bovine mammary gland to the penicillin molecule in the blood stream. At least one attempt to treat chronic *S. agalactiae* mastitis by this route has been recorded as a failure.[1] The appearance of penicillin in various body fluids in man following intravenous injection has been reported, and in the bovine, a selective absorption of penicillin from the blood by an active mammary gland might conceivably remove the drug from the blood stream at a rate comparable to that of the kidney, necessitating more frequent doses to maintain a desired blood level. To test this hypothesis, the milk from a Jersey heifer, free of mastitis, was tested for penicillin activity following intravenous injections.

Penicillin Injections: In the first trial, 80,000 Oxford units of a calcium salt of penicillin in eight ml of 0.95 per cent. saline were introduced into the jugular vein. In a second trial, a total of 500,000 units were administered in two portions of 15 ml each about one minute apart. Prior to the injection the four quarters of the udder were milked out until only small intermittent streams were obtained.

Sampling: During the six-hour period following the injection the animal was milked for three to four minutes at intervals of a half-hour, and in the subsequent six-hour period at intervals of an hour. A final sample was obtained 24 hours after the injection. The samples were held at 4° C for less than two hours before portions were removed to the assay cups.

Testing: Preliminary observations indicated that the cup method of assay is adaptable to milk solutions of penicillin and that milk enhances the action of penicillin against the test organism, as measured by the zone size. This effect is probably attributable to the high buffer content of the milk. The cup method is of particular value in testing turbid and non-sterile solutions, and is reasonably critical to about 0.2 Oxford unit, a value within the range of accuracy required for the purpose of this study. The test organism employed was *S. aureus* H. Controls of buffered distilled water containing two units of penicillin gave satisfactory zones after 18 hours of incubation at 37° C.

Results: Penicillin activity was not observed in any of the milk samples obtained in the 24-hour period following the intravenous injection of 80,000 units in the first trial and 500,000 units in the second trial. The samples obtained during the first six-hour period in the second trial were pooled and the cream and skimmed milk tested separately for penicillin. No zones of inhibition were observed.

Our observations do not lend supporting evidence to the value of the intravenous method for the treatment of chronic bovine mastitis with penicillin, and indicate that the lactating bovine mammary gland does not serve as a major systemic exit for penicillin in the blood.

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[1] C. S. Bryan, R. E. Horwood and C. F. Huffman, *Veterinary Medicine*, 40: 87–89, 1945.

ROTATION OF ELECTROLYTE BETWEEN INSULATED POLES OF MAGNET

F. EHRENHAFT has described an experiment in which a drop of $FeCl_3$ rotates between the poles of a permanent magnet from which it is electrically and chemically insulated by a coat of Piceïn wax. I stated, at the meeting of the American Physical Society, on January 19, that I had seen this experiment and that the insulation did not break down under a potential difference of 220 volts. At that time, however, I had not been able to obtain the effect.

By reproducing exactly F. Ehrenhaft's experimental set-up, the rotations were obtained at the Sloane Physics Laboratory. The waxed pole faces were 1.5 mm apart. Light from a carbon arc was sharply focused on the center of the drop of $FeCl_3$ with the help of two lenses, the second of which was a microscope objective of focal length less than 2 cm. The drop was observed with a microscope. The insulation was checked electrically.

By observing the drop with the naked eye it was found that the motion was not a true rotation. The liquid moves both to the right and to the left, in a horizontal plane, and definite up and down motions also take place in the drop. The experiment was repeated with thin glass plates insulating the drop from contact with the metal of the pole pieces, and $CuSO_4$ and $CuNO_3$ were used, as well as $FeCl_3$. The same type of motion was observed in each case. When the magnet was turned upside down, thus changing the direction of the magnetic field, the motion was observed in the same direction. To test decisively the role of the magnetic field, the magnet was replaced by a replica constructed out of brass.[1] Drops of $FeCl_3$, $CuSO_4$, and $CuNO_3$ were found to "rotate" to the same extent as before, both between layers of Piceïn wax and between glass plates.

