

force acting in conjunction with this lateral pressure, would, as shown by Daubreé, cause fractures to occur on the sides of the folds, in the direction of the axis of elevation, or nearly so. These combined forces would, also, according to Daubreé and Emmons, cause the fractures to occur in more or less parallel groups, and would account for the minor fractures or sheeting structure so characteristic of this district. Most of the metalliferous fissures in the district are thus found on the sides of the anticlinal ridges, more or less parallel to their strike, and cutting the bedding vertically or at a much greater angle than the dip of the beds. When such fissures cut belts of pyritous felstone, it seems to be the invariable rule, that some portions, at least, of their course will be found rich in gold.

Waters containing carbonic acid and other solvents acting on the pyrites and orthoclase would decompose them and carry the iron, gold and silica in solution through the fissures. The iron and silica were precipitated as limonite and vein quartz, but the gold, for some reason, was not evenly deposited with the other minerals, but was segregated into "shoots" or "courses" through the veins, the portions of the veins lying between these "ore shoots" being "low grade" or comparatively barren. It is possible that these "ore shoots" owe their richness to their position in the old channels through which surface waters, containing organic matter, or other precipitants, flowed with greatest freedom.

The brown and yellow felstones, commonly called "porphyry" in the camp, are, as before stated, the pyritous felstones leached of their auriferous pyrites, in the manner described, and colored as they are by iron oxides. Much of the gold in the veins may have been derived by a more direct process from the micas, and did not undergo the intermediate stage of deposition with pyrites in zones of impregnation.

No sign of glacial action is apparent in the district, and no large streams are found in the close vicinity of the mines. The valleys or gulches are synclinal troughs rather than valleys of erosion. The products of surface or atmospheric erosion, *since the formation of the mineral veins*, remain for the most part *in situ*—the lack of transporting agencies, such as glaciers or flooded streams, accounts for the thickness of the "wash" and the comparative absence of alluvial gold in the streams draining the district. Placers occur as often on the *tops of the hills* as in the valleys. Some of the decomposed material from the very summits of the hills has proved so rich in gold as to well pay for transporting in wagons to the stamp mills.

If water for hydraulic was available most of the "wash" would yield rich returns.

No attempt has been made in this paper to describe the many really great mines of the district. The writer has simply endeavored to show the connection or analogy between the alteration of granitic rocks and the occurrence of the mineral in veins. If the cause of the concentration of mineral matter into veins is "lateral secretion," it is evident that the greater the chemical and molecular alteration the country rock has undergone, the greater the richness of the veins will be. If this hypothesis is the true explanation for the origin of the gold, the magnitude of the country rock alteration will easily account for the great richness of the mines so far discovered as well as insure their permanence and future value.

In conclusion the writer desires to say that the area under discussion in these notes includes only the mineral belt in which the present pay mines are located. It embraces about fifteen square miles, and does not in-

clude the mountains to the north and west, such as Rhyolite Peak and Mt. Pisgah, which, judging from their appearance at a distance, and the testimony of others, are probably of eruptive origin.

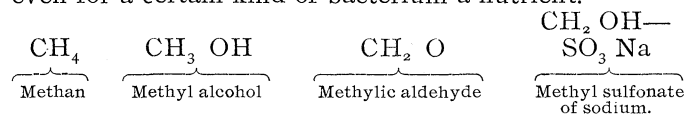
THE SYNTHETICAL POWERS OF MICRO-ORGANISMS—I.

BY O. LOEW, UNIVERSITY OF TOKIO, JAPAN.

AMONG all living organisms the micro organisms, micrococci as well as bacteria, bacilli and spirilli, are especially remarkable by their intensity of chemical activity. Oxydations and decompositions, reductions and synthetical processes are executed on an extensive scale. Numerous organic combinations are easily split up, and under atomic migrations substances of a more solid structure are formed, the products of fermentative actions. And amid this destructive activity, while the fight against easily changeable compounds is raging, there is built up in the interior of the cells the most labile of all combinations, the active albumen, being organized to living protoplasm. And this is done, under favorable conditions, with such rapidity that one cell can yield by growth and continual fission in twenty-four hours more than one trillion of new cells! What an energetic manufacture of living protoplasm, of living cells!

