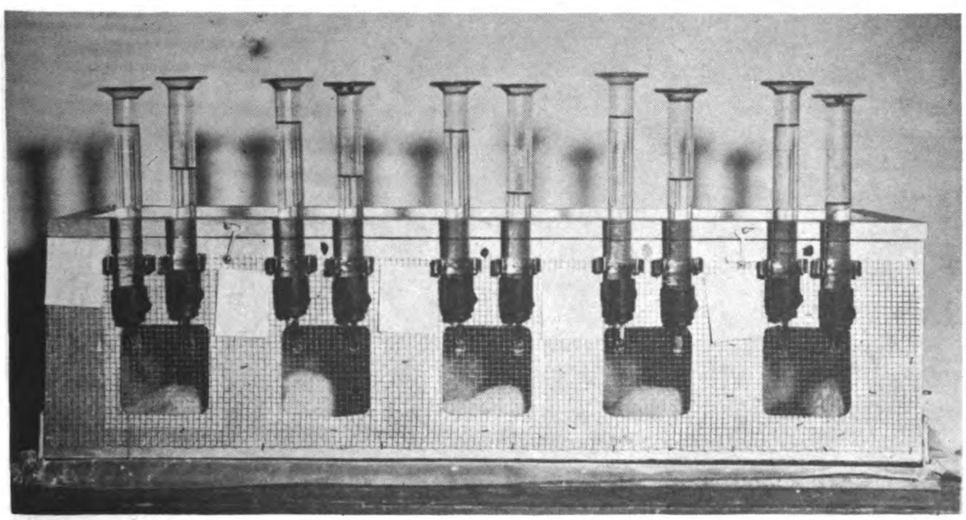

Figure 2. A bank of five individual living cages, each equipped with two calibrated drinking cylinders. In this picture the fluid in the right-hand container of each pair was preferred to that in the left.

fluids; furthermore it is known that certain substances can be tasted when they are injected into the blood stream directly. Hence it seemed quite reasonable to expect that the level of sodium in the blood would chemically affect the sense cells, causing a craving for salt.

This theory could be checked with the aid of modern electronic techniques adapted for recording the electrical signs of impulses in the sensory nerves of taste. These methods are in general use and have been applied to the study of nearly all the senses (Adrian, 1947). In the procedure employed by the present writer, the animal is anaesthetized and then prepared so that a branch of the nerve to the tongue can be exposed and placed upon electrodes connected to an amplifying system and cathode ray oscillograph and recording camera. Such an apparatus converts the nerve impulse signal from a weak one of a few microvolts to one that can be readily observed and recorded. Figures 4 and 5 show two types of recording obtained when sodium chloride solutions of different strengths are dropped on the tongue. In Figure 4 the increased nerve activity is shown as a series of aperiodic transients upon the base line. This represents the asynchronous discharge of many nerve fibers in the total nerve trunk. These transients may be summated by an appropriate electronic circuit to produce a somewhat more quantifiable record like that in Figure 5. The greater the deflection, the greater the number of impulses and the greater the number of fibers active. (This method was developed by Dr. L. M. Beidler at Johns Hopkins University.) Salts and acids produced a marked discharge. Quinine and sugar, on the other hand, were less effective, perhaps because fewer nerve fibers concerned with these latter sensitivities travel in the anterior tongue nerves.

Such amplified neural discharges may be used to determine whether the adrenalectomized rat has a greater taste sensitivity than the normal. The smallest (threshold) concentration of salt required to elicit a discharge of nerve impulses can be determined for both normal

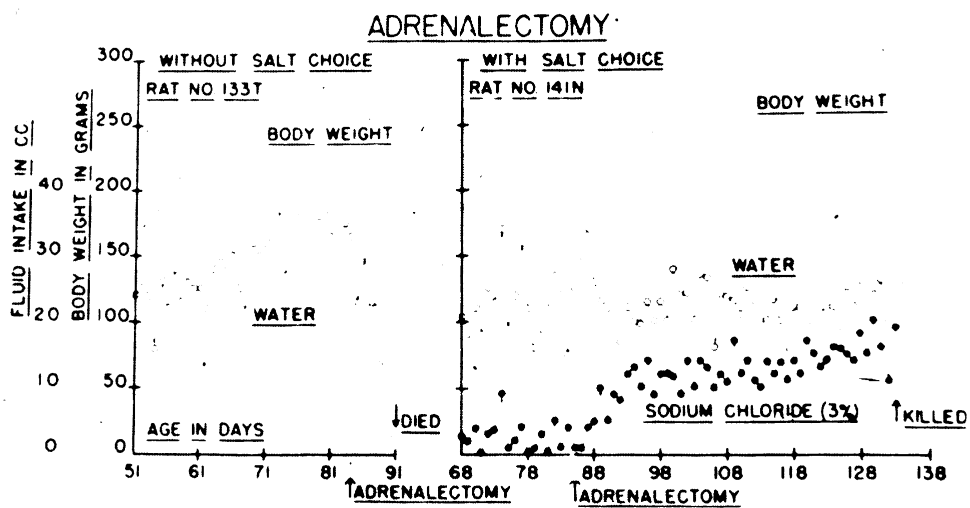

Figure 3. Increased salt intake following adrenalectomy. Rat 133T, adrenalectomized rat without access to salt. Rat 141N, adrenalectomized rat with a choice of water and salt. (By permission of the Science Press Printing Co., cf. Richter 1942.)

