MORE HUMAN TAILS

A FEW days ago I received a letter from Dr. E. G. Hastings, of the Department of Agricultural Bacteriology of the University of Wisconsin, in which he called my attention to a paper in the collected works of Robert Koch, the second volume, second part, page 822.

On consulting this paper (a most unexpected place for such a revelation), I found two photographs of human beings with well-developed tails about as long as a human foot, which had been photographed by Koch in India in 1871. One was a lad seventeen years old, and the other a child.

I thought that your readers might be interested in these photographs, as Dr. Hastings referred to my note on this subject, which was published in SCIENCE in the issue of June 11, 1926.

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SCIENTIFIC BOOKS

The Differential Calorimeter, with Special Reference to the Determination of the Human Basal Metabolism. By A. K. NOYONS. Louvain, 1927. 189 pp., 34 illustrations.

DU BOIS'S splendid book on basal metabolism,[1] backed by his unique experimental experience, has brought metabolism and, specifically, clinical calorimetry to the attention of physicists and physiologists, as well as medical men. From Louvain, Belgium, there has just appeared a book which not only supplements the technical portion of Du Bois's book but is all the more remarkable when one thinks of its birthplace, and how under most harassing economical conditions the human calorimeter has been developed to a point heretofore never attained. Recognizing that with man all measurements of the heat production, including the heat of vaporization of water, are best made by the differential principle, Professor A. K. Noyons, of the department of physiology of the University of Louvain, has printed in readable English the first description of an extremely clever device which physiologists have long known was being developed at Louvain. This differential calorimeter is unique in that the author, at once a physician, physiologist and physicist, has combined in it the most scientific and accurate methods applicable to the measurement of the heat given off by a human. The compensation chamber furnishes, for the first time, an exact duplicate of the heat of vaporization of water in that precisely the same amount of water vaporized from the skin and lungs of the human subject is there vaporized, and an electrical current, passed through a suitable resistance, generates precisely that amount of heat given off by radiation, convection and conduction from the subject.

Without governmental or, indeed, institutional subvention these calorimeters have been privately constructed and tested, and already one is being prepared for introduction into a large clinic. The technical details may not be discussed here. Noyons has seemingly forestalled every criticism so far as the physics of heat measurement on a human being is concerned—save for the perplexing question as to the changes in the average body temperature. The complete isolation of the patient in a rather somber chamber may be impracticable for temperamental cases. One can but wish that, in addition to the many text references, the extensive literature survey (which is international to a refreshing degree) necessarily made by the author could have been recorded as a list of titles on direct and indirect calorimetry.

The use of English was, we believe, wise. When one knows, as does the reviewer, that the book was thought out in Dutch, written in French, and then translated into English, one is surprised that so few distinctly foreign (though rarely, if ever, obscure) phrases occur.

As a promise of what this new metabolism center is to give us in the future, the book is most stimulating to all who have anything to do with heat production and basal metabolism, and with the present wave of interest in this subject, in perhaps less than a decade we shall all have basal metabolism measurements included as a part of our annual assessment of physical fitness.

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[1] Du Bois, E. F. "Basal Metabolism in Health and Disease." Philadelphia, 2d ed., 1927.

SPECIAL ARTICLES

PRESSURE PHENOMENA OF THE ELECTRIC WIND[1]

1. *Apparatus.* The spectacular group of experiments which we used to perform once a year seem but rarely to have come to any useful maturity. I can recall only the electronic measurements of Professor Chattock. Having appropriate apparatus at hand, it seemed promising to look at them in detail and in the attached figures I will summarize the main results.

The simple apparatus as originally used (Fig. 4, insert) consisted of the two brass posts P, P', usually 8 cm apart and fixed in the hard (or soft) rubber base B. T supported by P is a small thimble of brass perforated by the slender tube U, which leads to the

