other words, the permanganate delayed death for ten hours, on the average.

Some of the other experiments, with greater or less amounts of venom, gave opposite results and seemed to indicate that the permanganate has little if any value.

A tabulation of all the experiments indicates that a prompt use of the potassium permanganate had some beneficial effect under the conditions of this investigation. Whether it necessarily indicates its usefulness in cases of human snake-bite accidents, it is difficult to say; but since it seems evident that a 1 per cent. solution of potassium permanganate is practically harmless to living tissues, it is probable that the permanganate should still be used as an antidote to snake venom, at least as a first-aid treatment until other measures can be taken.

The value of incision and suction in the region of the bite is also subject to much debate, but the evidence seems to indicate that prompt and continuous mechanical suction may be of great value in removing the venom from the tissues in the region of the wound.

A more valuable series of experiments might be made with some larger animal where direct injection of venom and permanganate might easily be made into the blood vessels. Some authorities, however, claim that where the snake injects the venom directly into a blood vessel of some size nothing can be done that will effect a cure.

It is obviously not practicable to carry on such control experiments with human beings, but an extensive statistical study of cases of human snake-bite, where permanganate and other remedies are and are not used, should be of great value. India, where more than 20,000 people die each year from snake-bite, would probably be the best region in which to make such a study.

The details of this investigation will appear elsewhere.

Albert M. Reese
West Virginia University

UNDERGROUND WATER AS A TRANSPORTING AGENT FOR GASOLINE

On May 30, 1930, shortly after the opening of a filling station in Wooster, Ohio, gasoline was discovered floating on the surface of the water in a dug well, located 447 feet from the station. On the same day, a five-gallon can was filled with gasoline obtained from the well. On July 18, 1930, 65 gallons were drawn off. At a later time 45 gallons were removed and large quantities drawn off from time to time, until about November, 1930, when the accumulation decreased at a constantly diminishing rate. At no time since the discovery of gasoline in the well has the water been free from the odor of gasoline or the liquid itself. A constantly flowing spring in line with the dug well, and 622 feet from the gasoline station, was polluted; gasoline accumulated in a thick layer on the surface, the excess flowing into a creek, the water of which was rendered unfit for drinking by live stock. Across the road, 141 feet from the station, and in line with the well, a hole was dug to a depth of 12 feet. Gasoline was discovered floating on the water which appeared at the bottom of the excavation. Workmen who were digging a trench on the road between the station and the dug hole reported heavy gasoline fumes at a point opposite the station.

The station, well and spring are located on a slope, the former standing at a higher elevation. The ground water is therefore moving from the station toward the well and spring. Gasoline issuing from holes in defective tanks at the station makes its way downward through the bed-rock until it reaches the ground water upon which it floats. The bed-rock is thin-bedded and well-jointed sandstone, through which the underground water can easily move. The gasoline is transported down-slope by the water, spreading out fan-like, finally reaching the well and spring. Several gallons of brightly colored kerosene were placed in the dug hole opposite the station. In 23 hours the colored material appeared in the well; the underground water had moved a distance of 306 feet in that time.

Karl Ver Steeg
College of Wooster

MYOESTHESIS AND "IMAGELESS THOUGHT"

In the course of an experimental test of the behavioristic theory of thinking there was occasion for artificially inducing minimal or "implicit" contractions of human muscles by electrical stimulation. This work yielded a result which is of interest in connection with the "imageless thought" controversy, in that it sheds further light on the non-sensorial and imageless experiences reported by Binet, the Würzburg workers and Woodworth.

To very feeble electrical stimuli our subjects responded with a "sensation of electric shock" but no perception of movement. As the stimulus intensity was progressively increased, muscular contractions were elicited which were objectively recordable and even visible to the naked eye, yet not perceptible kinesthetically by the blindfolded subjects. It was not until the movements were fairly large in amplitude that the subjects reported kinesthetic awareness of them. This result was consistent and was found to hold for both faradic and galvanic stimulation, and for both trained and untrained subjects. The implication is that the supposedly non-sensorial or "pure thought" experiences of the Würzburgers may appear as such in consciousness simply because of the limitations of introspective observation, and that muscular activity might actually be present all the while without being introspectively detectable.

The foregoing applies only to muscular factors in thinking, and not to imaginal data of other sensory modalities. While the writer's electromyographic records tend to show that the traditional kinesthetic image is really a proprioceptive awareness of existing muscular contraction, they do not as yet yield a decisive answer to the question of whether all modalities of imagery are fundamentally muscular in nature: If the latter hypothesis (first propounded by Dunlap in 1907) should be proved valid, the present result concerning the comparatively high threshold of myoesthetic sensibility would serve to explain "imageless thought" in its entirety.