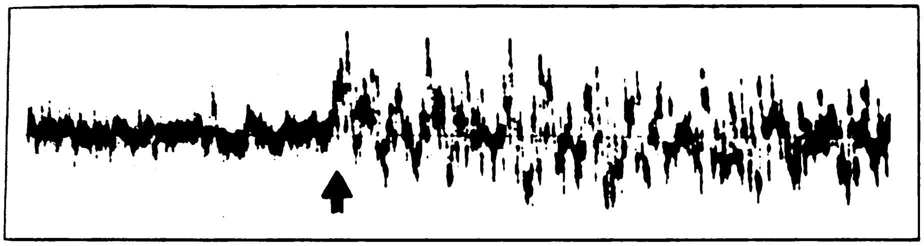

Figure 4. The neural discharge to a suprathreshold salt solution. An oscillograph tracing reading from left to right shows the increased electrical activity registered as an increased irregularity of the baseline (indicated by the arrow). The entire strip shown covers a 1/10th-second interval.

and salt-deficient animals. Actually no difference was found between the two (Pfaffmann and Bare, 1950). In the laboratory animal, at any rate, the increased craving does not seem to result from a change in the taste receptors themselves. Consequently the process by which this salt craving arises is still to be explained. Presumably either the level of salt in the blood or some hormone associated with the control of salt metabolism acts directly upon a part of the central nervous system.

That taste provides the basic signal to which the salt-needy animal can respond, however, is shown by the difficulty the rats encounter in discriminating salt solutions when the taste nerves have been severed prior to testing in the taste discrimination box (Richter 1942; Pfaffmann 1951). Furthermore, the magnitude of the nerve response shown in Figure 3 can be related to the degree of salt preference displayed by the normal, adrenalectomized as well as salt-fed animal. Interestingly enough, even the normal animal will show a preference for certain salt solutions. Very dilute salt solutions are taken equally with water. If the strength of the salt is increased in each successive test period, however, a concentration will be reached where the animal shows a preference for the salt solution. As the concentration is increased further, the animal will show an increased preference for salt until a maximum is reached at a concentration of approximately .6%. Beyond this point, the intake of salt solution falls off, and at the stronger concentrations, the animal avoids salt and takes only water. Such behavior is displayed even by the normal rat on a typical laboratory diet, while the increased salt intake of the adrenalectomized rat appears to be an exaggeration of it. The salt-needy animal shows the preference at a weaker concentration and at each concentration,

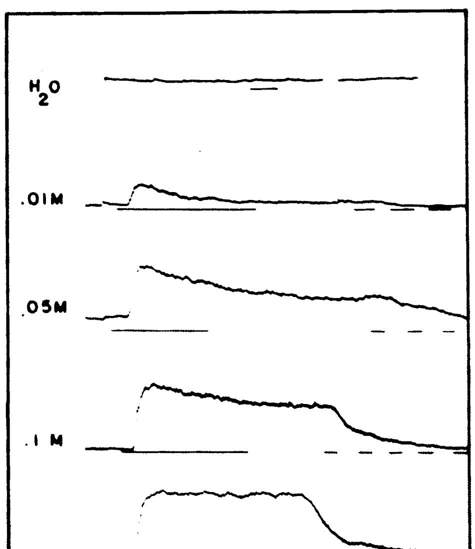

Figure 5. A series of records showing the neural activity as summated electronically. From top to bottom each successive row shows an increased deflection with each increase in stimulus strength.

takes relatively more salt than does the normal animal. In addition, it can be shown that the preference for sodium chloride can be depressed by loading the food with salt. When 10 percent of the solid food is sodium chloride, the animal increases his water intake generally, but decreases the salt intake.

Since the nerve discharge appears to be unaffected by the degree of salt need, at least in the case of the adrenalectomized animal, the nerve response curve may be considered to be a relatively stable and fixed characteristic of the taste receptor. Changes in behavior to stimuli within the operating range of taste presumably mirror changes in the reactivity of the central nervous system. The whole preference-avoidance curve for the adrenalectomized and normal animal and the avoidance curve of the salt-fed animals, lies within concentration limits that bracket the operating limits of the sense organ. Stimuli beyond these limits have little significance for behavior. The subthreshold stimuli are not sensed. The strong suprathreshold stimuli only lead to avoidance.

Research in progress is concerned with the further analysis of such behavior as well as with the study of the receptor and central nervous system processes of taste. The basic nature of the very process of taste stimulation is yet to be discovered. Only recently have the neural pathways and centers for this sense been located. The psychophysiology of taste can be established on a firm basis only when these basic receptor-neural processes are understood.