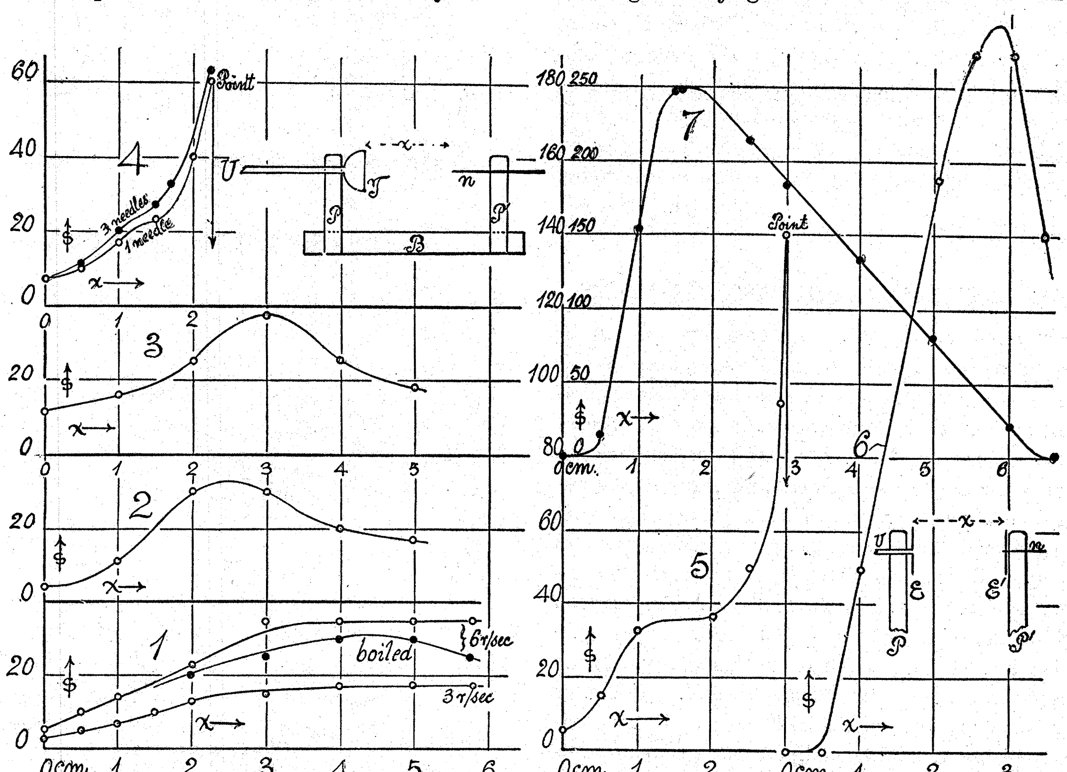
[1] Advance note from a Report to the Carnegie Institution, of Washington, D. C.

interferometer U-gauge. The post P' carries the darning needle n coaxially with U, and both n and U fit snugly, so that they may be slid to different distances x apart. P and P' are in contact with the poles of a small Wimshurst machine, capable of delivering inch sparks. The latter was usually turned by hand near a clock beating quarter seconds, and the speed of rotation of six turns (sometimes three turns) per second for each plate was easily maintained.

2. *Needle electrode.* The group of curves 1 refers to a hard rubber base with posts P, P', 8 cm apart. Irregularities are referable to freakish action of the machine quite apart from rotation; but it is noticeable that the pressures (s, approximately in 10^{-6} atmosphere) are (here) roughly double for 6 rot./sec. as compared with 3 rot./sec. I was disappointed at the relatively low mean pressures in evidence and therefore scraped and boiled the hard rubber base in dilute acid, for greater insulation. The resulting graph actually shows reduced sensitivity and now suggests a maximum. In curve 2 a soft rubber base was tested. The graph is smoother with a very definite crest, but no better in s. Finally the graph 3 on a cylindrical hard rubber base is no advance on the others.

Improved conditions appear with graph 4, referring to posts P P' but 4.5 cm apart. Whether one or three sharp needles are used is relatively unimportant; but this graph is rapidly accelerated upward as the needle point approaches the post P'. Close inspection of the data convinced me that the graph essentially consists of two constituents, one of which tends to a low crest as heretofore, while the other begins at the maximum and runs with great rapidity to high s, while the projecting needle end is shortened from a few millimeters beyond the post P' to zero. When the needle point retreats just within the post, the curve drops instantly to zero.

To accentuate this result the thimble was cut down (the form is practically immaterial), admitting of larger x between the same posts. The graphs, of which Fig. 5 gives an example, fully bear out the surmise, and the cusp has risen to nearly four times the height of the crests in figs. 1, 2, 3. What the larger x insures is probably greater axial momentum of the ionized wind, and a point immediately in front of a surface of high potential gives the latter a longer range of action. Eventually the life of the ions is in question. Again the forms of the curves must depend essentially on the position of charged bodies, like the poles of the electric machine, near the field, as these deflect the air current. No pressures are observed until the charge of the machine exceeds a certain specific ionizing potential, after which the appropriate pressure (s) appears at once. In the reversed case pressure vanishes before the machine is discharged. My greatest difficulties thus far have



been the fluctuating potentials of the machine, due, so far as I can see, to the casual partial self-discharge within. Sputtering is fatal.

