sitic water mites which live between the gills. One of the common species of the eastern United States, *Unionicola ypsilophorus* var. *haldemani* (Piers), is found in *Anodonta cataracta* Say. This mite occurs abundantly, at least in eastern Massachusetts, and can be obtained at any time of year when the host is available. When these animals are removed from the host, washed and placed in water free from host material, they show a positive response to light. If water from the mantle cavity, or water extract of the gills is added to water containing the mites, they usually show a distinct reversal to a negative state as regards the light. This negative response may persist for a half hour or more if the concentration of host material is high. The reversal may be interpreted as a type of conditioned response brought about by some material from the host; the positive response to light being primitive and the negative response acquired since the mites have taken up a parasitic life. It may also be shown in the case of *Unionicola* from *Anodonta* that only material from the host will bring about a reversal, water from the mantle cavity or extract of the gills of such forms as *Elliptio* or *Lampsilis* having no effect on the mites. The influence of host on parasite is seen therefore to be specific for a particular host-parasite combination.

In a typical experiment ten mites are placed in a small rectangular glass jar with sufficient water to cover them. This is placed between two light sources which may be used alternately. In a series of trials, using first one light source and then the other, the number of mites which are positive may be determined and any which are negative may be removed if desired. If one light source is of high intensity (100 watt lamp) and one of low (15–25 watt lamp) they may both be used at the same time and the effect of intensity on the behavior of the mites observed.

Next, using one light source and attracting the animals to the end of the jar toward the light, a small amount (1–3 cc) of filtered extract of gill may be added in the neighborhood of the mites, and usually there is an immediate reversal to a negative state. This is not a chemotropic response, for the mites will often move out of the region of greatest concentration of extract to a region of lower concentration. If results are not conclusive the mites may be washed, returned to fresh water, and the experiment repeated.

Finally, if desired, the mites may be allowed to collect on a small piece of gill and usually, regardless of directional illumination, they will remain on the piece of gill probably as the result of a positive stereotropic response to a familiar surface.

Not all species of mites are satisfactory for such experiments. Some have been parasites for so long that they have lost almost all power of locomotion, others, such as *Unionicola fossulata* (Koen) from *Cyclonais tuberculata,* are positive only to light of low intensity (about 0.1 meter candles) a condition difficult to attain outside the darkroom.

Two papers by the author regarding the behavior of parasitic water mites have appeared elsewhere.[1]

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Experiments on the nature of the structural units of solids: ALEXANDER GOETZ (by invitation). It is necessary for a general understanding of the physical properties of crystalline solids to assume in addition to a regular geometric configuration of atoms or molecules in a crystal lattice also the existence of a mosaic structure, as has been proposed in recent years by Smekal, Ewald, Darwin and Zwicky mostly with regard to heteropolar substances. Because of the special interest of the effects depending on the mosaic structure in metals, *i.e.*, homopolar lattices, a systematic experimental investigation has been started which, up to the present, leads to the following general conclusion: A crystal consists of a more or less regular conglomerate of structural units, the size of which is a quality of the substance in question. Each unit is an ideal crystal in itself, its boundaries which coincide with certain low index planes form potential walls, which as such affect the electric transparency of the crystal. Impurities of structurally different substances are imbedded within the boundaries affecting their separating qualities and being sometimes even able to start new types of boundary-layers along different crystallographic planes. At higher temperatures the perturbing influence of these boundaries affects the structural unit to a larger extent and thus decreases the size of the ideal structural unit without affecting their number. Hence a block of metal in its most stable, *i.e.*, single crystalline configuration is considered as consisting of a crystalline and an amorphous component.

Supra-conductivity and the Hall effect: EDWIN H. HALL. Kamerlingh Onnes described two experimental investigations, each of which he regarded as indicating that there is no Hall effect in the supra-conductive state of a metal. In the first of these, plates of tin and of lead, respectively, in the supra-conductive state were tested directly for a Hall effect in the usual way, between the poles of a magnet. In the second, a spherical

[1] "Reversal of Phototropism in a Parasitic Water Mite," *Biol. Bull.* 59, 165, 1930; "Specific Influence of the Host on the Light Responses of Parasitic Water Mites," *Biol. Bull.*, 61, 497, 1931.