Such researches as those described above may suggest to the reader that taste is a sure guide to the selection of elements needed for maintaining nutritional well-being. Although this may be true in general, certain qualifications must be noted. Other investigators, for example, have shown that not all individuals, even among animals, are able to select an adequate diet by taste alone. Individual differences in taste sensitivity and perhaps some condition like inherited "taste blindness" may blunt taste discrimination (Blakeslee and Salmon, 1935). Furthermore, certain needed substances are relatively tasteless while others that are of no value may taste like nutritious food. For example, the sugar taste for man can be duplicated by a number of relatively inert or even toxic substances; saccharine is one of the best known inert sweetening agents. For the rat as well, both sugar and saccharine are consumed avidly in preference tests. In the case of poisons, though many have a repulsively bitter taste, not all such substances can be identified so simply.

When the food habits of human adults are considered, the problem is even more complex. Although physiological factors probably play a role in man's taste preferences, likes and dislikes learned through many social and cultural influences may play an even more significant role. Certain food habits which historically may have had a physiological or hygienic origin, may, at the present time, seem to be far removed from their original context. The interrelation of these factors in human food habits is not well understood. It can be expected that further studies of the psychophysiology of taste in relation to eating behavior and food habits should provide information, not only of theoretical interest, but also of practical significance.

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Good Results from Psychiatric Interviews

How much can a psychiatrist find out about a man in one brief interview? This question is an important one to the Armed Forces, for they need rapid screening procedures to weed out possible misfits.

Studies made recently by investigators working under contract with ONR's Human Relations Branch reveal that a brief interview by a competent psychiatrist gives a good indication of the mental health of the subject. Men coming in for reassignment to a naval receiving ship were interviewed by rated vocational specialists who were not medical men. If any symptoms of personality disorders were noted the men were immediately referred to the attending psychiatrist for a brief interview. Subsequently the subjects were divided into three categories and assigned accordingly. The first was composed of those who showed mild symptoms or none at all; these were considered fit for general duty. The second group, showing moderate symptoms, were considered fit for limited duty after six months of shore duty. The men in the third group, who demonstrated marked signs of mental disorders, were hospitalized immediately at a facility where intensive therapy was available. Then the medical histories of all these seamen were followed for one year after assignment.

Some very interesting results followed. The group classified "mild" lost only 6.5 percent of its members as a result of mental disorders; the moderate group showed a higher list of neuropsychiatric casualties--20.2 percent, while the men who had showed severe symptoms lost almost 90 percent. In other words, the discharge rates bore out the predictions of the brief psychiatric interviews to a marked degree.

Moreover, the fact that the rate of mental disorders in this group was 10 times the normal Navy rate showed that non-medical interviewers can do a fairly efficient rough screening job. This is a fact which may prove of great value in an emergency situation, when medical men are at a premium.