If we consider the destructive and synthetical operations, we must arrive at the conclusion that the former are necessary for carrying on the latter; the former yield not only the forces necessary for the synthetical work, but also the suitable atomic groups. It is certainly a highly interesting question of physiological chemistry to study the relations of the two different directions, and to elucidate which the groups are that serve for the synthetical work. In order to see our way clear we must at first consider the chemical structure of the combinations that can serve as nutrients, we must investigate the causes that bring about the transformation of potential into actual energy, and we must recognize, above all, that the proteids of the living protoplasm are chemically distinct, are different from those of the dead; we must acknowledge that when the labile character of the former changes by atomic migration to a stable one the death of the cells has come.

Nutritive and poisonous qualities are relative conceptions, poisons may become nutrients for bacteria when highly diluted, as phenol or acetic ether, and nutrients may become unfit for nutrition if the concentration reaches certain limits. Small chemical changes may convert a nutritive substance into a poison, and again the poison into an indifferent substance; thus the methan is indifferent, the methylic alcohol a nutrient, the methylic aldehyd a poison and the combination of the latter with bisulfite of sodium again indifferent, and even for a certain kind of bacterium a nutrient.



Also the quantity of the produced fungoid matter depends a great deal upon the chemical constitution of the nutrient. Thus I have observed with cultures of mould fungi that tannin or tartaric acid yields only 10/12 per cent of their weight, acetic or succinic acids, however, 14/20 per cent, when nitrogen is present in form of ammonia salts. The more oxygen atoms are contained in a compound the less, naturally, will be the relative production of fungoid substance, but it makes a difference as to whether the oxygen atoms are present in form of carboxyl groups or in form of "alcoholic" hydroxyl groups. The easier a substance is decomposed, the more readily it will be used, and the quicker the development of cells will take place.

What substances then can be used as nutrients, can contribute to the multiplications of cells, *i. e.*, for the formation of more protoplasm, of albuminous matter? As albuminous matter contains carbon, hydrogen, nitrogen, sulfur and oxygen¹, we have to consider principally the questions: Which substances are suitable sources for the carbon, which for the nitrogen, which for the sulfur? Numerous experiments made by Nägeli and myself lead to the following conclusions:

1. As sources of carbon can be used in neutral or weakly alkaline solutions; alcohols, phenols, organic acids, ketones, aldehydes, carbohydrates, ethers and esters, many alkaloids.

2. As sources of nitrogen can serve: Ammonia salts, nitrils, amido acids, amins, ureas, guanidins, alkaloids, nitrates and nitrites.

3. As sources of sulfur can serve: Sulfates, sulfites, hyposulfites, sulfo acids, mercaptans, sulfons.

Now of all these substances, so very different in chemical structure and character, the bacteria can form synthetically the same albuminous matter, the substance of their own protoplasm. There can be no doubt that in all these different cases the same proteids result, otherwise the structure and functions of the kind of bacterium grown in these solutions would change, and new species would be formed with ease, according to the difference in food. Now, if we want to get an insight into this remarkable process, we must at first consider which substances are the fittest sources of carbon, which are neither useful nor poisonous, and which are directly noxious?

In regard to the first question we must draw from numerous observations the following conclusions for most of the non-pathogenic forms of microbes:

1. Hydroxylated acids are better than the corresponding non-hydroxylated ones, *e. g.*, lactic acid, $C_3H_6O_3$, is better than propionic acid, $C_3H_6O_2$.

2. Polyvalent alcohols are more favorable for the development than the corresponding monovalent ones; for instance, $C_3H_6O_3$, glycerin, is better than propylic alcohol, C_3H_7OH .

3. The nutritive quality of the fatty acids and monovalent alcohols decreases with the increase of the number of carbon atoms in the molecules; for instance, acetic acid, $C_2H_4O_2$, is better than butyric acid, $C_4H_8O_2$; methylic alcohol, CH_3OH , is better than amylic alcohol, $C_5H_{11}OH$.

4. The entrance of aldehyd or keton groups increases the nutritive qualities: glucose, $C_6H_{12}O_6$, is better than mannite, $C_6H_{14}O_6$; acetyl acetic ester is better than acotic ester (in 0.1 per cent solutions).