3. *Mucronate electrode.* Borrowing a term from the botanists, what is needed therefore is a slightly convex electrode E' with a sharp fixed needle point projecting less than a millimeter from its center (see insert Fig. 6) and facing (convexities toward each other) a similar but unarmed electrode E. P. P' are as before, 4.5 cm apart.

The results obtained with this mucronate electrode (Fig. 6) are astonishing; for the curve sweeps aloft in some cases to over five times the heights of the original crests. Thus far these graphs have not started until $x = .5$ cm is passed. They are peaked at the upper end, and drop from the sharp crest. They imply a degree of sensitivity that makes interferometer observation difficult, every little irregularity of the Wimshurst being magnified.

By placing the posts P P' 10 cm apart with a clear field between, the crest has been increased to $s = 250$. A good example of these results is given in a reduced scale in Fig. 7, which consists of two approximately linear branches on each side of the crest.

Micrometer results on the pressures s as related to the inverse saliency of the needle point can not be given here; but I may mention that for a spark gap $x = 2$ cm (30 kv/cm) a needle point projecting .005 cm beyond the effective limit of the electrode, gave a pressure $s = 560$, that is, 70 per cent. above the crest of Fig. 7, and about fifteen times the original sensitivity. Finally, it seems clear that the crests in Figs. 6 and 7 are to be associated with the limiting potentials of the machine, their x position being an indication of the maximum field between electrodes.

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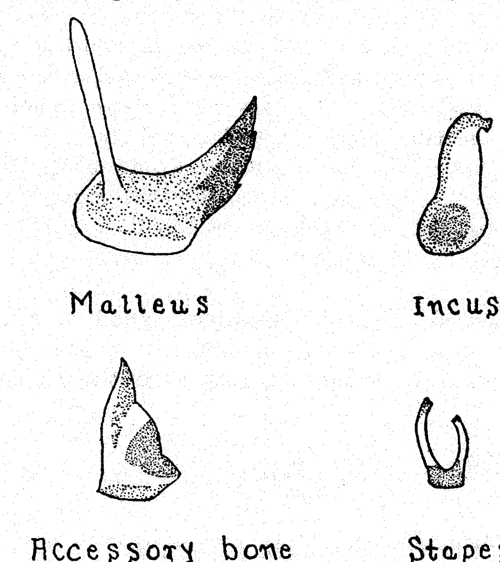
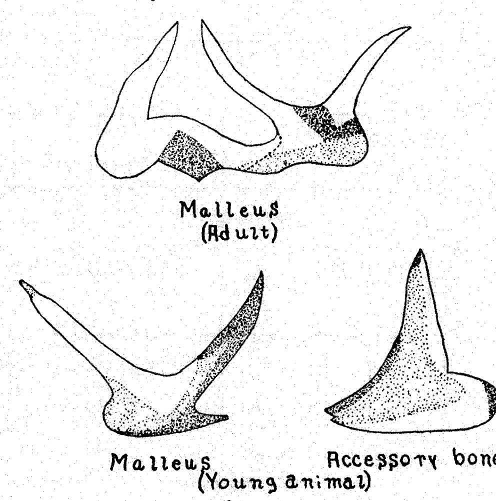
SOME PECULIAR AUDITORY OSSICLES

THREE auditory ossicles are generally said to be present in animals which possess these bones. While making a study of the ossicles of several genera of bats, the author found four present in many instances. Doran, in his famous monograph on mammalian auditory ossicles, has described and figured the ossicles from several genera of bats. The chief difference between the ossicles from the genera used in this study and those of Doran's is in regard to the head of the malleus. Each malleus which Doran studied possessed a well-developed head. In no case did a head exist on a malleus in this study. However, a fourth bone was usually found. This was located between the malleus and incus. It was entirely separated from the malleus, but in some cases it was found fused to the incus. This bone has probably become the head of the malleus in those animals which possess only three ossicles. It is designated in this study as the accessory bone. The fact that four ossicles are present in some bats suggested the idea that four ossicles may exist in other animals in earlier developmental stages.

Three ossicles are present in the adult white rat (*Mus rattus*). The malleus has a peculiar shape. The ossicles from an animal one day old were removed and studied. Four bones were found to be present. Two of these represented the malleus of the adult animal. The discontinuous lines in the figure of the adult malleus show the approximate place where the two bones fuse in the adult. Since four bones are found to exist in the young of this particular species, it is probable that they exist in



Vespertilio fuscus



Mus rattus