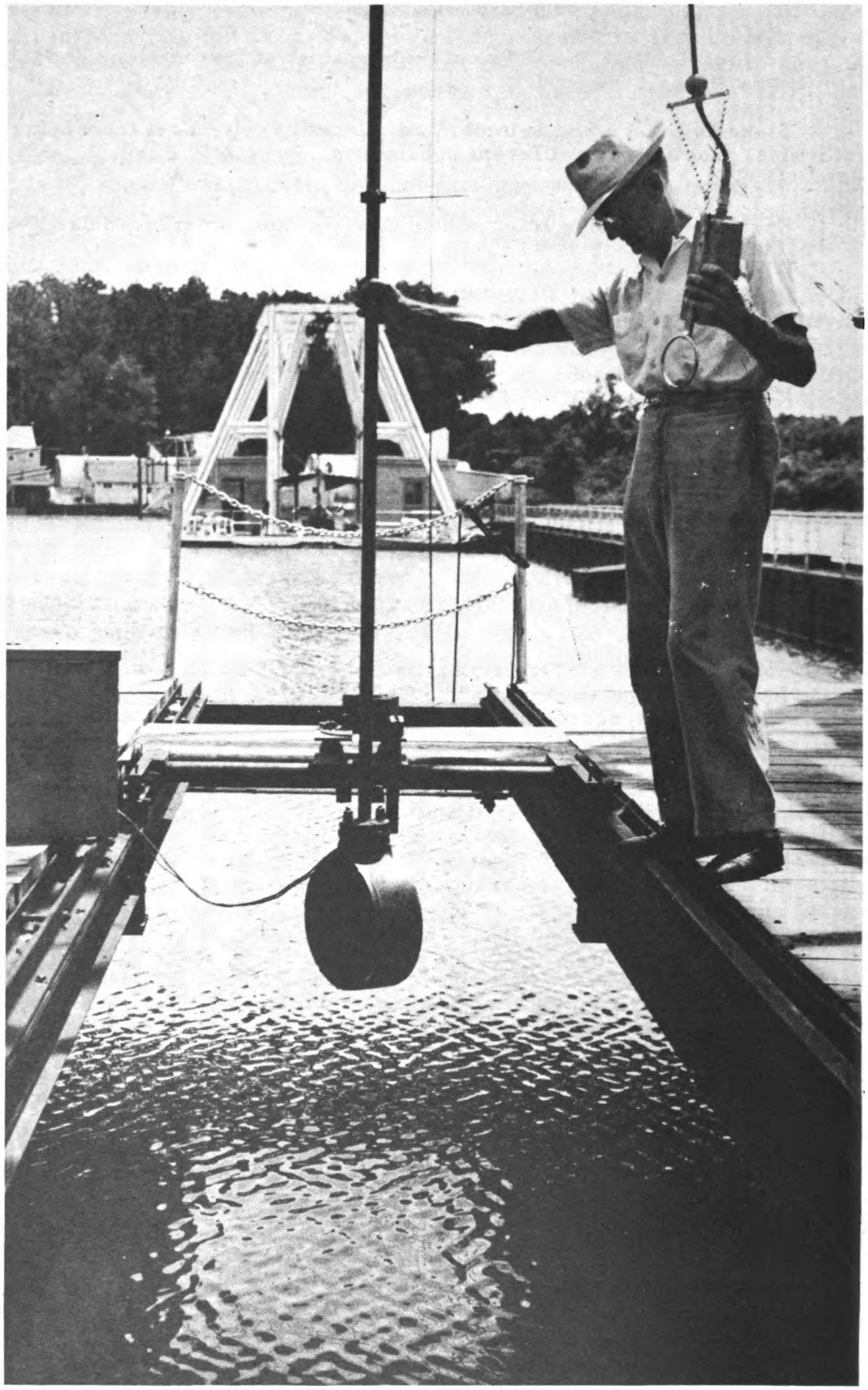


Figure 1. Underwater sound projector is lowered into well for testing while instruments on pier analyze and record performance. Model is World War II destroyer type since security forbids photographing new models. An additional testing platform is provided by the barge in the background, located in deeper water and anchored for maximum stability.

Testing Tomorrow's Sonar

The high seas may seem the logical testing ground to try out our Navy's newest sonar equipment. And so they are--eventually. But first every model of a new underwater sound gadget is tested in the waters of a very unusual little lake in Orlando, Fla. This is Lake Gem Mary, and scientists of ONR's Underwater Sound Reference Laboratory are performing experiments in its quiet depths that are helping to make the U. S. Navy a deadly menace to potential foes.

Actually the word "quiet" used to describe Lake Gem Mary is something of a misnomer, for there is plenty of activity in the area--especially since the installation acquired the new building and equipment shown on these pages. But the Lake itself is kept in a state of tranquility so that work may be carried on there under completely uniform conditions. For example, pumping stations keep the water level within half an inch of variation and even fish are barred because their presence would constitute a disturbance! Nature itself takes a hand in keeping other conditions satisfactory, for the waters of the smooth-bottomed, cone-shaped lake are the same temperature all the way down throughout the year.

To return to our original point--a lot of people once thought that testing sonar gear was most practicable on the high seas, where it would eventually find its greatest use. Not so, according to the Navy men and scientists who tried it during the last war! Many fine laboratories all over the Nation were then designing sonar instruments to help destroyers hunt down the enemy subs that constituted a serious impediment to our control of the seas. Sometimes two different models would be ready for testing at the same time. It seemed that this should have been a fairly simple matter. Two subs would be chosen--sister ships were always selected--and a "first-team" crew was aboard each. It seemed that a comparison of the showings made by the two different sonar instruments should give a fairly clear indication of which was the best. What could be simpler?

