Bacteriology. — *Terminology of Bacterial Variability.* By J. J. VAN LOGHEM. (Communicated by Prof. W. A. SCHÜFFNER.)

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I have repeatedly tried to call attention to the fact that the genetic way of considering the variations of bacteria is by no means convincing. I pointed out that inheritance of acquired functions, flexibility of the genotypical constitution, instability of the species, transgression of the limits of the species, and "Dauermodifikation" are conceptions that are not accepted by the genetics of the higher organisms, and have nevertheless found a place in microbiology.

In my own attempts at classifying the phenomena of the bacterial variability I have arrived at a physiological conception, which I think to be able to remove the difficulties attending the genetic way of consideration.

If not the single bacterial cell, but the clone (i.e. the posterity of one single cell) is taken as the individual (individual line, individuality), the variations to be observed in the clone are immediately recognized as functional phenomena within the individual existence of the bacterium [1].

A closer classification of the bacterial functions manifesting themselves as variations can then be made in conformance with the normal and pathological physiology of the higher organisms.

Accordingly I have proposed to distinguish the bacterial variations as Adaptation (physiological reaction on the influence of the outerworld.) and Regression (pathological reaction).

If this physiological view is adopted, it is necessary to revise the terminology of the bacterial variations. Varieties, mutations, types, atavists and other terms derived from genetics are not suitable to denote the conditions of adaptatively and regressively changed individuals.

I, therefore, propose to call the adaptatively changed bacterium an *adaptate*, and, in accordance with the classification of the regressive changes, given by me before (mutilation, atrophy, and degeneration), to distinguish the regressively changed bacteria as *mutilate, atropheont,* and *degenerant.*

I may be allowed to elucidate this terminology by a few examples.

Adaptates. Adaptative changes refer to normal, i.e. temporary reactions of the healthy individual to influences from outside. Their duration is

[1] Zntrbl. f. Bakt. I. Orig. 1922, 88.
KOCH's Zeitschrift f. Infect. Krh. 1929, 110, 2.
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sometimes limited to the time that the stimulus acts; (f.i. absence of production of pigment at a certain temperature or size of colony at a certain hydrogen-ion-concentration of the medium).

Sometimes the adaptation is maintained for a considerable time. I mention as examples only the temporary loss of the faculty of forming pigment or enzyme, the temporary change of the shape of the colony, the temporary change of the antigenic structure.

A coli-bacillus, which after having been cultivated in special surroundings produces no lactase for a time after having been brought back to its ordinary medium is neither mutant nor atavist, but an adaptate; the same thing applies to a "rough" strain, which having originated from a "smooth" strain, would reassume the normal smooth character after some time. In some cases it may be difficult on account of the artificiality of all laboratory cultivation to decide which is the normal form and which the adaptate. The divergent appearances in which the atoxic dysentery bacillus is met with, are an example of this.

The *regressive changes* are characterised by their durability. It is, therefore, not possible to recognize a bacterial change as a regressive one at the first moment. As an example I may mention an anthrax strain developed by me out of one spore by microscopic way, which after having been cultivated for a considerable time in a glycerol medium, has become asporogenic. After more than a year the sporogenic property reasserted itself; what seemed regression was adaptation in reality. Over against this, there are however undoubtedly regressive changes to be distinguished as mutilation, atrophy and degeneration.

Mutilate [1]). Mutilates are clones (permanently) mutilated by abnormal stimuli from outside. The asporogenic descendants from sporogenic bacteria, the immobile descendants of mobile bacteria, the non-encapsulated descendants of encapsulated bacteria are characteristic instances.

Atropheont. Atropheonts are regressively altered clones, in which one or more functions have been irretrievably lost. Examples are furnished by bacteria, which have changed from virulent into non-virulent bacteria or have lost their power of liquefying gelatine. Also permanent defects of the antigenic structure may be considered as atrophic changes.

Degenerant. By the term of degeneration, I have already before indicated the permanent change of the clone, which manifests itself as a phylogenetic retrogression (atavism). As examples I may mention the production of indol by old typhoid and paratyphoid cultures, the streptococcus character of old pneumococci, the spirillum form of old cholera vibrios.

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[1]) The term of mutilate was already used by Dr. DEN DOOREN DE JONG, cf. These Proceedings XXXIII, 1, 1930.

In conclusion a few words about the term of Typus. In genetics the term of typus is synonymous with biotypus, race, sub-species and elementary species. Hence the term refers to the genotypical constitution. Genotypically similar individuals are combined within the conception of typus. Individuals of different typus have a different genotypical constitution.

Also the bacteria species may be subdivided into smaller genotypical units [1]). There are solid grounds to assume that the *typus humanus* and the *typus bovinus* of Mycobacterium tuberculosis are equally far removed from each other as are *Trypanosoma gambiense* and *Trypanosoma brucei*. In this connection I may also mention once more the intra-specific differences in antigenic structure [2]).

This does not mean to say that all the types adopted in bacteriology are distinguished as such for good reasons. As an example of a faulty terminology I mention SONNENSCHEIN's Bacterium typhi *haemolyticum*, the description of which appeared under the title of „Experimentelle Züchtung neuer Bakterientypen durch Bakteriophagen" [3]). With Dr. VEDDER I have shown [4]) that the strong haemodigestive action of SONNENSCHEIN's typhoid-strain rests on the presence of the bacteriophage ; as also the endo-haemolytic action of the cholera vibrio may be enhanced by the bacteriophage [5]). There is no question of „Umwandlung", i.e. of genotypical change.

Also the mutually differing representatives of the atoxic dysentery bacillus are probably erroneously indicated as „typus", since it is possible to change bacilli of one type into those of another type by cultivation. In such cases one has not to do with real types, but with adaptates.

It may be derived from GRIFFITH's and NEUFELD's latest investigations, that the so-called types of pneumococcus are likewise erroneously distinguished as such. Another interesting question is whether the differences in antigenic structure in meningococcus and paratyphus-B-bacillus also rest on adaptation.

Summary.

In the above discussion a number of terms are proposed in behalf of the physiological conception (individuality theory) of bacterial variability given before by the author.

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[1]) Bacterieele Typen en Pseudotypen. Ned. Tft. v. Geneesk. 1930. 74. (4402—4407).

[2]) Antigene Structuur en Specifiteit. (These Proc. XXXI, 9).

[3]) C. SONNENSCHEIN, Zentrbl. f. Bakt. 1929, I. Orig., 111, p. 177.

[4]) Zentrbl. f. Bakt. 1930, I. Orig., 116, p. 185.

[5]) Zentrbl. f. Bakt. 1926, I. Orig. 100.