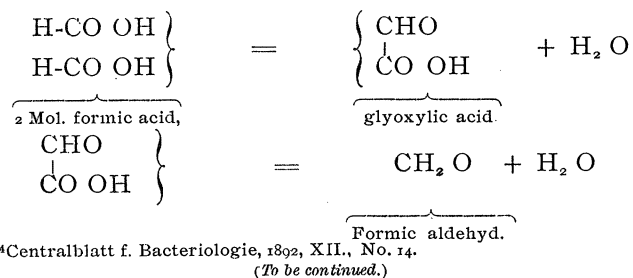
5. Neither noxious nor nutritive properties have been observed by me with picronic acid, chloralhydrate, pinakon, ethylendiamin, glyoxal, amidoacetal; very poor nutrients are acetoxim, diacetonamin and maleinic acid.² (These substances were applied in neutralized solutions containing 0.1–0.5 per cent). According to B. Meyer also mesaconic, citraconic, paramethyl succinic, dimethyl succinic, and benzoyl succinic acid are incapable to serve as food.³

6. The poisonous qualities are determined by the energy with which the labile atom groups of the living protoplasm are attacked; chloroform, phenyl, hydrazin, formic or methylic aldehyd may be mentioned here.

Those observations permit us to draw certain conclusions as to the group useful for synthetical purposes. If methylic alcohol is better than amylic alcohol, then the group serving for synthetical purposes will be, of

course, more easily prepared from the former; the same is true for acetic acid compared with butyric acid: we are forced to the conclusion that the group for commencing the synthesis of albuminous matter is a very simple one, with only one atom of carbon, and as methylic alcohol as a saturated compound cannot be used as such, the group in question can only be methylic or formic aldehyd. Neither can acetic acid be used as such; it must be converted into a substance suitable for condensating processes, and this cannot be anything else than formic aldehyd also in this case. If this conclusion be correct, then we understand why substances containing the group $CH\ OH$ are very favorable for nutriment and increase in their useful qualities with the number of these groups (the polyvalent alcohols, the polyvalent acids). We understand also why such substances are capable to nourish certain bacteria endowed with fermentative properties, even in *absence of air*, while substances without this group can be used as food only in presence of air, oxydation being then necessary to form this group. But how is that conclusion possible, if formic aldehyd is a poison? No doubt this seems an objection of weight; but if we consider how easily the formic aldehyd is changed under condensating influences, and how indifferent simple combinations of this aldehyd are, the objection appears no longer so serious; we must only adopt the view that the formic aldehyd undergoes rapid transformations, and that no molecule formed remains unchanged for a second.

If certain substances, as picronic acid, chloralhydrate, pinakon, cannot be used as nutrients, we may find the reason in this, that those substances offer too much resistance to the bacteria for the production of formic aldehyd; hence no albuminous matter can be synthetically prepared, the living protoplasm cannot grow, not increase, the formation of new cells becomes impossible. It is also simply explained, why oxalic acid cannot be used as food; it can neither by oxydation nor by splitting yield formic aldehyd. Neither are the salts of formic acid suitable nutrients, the conversion into formic aldehyd being rather difficult. I have observed only one kind of bacterium that is able to grow in diluted (0.5 per cent) solutions of sodium formiate; it occurs in the dust of air and forms reddish pellicles.⁴ The conversion of formic acid into formic aldehyd by this microbe might be explained by the following equations:



⁴Centralblatt f. Bacteriologie, 1892, XII., No. 14.
(To be continued.)

—The December election of officers of the Wilson Ornithological Chapter of the Agassiz Association resulted as follows: President, Willard N. Clute, Binghamton, N. Y.; Vice-President, Reuben M. Strong, Oberlin, O.; Secretary, William B. Caulk, Terre Haute, Ind.; Treasurer, Lynds Jones, Oberlin, O. The chapter is in a very flourishing condition, with seventy-three active, four honorary and thirty-one associate members. The past year has been devoted to a special study of the Warblers, and the forthcoming report promises to make a very interesting paper. Any information regarding the chapter will be cheerfully furnished by the secretary.

¹We leave here the nucleins out of consideration, they contain phosphoric acid in their molecule.

²The isomeric fumaric acid is, however, a good nutrient.

³I may add that methylamin is a better source of carbon than trimethylamin.