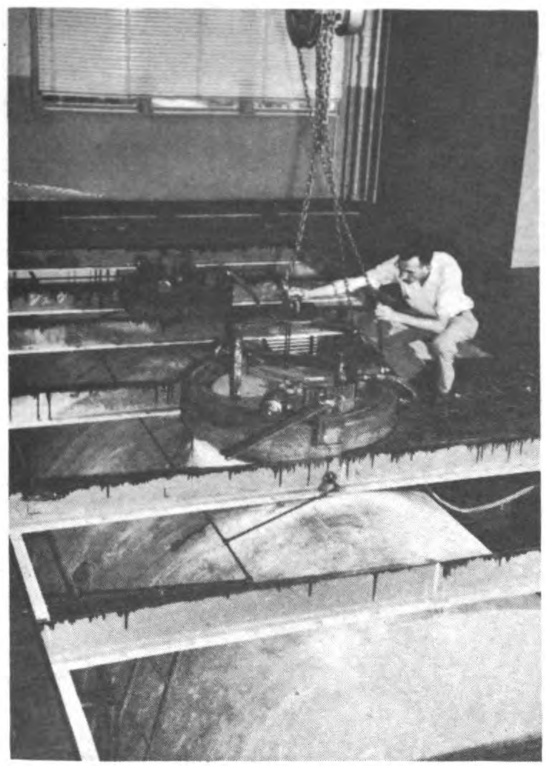
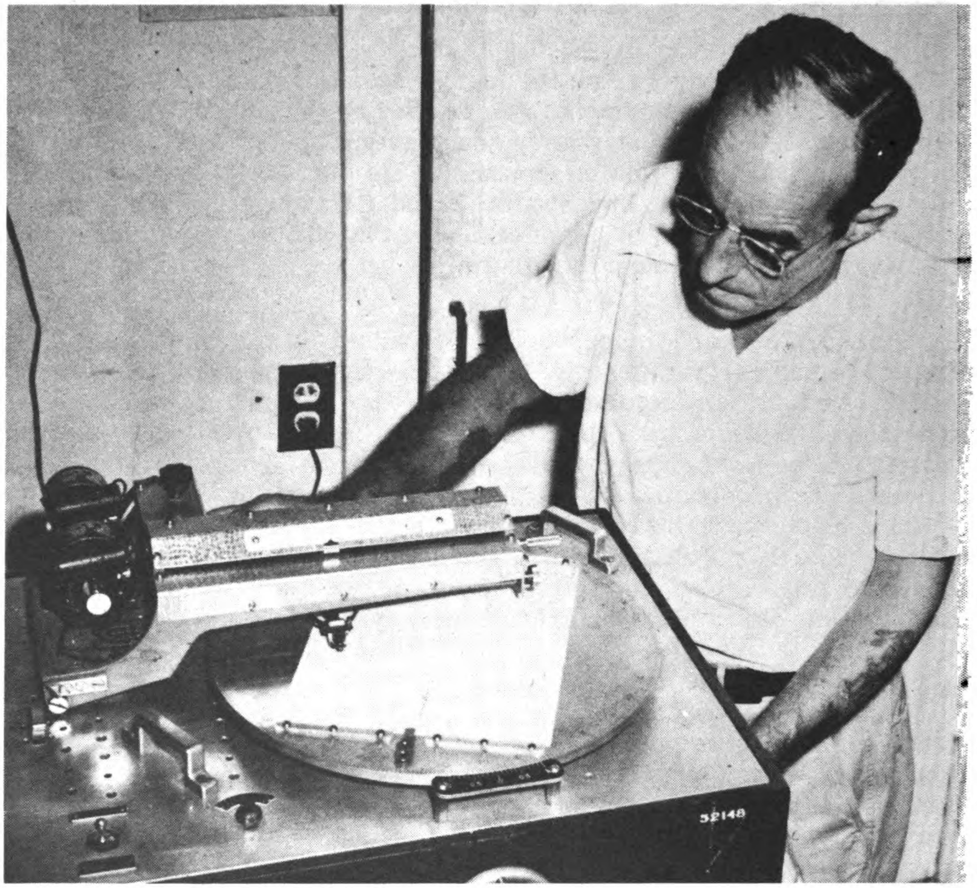


Figure 2. This high-pressure tank is used for testing the ability of submarine sonar equipment to withstand the pressures of deep submergence. The tank is built of four-inch-thick steel to withstand pressures of 1000 pounds per square inch, corresponding to a sea depth of 2000 feet.



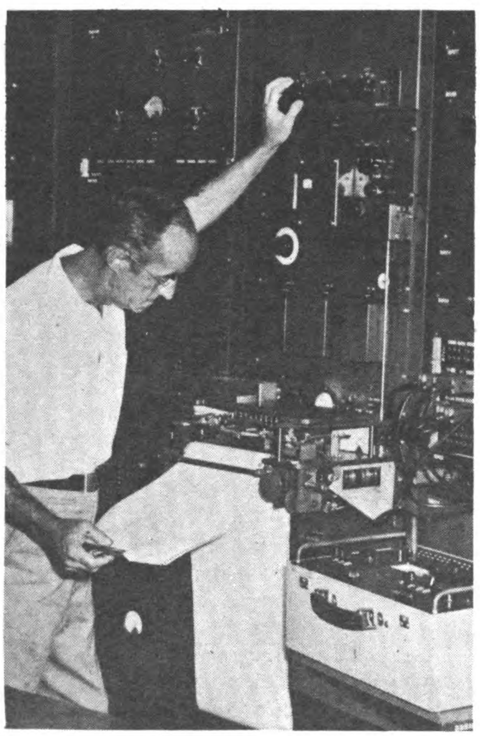


Figure 3 (above). As the equipment shown on p. 22 is lowered into the lake for testing and calibration, the results of the tests are recorded on equipment housed in air-cooled shacks located on the shores of the lake. Here an electroacoustic console provides elaborate and complete instrumentation for measuring and recording sound output of the new sonar equipment being tested.

Figure 4 (at left). Beam pattern recorder traces acoustical output of a new sonar projectors on all bearings.

Figure 5 (above, opposite). The new laboratory building, opened June 22, 1951. The older facilities, which had been in operation since 1942, were located across the lake.