This finding also provides a simple physiological answer to an objection raised against the peripheral or motor theories of thinking;—the objection, namely, that if the motor theory is valid, the thinker should experience a kinesthetic awareness of the peripheral muscle-contractions, whereas actually such awareness is frequently lacking. Dunlap meets this objection by stating that the muscle-patterns, like those of the ocular muscles in depth-perception, act merely as unperceived "signs" whose meanings alone enter into consciousness. Rexroad has subsequently offered a somewhat similar explanation. In the light of our experimental results, however, a less involved explanation would be that such muscle-patterns remain unperceived simply because they are below the threshold-intensity for myoesthesis.

LOUIS WM. MAX
LABORATORY OF PHYSIOLOGICAL PSYCHOLOGY,
NEW YORK UNIVERSITY,
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SCIENTIFIC APPARATUS AND LABORATORY METHODS

PRESERVATION OF BACTERIAL CULTURES UNDER LIQUID PARAFFIN

NUMEROUS attempts have been made to obviate frequent and essential transfers of bacterial cultures in order to keep stock strains alive. Swift[1] was able to keep alive certain strains of *Meningococcus* for several months by freezing and drying the cultures at low pressure. Hiss[2] kept several strains of *Meningococcus* alive for as long as 14 months in a medium consisting of 1 per cent. glucose broth and 1 per cent. calcium carbonate. Murray[3] succeeded in keeping meningococcic cultures alive for 6 months to 1 year on Dorset's egg medium and the tubes sealed with cotton plugs soaked in molten wax. Other investigators have been less successful with this method. Bruni[4] made the important observation that strains of *Meningococcus* grown on ordinary agar could be kept alive after 80 days at 37° C. if layered with liquid paraffin. Parish[5] confirmed Bruni's observation and extended the study to include besides the *Meningococcus* several strains of *Gonococcus, B. influenzae* and *M. catarrhalis*. These cultures he cultivated on ordinary agar, blood agar and trypagar for 24 to 48 hours at 37° C. when he added approximately 8 cc of previously sterilized liquid paraffin to each tube and replaced the cultures in the incubator. In this manner he succeeded in keeping *Meningococcus* and *B. influenzae* alive for 8 to 12 weeks, *Gonococcus* and *M. catarrhalis* for 16 to 22 weeks. Control cultures in tubes sealed with cotton plugs soaked in molten wax usually died in 2 to 3 weeks.

We have repeated Bruni's and Parish's studies with 2 strains of each of the following organisms: *Streptococcus hemolyticus* (scarlet fever and erysipelas), *Streptococcus viridans, Pneumococcus,* types I, II, III and IV, *Gonococcus, Meningococcus, B. influenzae, B. pertussis* and *C. diphtheriae* (Park 8 A). The bacteria were grown on blood agar slants for 24 to 48 hours at 37° C., when approximately 10 cc of sterile liquid paraffin were added to each tube from a pipette. At this time rubber stoppers were substituted for cotton plugs and the cultures replaced in the incubator. It was apparent that bacterial metabolism was slowed down by the addition of liquid paraffin and that no appreciable increase in size of colonies took place during the subsequent long periods of incubation. It was also noted that the blood agar discolored exceedingly slowly under liquid paraffin, in contrast with the rapid development of chocolate color in the control culture tubes within 2 to 3 days at 37° C.

Subcultures were made onto blood agar plates by removing a small platinum loopful of surface growth, at bi-weekly intervals. Care was taken to allow the liquid paraffin to run off the loop by touching the wire against the sides of the tube. *Meningococcus, Gonococcus* and *B. influenzae* were found to remain viable for 10 to 12 weeks under liquid paraffin. *Pneumococcus,* type III, lived for 16 weeks. *Strepto-*

[1] H. F. Swift, *Jour. Exp. Med.*, 1921, xxxiii, 69.
[2] P. H. Hiss, Zinsser's "Textbook of Bacteriology," 6th edition, p. 436. 1927.
[3] E. G. D. Murray, *System Bact. Med. Res. Coun.*, London, 1929, ii, 291.
[4] E. Bruni, *Ann. di. Med. nav. e. col.*, 1930, xxxvi, ii, 396.
[5] H. J. Parish, *Jour. Path. and Bact.*, 1932, xxxv, 143.