and at maturity. It would favor the most rapidly developing zygotes, not only in the embryonic period—where crowding might occur, as Haldane points out, but also during lactation, and even subsequently. I have sometimes tried to rear, with the aid of a common foster mother, rabbits born on the same day to large race and small race mothers, but usually without success, because the large race young are so much heavier and stronger that they push the small race young away from the nipples and monopolize the milk supply. But if the two sorts of young are put to separate foster mothers, both lots thrive. Similar considerations make it impracticable to pen large race and small race rabbits together, after they are weaned.

There can accordingly be no doubt that large body size is an advantage to the individual in competition with other individuals in early life. Whether it would remain such in adult life would depend upon numerous environmental agencies. It might turn out, under some conditions, to be a positive handicap, as when hunters kill only animals above a minimal size.

Students of paleontology record the observation that the earliest mammals were small, and that in various lines of descent the size of the individual has increased, and that the attainment of maximum size has usually preceded extinction. This has been true, not alone in the case of mammals but also in that of birds and reptiles. This has been regarded by some as evidence of an orthogenetic tendency quite apart from fitness. Haldane rightly emphasizes the point that the final stage may be positively disadvantageous and so lead to extinction, though it is only a consequence of a prenatal or juvenile contest, in which larger size assured victory.

Another supposed orthogenetic tendency, involving a change in proportions, has been shown repeatedly to be only an indirect consequence of change in absolute size. This fact is emphasized (though it was not first discovered) by Julian Huxley in his recent book on "The Principle of Relative Growth."[3] A rabbit (or any other mammal), as it grows, increases in *length* of body, tail, ears and legs, faster than it grows in *width* of the same parts. Thus its skull, leg bones, etc., become steadily more slender in their proportions, as the absolute dimensions increase. The same relation holds between the final or adult stages of races of different body size. The larger race has the more slender form. And we need not confine the comparison to races within a single species. Compare, for example, the huge jack rabbit with the little cottontail which lives on the same prairies. Or compare the long-headed modern horse with the small-bodied species which flourished in Eocene times.

[3] The Dial Press, New York, 1932.

A supposed orthogenetic tendency to change the proportions in a certain direction is probably, in reality, only a consequence of increased body size, which, in turn, may be a consequence not of orthogenesis but of the competition, within the same species, between embryos with slightly different developmental growth rates.

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THE TUBERCLE BACILLUS

IN a recent note in SCIENCE,[1] Professor Hastings and Dr. McCarter protest the use of the term "tubercle bacillus" as applied to an organism used in recent studies in this laboratory and in two American laboratories. At the same time they present a description of the species they consider will permit only the inclusion of the true bacillus of Koch. While the description is in many respects a conventional one, it appears unwise at the present time to exclude, by definition, organisms which many students of the group regard as tubercle bacilli and at the same time to make the limits so narrow as to deny the application of the dissociation phenomenon to the species. The description of the species suggested by Professor Hastings and Dr. McCarter appears to do both.

Several features of this definition of the species is out of line with recent work. Probably the authors intend it to be controversial. Exception may be taken particularly to the defined pathogenicity. It seems quite reasonable to "regard as tubercle bacilli only those which, when introduced into the body of a susceptible animal, such as the guinea pig produce tuberculous lesions inoculable in series." Professor Hastings and Dr. McCarter quote this from Calmette, and yet such a limitation will exclude from the species the important bacillus of Calmette and Guerin (BCG) since, in its most characteristic form, it can not be regarded as inoculable in series. For the same reason this portion of the definition will exclude R forms of tubercle bacilli from the species, notwithstanding the fact that such experienced workers as Petroff, Medlar, Kahn in America, Begbie in Britain, Uhlenhuth, Seiffert in Germany advance many evidences of the origin of such forms as variants of the more characteristic types.

This definition excludes another important variant of the tubercle bacillus when it states that growth occurs "only on the surface of liquid media and the inoculum must be floated on the surface." Dreyer and Vollum[2] have recently shown that variants, in

[1] E. G. Hastings and J. McCarter, SCIENCE, n. s., 75: 512, 1923.