Unfortunately such testing soon proved unreliable. One hitch was that one of the devices might be installed on a newly built sub in Portsmouth, N. H. while the other was placed on a war-scarred vessel in Pearl Harbor. Since the temperature of the water has a great effect on underwater sound transmission the sharp contrast between the chill Atlantic and the tropical Pacific made any comparison between the performances of the two instruments almost meaningless. And sometimes when the temperatures of the waters chosen for testing were similar, other important factors were not. For example, the shape of the bottom made a difference. Sound waves bounce off a hard smooth surface, while irregularities produce distortion. It seemed well-nigh impossible to find ocean locations where all important conditions were duplicated, for weather, tides, water temperature, and condition of the bottom are too often unpredictable. Hence it was necessary to find a spot where testing could be carried out under known, stable conditions. These, then were the origins of the installation at Lake Gem Mary.

The accuracy and dependability of our present fleet sonar systems on submarine and surface ships are in large part due to the work which has been done here. It was exacting, time-consuming and often tedious. But it succeeded in setting reliable standards for what sonar equipment should be able to do. It is no longer necessary to send untried prototypes to the Fleet. Every new sonar for surface ships and submarines comes to Orlando first for accurate measurement against known standards of performance. Only after it has passed the rigid testing here will it be sent to the operating ships of the Navy for tactical trial.

This work until recently had to be carried out under great difficulties with less than adequate equipment in a laboratory that had served since the last war. Nevertheless the results obtained had made our Navy supreme over every enemy it faced. Now that a new laboratory has been built which is as completely equipped and thoughtfully designed as the Navy's civil engineers can make it our Navy's opportunities for retaining its fighting form have been greatly increased.

Scripps Oceanographers on Second Expedition

Sea-going ONR scientists are underway again. This time the group from the Scripps Institution of Oceanography, who last year discovered the Mid-Pacific Mountains, are delving into the geography and biology of the waters of the northern Pacific and Alaska.

The voyage will take in a lot of ocean--some 7,000 nautical miles of it, to be specific. A giant underwater cliff that extends several hundred miles due west of Cape Mendocino in northern California is the first object of interest to this year's expedition. Eleven hundred miles west of the coast the vessel will turn north to the center of the Gulf of Alaska, where samples will be dredged from the peaks of mountains which loom up into these waters.

The Horizon will then call at Kodiak, the only stopover on the voyage, before sailing southward along the Aleutian trench to Umiak Pass. Thence it will veer southward on an 1800-mile voyage to a point approximately 500 miles northeast of Honolulu.

On the way back to San Diego some interesting discoveries may be made. Scientists suspect that an escarpment lies below these waters, facing the Menodocino Escarpment, in the vicinity of 33 degrees north.

Scientists also hope to make some important discoveries with some new equipment they are taking along. This year's expedition is equipped with a Midwater trawl, a net that they hope will help them to uncover facts about the ocean's mysterious deep-scattering layer. This is a portion of the ocean that has caused much speculation. Ordinarily scientists use an instrument called a bathograph which emits sound waves, whose echoes, as they bounce off the bottom, are timed to calculate the depth of the water. But in some areas where the depth is known, the sound waves bounce back from a layer of water that is located only about halfway down. What makes them bounce is unknown to the scientists, for the only solid objects that have been dredged up from these depths are plankton--fish too small to account for the echoes. One of the difficulties in getting more data is that available nets could not be dragged at a fast enough rate of speed at such depths to catch any fish worth his salt. Thus the new net, which can be pulled along much faster, may bring some very interesting specimens into the light of day.

Last year's expedition, called Operation Midpac, used the same vessel for a 24,000-mile voyage in the Pacific. One of the most important discoveries made was the finding of an undersea mountain range located between Hawaii and Bikini and comparable in size to the Rockies. Previously investigators had discovered some of the peaks, but the existence of a range of such great size was unknown. In addition to the discovery of the new mountain range, the expedition made many other investigations, the results of which are now being subjected to intensive studies.

On the Naval Research Reserve

VNRRU 11-6 Looks Back on Year of Notable Accomplishments

LCDR Joel A. Benedict (left) reads orders relieving him of command of Unit 11-6 to members of the Unit and to LCDR Milton B. Morse, the new CO.

Getting any new organization shipshape is always a difficult task. That is why reports of the accomplishments of Unit 11-6 make such encouraging reading. When change of command ceremonies brought the first year of operation of the Phoenix, Arizona group to a close recently, members were able to survey their record with well-founded satisfaction.

Although 11-6 is the youngest of the Research Reserve units in the naval district, an enthusiastic membership, headed by LCDR J. A. Benedict, enabled the fledgling unit to win the Commandant's trophy for the "best unit" at the conclusion of the rough annual military inspection. Its efficiency was commended in three departments: personnel, training, and administration.

While achieving this fine record, the unit has also become widely known for its hospitality to visiting reservists from other parts of the country, who attend its meetings during visits to Phoenix.