shell of lead, in which self-persistent electric currents had been induced, was suspended in a magnetic field under such conditions that a torque exerted by the twisted suspension was opposed by a torque exerted on the current-bearing sphere by the magnetic field. When a balance between these torques was once established it remained substantially unaffected for hours. Onnes interpreted this fact as proving that the persistent currents in or on the surface of the sphere were held unchanged in their paths in spite of the couple exerted upon them by the magnetic field in which the sphere was suspended, and this conclusion he expressed by saying that there was no Hall effect in the supra-conductive lead. The first of these two methods of experimentation seems open to the objection that the lines of induction of an applied magnetic field can not penetrate a metal which is already in the supra-connective state. Criticism of the second method can not be so briefly stated. The question whether a metal in the supra-conductive state can show a Hall effect remains undecided. The proper way to answer this question would seem to be as follows: Apply the magnetic field to the metal plate, carrying a longitudinal current, while the metal is in the normal state, then cool it to the supra-conductive state, test for a transverse potential difference, then raise the temperature of the metal above the transition point, reverse the magnetic field, cool to the supra-conductive state again, then test for a transverse potential difference opposite to the one observed before.

The scattering of light by supersonic waves: P. DEBYE and F. SEARS.

The projection of motion pictures in relief: an experimental realization: HERBERT E. IVES (introduced by F. B. Jewett). The projection of motion pictures in relief, visible to a group of observers occupying a wide range of positions with respect to the screen, but demanding no special spectacles or other apparatus at the eyes, has been experimentally realized on a small and crude scale by an application of the principle of the parallax panoramagram. The individual pictures constituting the record of motion and relief are made up of narrow juxtaposed strip images, each of which is a minute linear panorama of the scene presented to the camera. The camera consists of a large 4-foot diameter concave mirror, at whose focus is a transparent screen consisting of approximately 200 minute concave grooves. The virtual images of the mirror formed in these grooves are photographed by a single exposure onto a lantern slide size plate. Prints from negatives so made are then mounted on a large disc capable of slow rotation in the slide plane of a projection lantern coupled with another rapidly rotating disc with an aperture which flashes a bright beam of light through the projection system as each picture comes into position (Plateau's magic disc or Plenakistoscope). The projection screen consists of 200 transparent rods, one quarter inch in width, having convex cylindrical surfaces in front and rear, of such curvatures that linear images on the rear surfaces are projected as parallel beams into the observing space. When the pictures, made as above described, are projected with each panoramic strip in accurate register upon a rod a composite picture is seen on the 4-foot diameter screen which varies with the direction and distance of observation, exhibiting stereoscopic relief. Succession of such pictures at the rate of 15 to 20 per second provides motion pictures in relief. Successful results depend upon such extreme accuracy of all mechanical and optical parts and adjustments that commercial application appears remote.

Some recent developments of electric waves guided by wires: GEORGE O. SQUIER. There is no depression in science, but on the contrary it has been said that we are in the midst of a second and greater Renaissance. During 1931 the Bell Laboratories have concentrated on the investigation of wide-frequency band transmission of electric waves over telephone cable circuits, the results of which are summarized as follows: It now seems clear that circuits can be provided in aerial or underground cable that will have characteristics permitting an extremely wide band of frequencies to be transmitted with substantial uniformity throughout the band. The net result of this work has been to open up the possibility of very long circuits, each of which can carry a very large number of non-interfering telephone communications, and a very much larger number of non-interfering telegraph communications. Television, which is still "around the corner," logically fits into the spectrum of short electric waves guided by wires. The year 1931 has witnessed no "depression" in the development of broadcasting. Instead the thoughts of the whole world were delivered by engineering skill from any quarter to the very walls of the steel frameworks of the huge buildings which house our city populations. This "Outdoor Broadcasting" has been accomplished, but we must now attack seriously the engineering problem of "Indoor Broadcasting" by which these myriad messages may be sorted out and delivered to the vast audiences within these steel walls who are the "supreme court" of ultimate success. The next two years will witness this basic engineering problem being realized by going directly back to the original plans of Marconi. Instead of broadcasting through space for hundreds of miles from an antenna, we will set up a complete radio broadcasting plant inside a multiple wire cable and broadcast multiple programs from a single antenna within the cable to receivers in each of the rooms. This is the only engineering solution of interference prevention to meet the severe requirements of each and every tenant who has chosen to live inside these modern steel structures. There are two methods of accomplishing this, to wit: (1) Utilize the existing telephone plant already provided. (2) Construct a separate wire-wireless indoor broadcasting equipment. Radio City offers an ideal opportunity for this development.