Further experiments with the Piceïn-covered permanent magnet showed that there was a very definite acceleration as the light beam was first put on. Progressively dimming the illumination considerably

[1] I am indebted to Professor Leigh Page for this suggestion.

slowed down the motion of the drop. Illuminating the drop from the opposite side definitely changed the direction of motion. The red and infrared radiation was then filtered out by a 2 cm layer of a solution[2] known to pass about 25 per cent. of the visible light. The motion stopped completely within 40 seconds and started again as soon as the filter was removed. When the total intensity of the beam was reduced to 25 per cent. by halving the diameter of a variable diaphragm, the motion slowed down, but did not stop.

From the above results, we can conclude (*a*) that a magnetic field is not necessary for the production of this particular "rotation," (*b*) that this effect is due to the heat radiation of the illuminating light which causes convection currents in the drop (the center being maintained at a higher temperature than the lateral surface, at which evaporation takes place).

No inferences should be drawn from these conclusions as to any other kind of rotation, either in liquids or gases. Further experimental work on these will be published later.

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WHY THE HALO AND THE CORONA DO NOT APPEAR IN THE SAME CLOUD

As explained in any work on atmospheric optics, the halo, of which the most common of its several forms is the rainbow-tinted circle of 22° radius (the full moon subtends half a degree) around the sun or moon, is caused by snow crystals in the air; and the corona, a rather brightly colored ring (sometimes, two —rarely three—concentric rings) usually of two to four degrees radius, about the sun or moon, by tiny water drops.

Both these phenomena, the large halo and the much smaller corona, are often seen in thin clouds (thick clouds scatter the light too much for the rings to remain conspicuous) but never both in the same cloud.

Clearly, then, an intermingling of water droplets, essential to the corona, and ice crystals, necesssary for a halo, can not persist in the air. And this, in turn, is owing to the fact that at every temperature below the freezing point the tendency of water droplets (undercooled, of course) to evaporate is greater than that of ice crystals at the same temperature. The ice crystals, therefore, in a cloud of crystals and droplets, if such a cloud could and did occur, would grow at the expense of the droplets, which quickly would disappear.

At temperatures above the freezing point, snow crystals obviously can not exist, nor, as above explained, can water droplets and snow crystals persist mingled together at temperatures below the freezing point, and even at the freezing point, when the vapor tension over a flat surface of pure water is the same as that over ice, the droplet, owing to an effect of surface tension, still evaporates over to the crystal. Hence, an intermingling of water droplets and ice crystals can not persist at any temperature. Hence, the halo and the corona never appear simultaneously in the same cloud.

In this connection it is interesting to note that, according to tables in Dorsey's "Properties of the Ordinary Water Substance," the difference between the vapor tension of water and that of ice at the same temperature has its maximum value, an amount sufficient to sustain a 0.2 mm column of mercury or equal to a pressure of five pounds per square yard, at around 10° F., a common temperature of the air at halo levels.

W. J. HUMPHREYS

SCIENTIFIC BOOKS

ALGEBRA AND TRIGONOMETRY

College Algebra and Trigonometry, A basic integrated course. xii + 324 pp. By FREDERIC H. MILLER. John Wiley and Sons. 1945. $3.00.

MANY colleges require a year of college algebra and trigonometry as preparation for subsequent study of analytic geometry and the calculus. Some of these colleges may prefer that this college algebra and this trigonometry be intimately merged in some significant way. If so, they will wish to give careful consideration to Mr. Miller's new book.

The reviewer has little interest in a merger of this sort; and, although convinced that much unhappiness in analytic geometry and the calculus is attributable to a poor grasp of algebra, he sees no reason to insist —as so many colleges do insist—that analytic geometry and the calculus shall be withheld until the student shall have acquired so wide an acquaintance with algebra or so rigorous a training in it as this book demands. Nevertheless, the reviewer does have an interest to see that every program, whether traditional or novel—and Mr. Miller's program is a mixture of both—shall have a fair chance to prove its worth; and no program can have this chance until embodied

[2] Handbuch der Physik, Vol. XIX, "Herstellung und Messung des Lichts." Berlin, Julius Springer, publisher, 1928.