LCDR M. B. Morse, the new commanding officer of the unit, has ordered to duty the following staff: Executive Officer, LT I. B. Watts; Training Officer, LT R. K. Bailey; Personnel Officer, LT R. R. Nicolay; and Publicity Officer LCDR T. L. Edens.

CDR George Z. Dimitroff is New Training Officer

CDR George Z. Dimitroff's energy and enthusiasm make it clear how he was able to cram into a relatively short span of years achievements and distinctions enough to fill a couple of ordinary lifetimes. An astronomer of international repute, whose career has taken him to almost every section of the globe, CDR Dimitroff's perspective was broad enough to take in the fact that there was a crying need today for capable scientific administrators in the Nation's national defense scheme. That is why he has taken on the job of training officer in the Research Reserve's Personnel and War Plans Division.

A friendly man with a ready smile, CDR Dimitroff's mobile face lights up with humor and satisfaction as he tells of the full and varied career that led him to his present post. His rapid speech and ease of expression belie the fact that he was born in Bulgaria and received a part of his training at Robert College in Constantinople (he has been a U. S. citizen for many years).

The process of acquiring his present command over English, however, led the commander into one rather unusual experience. Boston University was the scene of his first academic endeavors in the U. S. and there he was somehow placed in a more advanced English course than were any of the other freshmen. As a result, his record at the end of the first term showed superlative grades in everything except English, in which he received a very low mark. This was a sore discouragement to an ambitious young student and he felt it as such. But the university authorities, who knew a good man when they saw one, persuaded him that prospects were not as gloomy as they appeared. Their confidence was justified, for he went on not only to academic honors at B. U. but also to win a scholarship for graduate study in astronomy at Harvard, where he took his Master's and Doctor's degrees. Sandwiched in between this academic work was a stint at Colorado State College as assistant professor of Physics.

In 1937 Mr. Dimitroff took over the job of Superintendent of the Harvard Observatory, where he helped to build some of the largest Schmidt cameras in existence prior to the building of the one now operating at Mt. Palomar. These are the instruments which have enabled scientists to probe the voids of space to discover new galaxies.

Navy Opening Officer Candidate Program

An officer candidate program is being opened by the Navy in the near future. Applicants (males only accepted) must be between 19 and 25 and must be eligible for induction under the Selective Service Act. In addition they are required to have a bachelor's degree from an accredited university which included training in trigonometry. Candidates who successfully complete the indoctrination course will be appointed to the grade of Ensign, U. S. Naval Reserve, and ordered to appropriate active duty for three years. Your recruiting officer has details.

By this time CDR Dimitroff was becoming well known even outside of the United States, for at the invitation of the Mexican Government he went to Puebla, where he acted as a consultant in the building of the new astrophysical laboratory there.

Soon after this, CDR Dimitroff decided that he could render his greatest service to our Nation's war efforts as a naval officer. His first post was at the Bureau of Ordnance, where he aided in the work of degaussing ships to protect them against magnetic mines. In 1945 he traveled to Europe as Navy member of the ALSOS Commission in charge of studying atomic developments there. Afterward he had another scientific mission to Europe--the task of studying optical developments as a member of the Naval Technical Mission. Later a similar errand took him to Japan.

After the war CDR Dimitroff became Professor of Astronomy at Dartmouth, where he took an active interest in the Research Reserve, eventually becoming CO of Unit 1-7 in Hanover, N. H. His work there convinced him that the organization was worth its salt and he decided he wanted to put his full time efforts into aiding its growth and progress. Certainly the presence of officers like CDR George Z. Dimitroff should aid the VNRR to realize its full potentialities in the national defense scheme.

Tentative Plans for Reserve Seminars Announced by Bureau of Naval Personnel

There is good news in the air for Research Reservists who have hopes of attending a seminar or being assigned to training duty during fiscal 1951. In spite of the current emergency, which caused many to anticipate possible curtailment of these phases of the VNRR program, plans have been approved by BuPers for holding these annual activities which have proved to be of such value in indoctrinating reserve officers in the activities of ONR. Changes in the plans are, of course, possible, but here is the present outlook for these events.

The Special Devices Center will be host to reservists from 20 April through 3 May, 1952. Those who attend will be given a thorough indoctrination into the aims, accomplishments, and facilities of the Center.

For this reason priority will be given to members of units who are Special Devices Reserve Officers.

The annual ONR-Washington seminar, which has had the enthusiastic praise of reservists who attended it in other years, will be held from 8 to 21 June, 1952. This seminar provides an opportunity for reservists to study the plans, objectives and functions of ONR, with emphasis on the VNRR program. Because it is important for as many members as possible to have the opportunity to attend, applications should be submitted only by those who have not come to any of the previous Washington seminars.

In addition to the seminars which have been approved "on-the-job" training has also been approved. The quotas for each of these activities from the various naval districts are as follows:

Naval District	Quota*
1	42
3	38
4	25
5	35
6	42
8	20
9	63
11	17
12	36
13	30
PRNC	47
total	395

*Note: Each district can send the specified number of men to each of the three activities.

