chance of winning truth. To me at least it appears that the line of thought flows in a true channel, that it may help to give a meaning to the observations of the spectroscopist, and that many interesting problems, here barely alluded to, may perhaps be solved with sufficient completeness to throw light on the evolution of nebulæ and planetary systems.

III. "On the Secretion of Saliva, chiefly on the Secretion of Salts in it." By J. N. Langley, M.A., F.R.S., Fellow of Trinity College, and H. M. Fletcher, B.A., Trinity College, Cambridge. Received August 17, 1888.

(Abstract.)

Heidenhain has shown that when saliva is obtained by stimulating the chorda tympani, the percentage of salts in the saliva depends upon the rate of secretion, so that the faster the secretion the higher the percentage of salts is up to a limit of about 0·6 per cent. Werther has come to the same conclusion, but finds that the percentage of salts may be as much as 0·77. Both in Heidenhain's and in Werther's experiments there are many exceptions to this rule, attributed by them to variations in the rate of secretion of saliva during the time of collecting any one sample.

We have repeated, with some modifications, the experiments of Heidenhain, paying especial attention to the rate of secretion of saliva, and find in 10 out of 11 cases, that his law of an increase in the percentage of salts with an increase in the rate of secretion holds. The single exception may be due to a modification of the blood-flow through the gland during the time of collecting the saliva. The slowly secreted saliva contains a low percentage of salts, whether it is produced by a weak nerve stimulus, or by a very strong nerve stimulus which lowers the irritability of the nerve-fibres.

We do not find any rate of secretion, beyond which an increase in rate fails to increase the percentage of salts in the saliva. The increment in the percentage of salts decreases, however, with each equal successive increment in the rate of secretion.

As a rule in saliva obtained by injecting pilocarpin, the percentage of salts follows Heidenhain's law; we take the exceptions to be due to the action of pilocarpin upon the circulation, the blood-flow through the gland being less than normally accompanies the degree of stimulation of the gland cells.

The percentage of salts in saliva obtained by stimulating the sympathetic is higher than corresponds to its rate of secretion, the saliva obtained by stimulating the chorda being taken as a basis of comparison; this sympathetic saliva may be secreted at $\frac{1}{180}$th of the rate

of chorda saliva, and yet contain very nearly as high a percentage of salts.

Dyspnœa decreases the rate of secretion of saliva with a given stimulus, and if not too prolonged, increases the percentage of salts, and tends to increase the percentage of organic substance in the saliva. This holds whether the saliva be obtained by stimulating the chorda tympani, or by injecting pilocarpin. Dyspnœa has, for a short time, an after-action, tending also to increase the percentage of salts, and possibly that of organic substance.

Clamping the carotid during secretion has the same general effect as dyspnœa, but it causes a still more marked increase in the percentage of salts. Its after-effect is also much greater, and lasts longer.

Bleeding has a similar effect to dyspnœa and to clamping the carotid, but its most marked effect is an increase in the percentage of organic substance.

Injection of dilute salt solution, NaCl, 0·2 to 0·6 per cent., in sufficient quantity, considerably increases the rate of secretion of saliva; the percentage of salts in the saliva decreases, although the rate of secretion of salts usually increases; the percentage of organic substance decreases; that is, increasing the volume of the blood with dilute salt solution chiefly increases the rate of secretion of water.

The percentage of salts in samples of saliva obtained *after* the injection of dilute salt solution, increases with the rate of secretion, it is only when these are obtained before the injection that a discrepancy in the normal relation between percentage of salts and rate of secretion of water appears.

Injection of sodium carbonate 2 per cent. also increases the rate of secretion of saliva; in this case the percentage of salts is about normal, the percentage of organic substance falls slightly only, *i.e.*, the irritability either of the nerve-fibres or of the gland cells is increased.

Injection of considerable doses of potassium iodide, 1 per cent., after the sodium carbonate still allows a rapid secretion, but the percentage of salts falls.

Injection of strong salt solution increases the percentage of salts in saliva, this is in accordance with the recent observations of Novi that the chlorine in the salts of saliva is increased for a given rate of secretion by increasing the percentage of sodium chloride in the blood. We find, however, that in the case of an injection of strong salt solution into the blood which leaves the secretory power of the gland unaffected, the increase in the percentage of salts is much greater with slowly than with rapidly secreted saliva, and that when the secretory power of the gland is affected by strong salt solution, an increase in the percentage of organic substance also takes place; this and a part of the increase in the percentage of salts we attribute to a decrease of the blood-flow through the gland.

Saliva produced by stimulating the chorda tympani, or by injecting pilocarpin, after a small dose of atropin has been given, contains a low percentage of organic substance and of salts.

We, like Werther, find that sub-lingual saliva has a considerably higher percentage of salts than sub-maxillary saliva.

If lithium citrate, potassium iodide, potassium ferrocyanide, and pilocarpin are injected into the blood, lithium can be detected in the first drops of saliva secreted, potassium iodide after the first six drops; potassium ferrocyanide cannot be detected at any stage of secretion.

The general result of these experiments is to show that the secretion of water, of salts, and of organic substance are differently affected by different conditions, and that the percentage composition of saliva is determined by the strength of the stimulus, by the character of the blood, and by the amount of blood supplied to the gland.

All or nearly all the arguments which have been adduced to prove that the secretion of organic substance is governed by special nerve-fibres, have their counterparts with regard to the secretion of salts, so that we might imagine at least three kinds of secretory fibres to be present. The experiments, on the whole, indicate that this complicated arrangement does not exist, but that the stimulation of a single kind of nerve-fibre produces varying effects according to the varying conditions of the gland cells.

IV. "Observations upon the Electromotive Changes in the Mammalian Spinal Cord following Electrical Excitation of the Cortex Cerebri. Preliminary Notice." By Francis Gotch, Hon. M.A. Oxon, B.A., B.Sc. Lond., and Victor Horsley, B.S., F.R.S., Professor of Pathology, University College, London. (From the Physiological Laboratory of the University of Oxford.) Received August 27, 1888.

[Plate 1.]

Hitherto pathologists have attempted the analysis of the epileptic convulsion by the graphic method, that is, by recording the spasmodic contractions of the muscles involved. Recent investigations of this kind have shown that the excitation of the cortex cerebri, whether by electrical or chemical means, or by the presence of certain pathological states, neoplasms, inflammation, &c., is invariably followed in the higher mammals by a definite and characteristic sequence of movements in the muscles. It is, however, obvious that such investigations have up to the present succeeded in determining the characters of the neural disturbance only when this has reached the peripheral