[2] G. Dreyer and R. L. Vollum, *Lancet*, I, 9, 1931.

other respects characteristic tubercle bacilli, may be grown in the depth of culture fluids, an observation which we[3] have just confirmed and extended.

In our papers,[4] which the authors quote among their examples of "misnamed cultures and studies of the tubercle bacillus," we demonstrated that a series of cultures of tubercle bacilli recently isolated from active tissue lesions and cultures with a history of maintained virulence exhibit certain characteristics, characteristics which without question place them as belonging to the species. Certain of these have been shown to dissociate into avirulent forms which exhibit certain characteristics at variance with the classical definitions. These observations are in agreement with and in extension of the work of the authors mentioned in the previous paragraphs. At the same time, we pointed out that a series of avirulent cultures and cultures with a history of loss of virulence exhibit characteristics which relate them to the forms known to have arisen by dissociation from characteristic tubercle bacilli. Professor Hastings and Dr. McCarter advance interesting historical evidence that one of the latter should be regarded as an acid-fast saprophyte rather than a tubercle bacillus.

Work of the last decade has established beyond cavil the fact that bacteria are subject to variation. Variation of the tubercle bacillus is imperfectly understood, but the results and theories so far advanced are in complete agreement with the more extensive data accumulated concerning other groups. Studies of the tubercle bacillus will not be promoted by defining the species in such conservative terms as to exclude the variants which we observe.

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THE SWARMING OF ANTS

ON Sunday afternoon, September 4, 1932, as I was returning from a walk in the country, I noticed several winged ants (*Tapinoma humilis*) in the air. By the time I reached home, there were great swarms of them everywhere. I examined my front lawn, and found great excitement among the ant colonies. Workers, winged queens and winged males were running here and there around their entrances. The entire lawn was a seething mass of ants. The winged forms were rapidly leaving the ground, and taking to the air.

On my coat I found many males, apparently exhausted and unable to fly away when I tried to shake them off. They had mated with some flying queen a few minutes before, I assumed. Before an hour had passed, I noticed numerous males on the ground, helpless, and apparently dying. Some were being dragged away by workers, which appeared to be attacking the males as though helping to kill them.

At the end of another hour there were many mated queens crawling about on the ground and on the grass blades. As I watched them, I found several in the act of tearing off their own wings. They had evidently mated while in flight, and were now ready to settle down to their business of rearing a family. Soon there were countless queens stripped of their wings crawling about everywhere, seeking new homes. There were also many queens which did not tear off their wings.

As darkness approached, the air cleared up, and no more flying honeymoons were in evidence. The excitement of the colonies was dying down, and the queens were disappearing in various crevices and holes. There were still many males crawling about in a semi-stupor. A careful look over the surface of the ground revealed hundreds of delicate wings which had been shed by the mated queens. As darkness fell, all was again quiet.

My attention was first called to the flying ants about three o'clock in the afternoon, Central Standard time. Their numbers seemed to be greatest between four and five o'clock, and by six o'clock, the affair was waning. By seven-thirty, all was quiet. I inquired to find out whether this swarming was very extensive, and learned that it covered most of this state as well as adjoining states. I do not know how much farther it extended. Tourists stopping at the gasoline stations that same evening, reported having driven through swarms of them for several hours over a distance of a hundred miles or more.

The next morning I examined my lawn again, and found no indications of the previous day's rendezvous, aside from the many wings scattered about like the remains of some aeronautic battle. A few wingless queens were found, and a number of dead males were uncovered. The workers had apparently cleared away the débris as much as possible. All was peaceful and industrious. Life had once more settled down to routine matters.

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THE GROWTH OF STALAGMITES

THE brick part of Fort Morgan (at the mouth of Mobile Bay, Alabama), where the data in this communication were observed, was built in 1855. Active use was made of this portion of the fort until after the Spanish-American War, when it was abandoned.

[3] G. B. Reed, *Canadian Journal of Research*, in press.
[4] G. B. Reed and C. E. Rice, *Canadian Journal of Research*, 4: 389, 1931; 5: 111, 1931.