Evidences of cycles in tree ring records (illustrated): A. E. DOUGLAS (by invitation).

Periodicities in solar variation: C. G. ABBOT. Summary was made of the observations of the Smithsonian Astrophysical Observatory since 1895, including references to various new instruments for scientific work. Among them is the periodometer which has been employed to discover and evaluate periodicities in solar variation and in the temperatures of Clanton, Alabama, Washington, D. C., and Williston, North Dakota. The variation of the sun since 1918 is well represented as the sum of 7 periodicities, respectively of 7, 8, 11, 21, 25, 45 and 68 months. The temperature departures of the 3 stations named are also closely represented as the sum of these periodicities supplemented by two or three others which seem to be of terrestrial rather than of solar origin. However, at each station the sum of the amplitudes of the periodicities apparently of solar origin exceeds by about twofold the sum of the amplitudes of the terrestrial periodicities. This indicates that temperature departures are largely governed by variations of the sun, and holds out a hope of long period forecasts possibly extending for several years in advance. Further investigation must ensue before this hope can be thoroughly tested.

The nature of the solar cycle: W. S. ADAMS and S. B. NICHOLSON. The physical appearance of the sun varies from day to day as the sunspots, faculae and prominences develop and disappear on its surface. These phenomena may be distributed irregularly around the sun so that the number of objects visible at any time depends on the rotation period of the sun which approximates to a month. Their average monthly frequency, therefore, is an indication of the actual solar activity. The solar activity measured by this method fluctuates irregularly in cycles ranging from six to fifteen months and shows variations up to one fourth its mean value. The solar cycle which is most nearly periodic and which has the largest amplitude is of about eleven years' duration. This period may vary between nine and fourteen years and the amplitude of the cycle by about 50 per cent. of its average value. Period and amplitude are apparently unrelated. It seems probable that both the quantity and quality of solar radiation vary during this cycle and many attempts have been made to correlate terrestrial phenomena with sun-spots. Definite correlations have been found with the variations of terrestrial magnetism and its related phenomena. There is evidence of a slight correlation between sun-spots and atmospheric temperature in certain regions on the earth and with other factors of weather and climate for limited regions and for limited time intervals. These correlations are so uncertain that, in the majority of cases at least, predictions based on them have very little weight.

Correlation of sedimentary and climatic records: ISAIAH BOWMAN. The earliest studies of banded sediments were made to obtain measures of geologic time—measures akin to those of Michelson on the speed of light in that the end in view was a more accurate yardstick. Later on, the interpretation of sediments passed into a more advanced stage in which there was accomplished the cross-dating of banded clays of late glacial origin. The most noteworthy work upon them was done by De Geer in Sweden and by Antevs in New England. The latter demonstrated a rate of retreat of the ice in the Connecticut Valley of about a mile in twenty-two years over a period several thousands of years long. By comparing the lake deposits in series along the edge of the ice front the measured rate of retreat of the ice was determined. But up to the present all such datings are relative. That is to say, no one has yet found the bottom of the oldest deposit nor the top of the youngest. Nor has there been established a correlation between the banded clays of New England and the oldest trees. The clays are on one side of the country and the oldest trees, the Sequoias, are on the opposite side and the differences in climatic habit are wide. Because the lakes of the Great Basin have expanded and contracted in response to climatic change, one naturally turns to that region for a possible correlation between lake history and tree history to see if identical periods of wetness and dryness can be distinguished. Unfortunately, from this standpoint, the lakes of the Great Basin are and have been mostly salt lakes, whereas the banded clays that lend themselves most readily to the dating of events in geological time are formed in fresh-water lakes. A neglected field of study has been the sedimentation process. Until that process is studied in detail and correlated with rainfall, temperature, cloudiness and stream discharge, there is no solid experimental basis for the interpretation of sediments now exposed on basin floors in sections that are accessible. The drought of the past three years has exposed lake floors that have been covered with water for many decades and that have been exposed to view probably not more than once or twice since white occupation of the West. This makes it a matter of urgent importance that the studies of the now dry lake beds should be pushed with all speed before they again become covered with water and the sedimentary record of their fluctuations is again difficult to sample.

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