Australians Request 11-5's San Diego Bay Report

Some of the Civil Defense work being done by Research Reserve units is receiving international notice. Last month we ran a story on a survey made on the San Diego Bay area by Unit 11-5, whose members thought that it would be useful to calculate in advance the probable effects of an atomic bomb on the waters of the Bay. They wrote such a good report on the work that the Australian Government's Bureau of Fisheries has requested copies. The Australian Governments is engaged in making extensive oceanographic surveys of estauaries on the Australian coast which are similar in nature to the San Diego Bay.

Rockets for Research: Silhouetted against the night sky at White Sands Proving Ground, New Mexico, is a Viking Rocket. Scientists at ONR's Naval Research Laboratory are conducting research into the composition of the upper atmosphere by means of such missiles. The last one was fired this month at the Proving Grounds. Watch for more news of rocket research in future issues.

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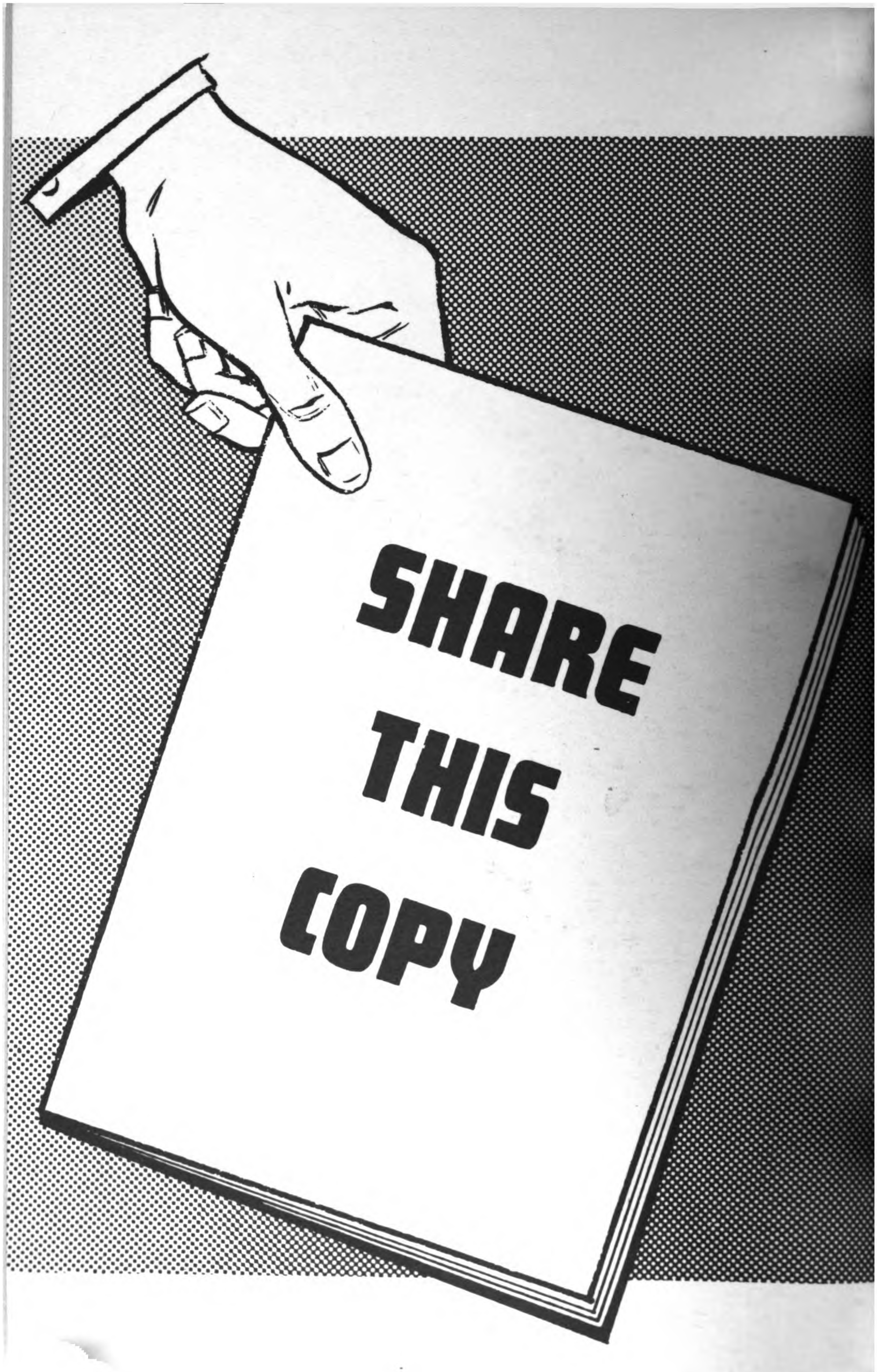
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