the 41° hollow cone on which all primary rainbows lie, whose axis is the line SO drawn from the sun to the observer and whose vertex is at the eye of the observer (Fig. 1). If the elevation of the sun were exactly 41°,

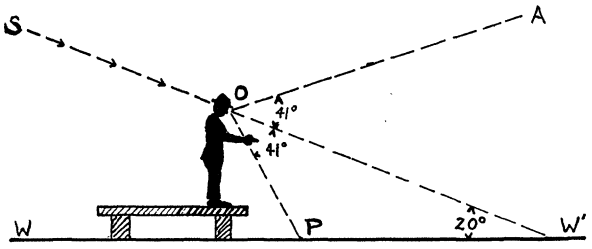

FIG. 1. Spherical water droplets resting on the plane W W′ give rise to an hyperbolic bow as a section of the cone AOP.

the element OA of the cone would then be horizontal and the section on the surface of the water would be a parabola; but at the time of observation (8 A.M.) the sun was only about 20° above the horizon, so the section must have been an hyperbola. Presumably it would be possible to have an elliptic bow if the elevation of the sun were greater than 41°. The colors in the bow were arranged in the same order as those in a primary rainbow, with red outermost. The bow was narrow and the colors were most brilliant at the vertex of the hyperbola P, where the bow met the shadow cast on the lake by the observer's knees; at more distant points the intensity gradually faded as the bow became wider, but it was clearly visible for more than 200 feet along each limb of the hyperbola.

Close examination of the water surface showed no evidence of ice crystals, but it did disclose the presence of countless drops of dew, some of which glistened individually with jewel-like brilliance when viewed at the proper angle. A rainbow is usually observed under conditions where the distances to individual particles which contribute to it are never observed directly and where, in fact, light is reflected from a considerable depth of the parent mist or fog. Hence one unconsciously projects the bow against the celestial sphere and it appears as a segment of a right section of the 41° cone; *i.e.*, circular. But in this unusual case, the reflecting droplets all lay on a single surface (which doubtless contributed to its brilliance) and the bow appeared definitely to lie upon the motionless lake.

Turning to the laboratory for verification, the writer has succeeded in reproducing a segment of such a "dew-bow" in the following manner: Water does not wet a smoked glass surface. Hence, by covering a piece of plate glass with soot from burning turpentine and then by spraying it with water from an atomizer, the surface may be covered with numerous small droplets which are virtually spherical because of their surface tension. When this surface is illuminated obliquely by a carbon arc and viewed at the proper angle, brilliant colored reflections appear. The most brilliant effects come from droplets about 0.5 mm in diameter, which appear to be of the same order of size as those observed resting on Pocono Lake.

It remains to discuss how dewdrops can possibly rest on the surface of water without coalescing. In all probability the unusual stillness of the lake had allowed a thin film of organic matter to spread over the surface so that the dewdrops failed to make intimate contact with the water. The writer has frequently observed much larger drops of water from an oar or paddle rolling over the surface of a quiet lake, in some cases for several seconds before they disappear. Small droplets of alcohol may be observed to remain for an appreciable time upon the surface of alcohol. (Incidentally, when they do dart beneath the surface, they leave behind an almost microscopic droplet which may remain until it evaporates; the liquid in the original droplet darts below the surface in a vortex ring which may be followed if the drop of alcohol has a little coloring matter in it.) Likewise, water droplets from a small jet held obliquely just above the surface of a beaker brim-full of water may be observed to roll across the top and over the edge of the beaker. The phenomenon of droplets of a liquid resting upon the surface of the same liquid is therefore an experimentally repeatable one. However, its duration must depend in large measure upon conditions of surface tension and freedom from agitation of the surface. In the case reported, where such a beautiful "dew-bow" was formed, the conditions must have been ideal.

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THE VALIDITY OF AGE DETERMINATIONS FROM THE SCALES OF LANDLOCKED SALMON

FOR a number of years the Fish Cultural Branch of the Department of Fisheries, Ottawa, has been securing eggs from the landlocked salmon of the Chamcook Lakes in New Brunswick. The salmon are trapped at spawning time in a small stream connecting First and Second Chamcook Lakes. The fish are stripped, the eggs being taken to the hatcheries and the stripped fish released into the lake. In the fall of 1931 the entire catch of two hundred and thirty salmon was tagged by the Biological Board of Canada under the supervision of Dr. R. H. M'Gonigle. Although 35.6 per cent. of the fish have never been heard of again, many of the remainder were found on the spawning grounds several years in succession. This has afforded an excellent opportunity of comparing the true age with the age shown on the scales.

The scales of young fish under three years are fairly easy to read. The growth during the summer is quite

uniform with only an occasional accessory check and the winter check is quite definite. The growth during the first year is invariably poor and the ridges are very close together, but there is no difficulty in distinguishing the first winter check. Fish over three years old have usually spawned on one or more occasions, and it is after the first spawning that the scales are unreliable for age determinations. Most of the females spawn in the fall of the fourth year and the males a year younger.

In about 67 per cent. of the cases the ages can not be determined correctly from the scales, the fish being anywhere from one to four years older than is recorded on the scales. This is due to the fact that the mature fish, spawning consecutively for a number of years, grow very little from one year to the next. Consequently the scales show little, if any, growth, and this, coupled with extensive scale absorption, renders the scales difficult, or impossible, to be interpreted correctly. For example, one fish was tagged in 1931 and taken again in 1933 and 1934 on the spawning grounds. It increased in length 7 cm, the weight remained the same, namely, 2.75 lb., and the scale age in 1931 was 3+ years and in 1933 and 1934 was 4+ years with one spawning mark. Thus the true age was 6+ years and the scale age 4+ years.

The scale absorption during the spawning season is very extensive in the posterior region of the scale and along the sides, but seldom extends to the anterior edge of the scale. In contrast to sea salmon the two layers of the scale are almost equally absorbed. The outer layer, though, is absorbed slightly more than the inner layer, thus forming ridgeless scars to denote the spawning mark, but these occur only at the sides of the scales and are quite often completely absorbed by subsequent spawning when the fish are annual spawners. The spawning mark is always followed by closely spaced ridges, and when the sides of the scales are absorbed enough to eradicate the ridgeless scars, all that remains of the spawning mark is a band of closely spaced ridges in the middle of the scale. It is then rather hard to distinguish a spawning mark from a winter check, for likewise all that remains of the winter check is a band of closely spaced ridges in the middle of the scale. In the spawning check, however, a few of the ridges are very close together, and these are followed by wider and wider ridges until summer growth is reached, but the closest ridges of a winter check are followed quite abruptly by the wide summer ridges. This distinction is applicable to the salmon from Chamcook Lake, but evidently each lake presents its own problem since the winter check is already formed by the middle of November, *i.e.*, before spawning, in salmon from nearby Gibson Lake, and consequently the winter check and spawning check occur together. In Gibson Lake, which is a smaller lake than Chamcook, the seasons occur earlier and the salmon are similarly affected.

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STABILITY OF CONDITIONING AND SEXUAL DOMINANCE IN THE RABBIT

IN a series of studies[1] on the dim visibility curve, bright visibility curve, and color vision for the rabbit, I noted an interesting correlation between stability and magnitude of the conditioned breathing response to light and sexual dominance. Conditioned breathing responses were established in six males at six months of age and were studied intensively in three over a two-year period. Characteristic homosexual behavior was present throughout this period. It was possible to rank each of the six animals in terms of the number of other rabbits it dominated in male sexual activity. Ranking in terms of sexual dominance agreed well with the consistency and magnitude of the conditioned responses. The more dominant an animal the greater were the consistency of conditioned response from day to day and the magnitude of response.

It was also observed in the three rabbits which were studied for two years that changes in sexual dominance were accompanied by changes in the stability of conditioning. At intervals of two, three or four weeks, a reversal of the male rôle occurred for one or more of the three relations between the three rabbits. Such reversals correlated with changes in conditioning. A formerly dominant animal became less consistent in conditioning upon assuming the female rôle in sexual activity, and a formerly submissive rabbit became more consistent when it assumed the male rôle over one or both of its partners.

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"MEDICAL CLASSICS"

THE second number of Volume 1 (1936) of a new journal, *Medical Classics,* is devoted to Sir Charles Bell. It contains an 1833 version of Bell's paper, "On the Nerves," originally published in 1821 in *Philosophical Transactions of the Royal Society.* In brackets between the title and text this alleged reprint bears the inscription, "Read before the Royal Society, July 12, 1821." The editor's use of this version is on the ground that "it includes two additional illustrations." Although this reprint bears the specific statement in cold print that the paper was read before the Royal Society, this is not the truth. It is the doctored ver-

[1] R. H. Brown, *Jour. Gen. Psychol.,* 14: 62–82, 83–97, 1936; 17: 323–338, 1937.