Physiological Chemistry.

Exhalation of Nitrogen-gas during the Respiration of Animals. By J. REISET (*Compt. rend.*, **96**, 549—553).—A historical and critical summary. C. H. B.

Feeding Calves with Skim-milk. By G. A. PAUL (*Bied. Centr.*, 1883, 108).—A statement of the loss and gain experienced by feeding three calves with skim-milk, to which was added malt-combs and earth-nut cake. In the case of the first calf, 80 kilos. live weight were produced at the cost of 63 marks, whilst the milk produced by the cow was 187 marks, of which the calf only received 56 marks' worth; 42·5 kilos. live weight of second calf cost 38 marks, the cow's milk was valued at 79 marks, of which the calf received 36 marks' worth; to obtain 34·5 kilos. increase in live weight in the second calf, 52 marks were spent, cow's milk valued at 119 marks, of which the calf received 47 marks' worth, so that there was a saving of about 67 marks. E. W. P.

Distribution of Peptone in the Animal Body. By F. HOFMEISTER (*Zeitschr. Physiol. Chem.*, **6**, 51—68).—Nothing has as yet been accurately determined in regard to the way in which nitrogenous nutritive principles absorbed from the alimentary tract are disposed of in the system.

Peptone has always been looked upon with special interest amongst the products of the digestion of albumin, and Schmidt and Mülheim (*Du Bois Reymond's Archiv. für Physiol.*, 1879, 39) have established by their observations the fact of the transformation in chief part of albumin into this body. It has generally been believed that peptone, being relatively of easy diffusibility, passes through the alimentary mucous membrane into the blood-vessels, and is then carried to the place of its assimilation. Support to this view was given by the observations of Drosdoff and Plósz and Gyergyai, who found peptone in the blood of the portal vein. The quantity was, however, very small. Two different modes of explanation of these facts present themselves: either very little unchanged peptone reaches the blood through the intestinal mucous layer, or the peptone undergoes transformation immediately after its passage, losing its own characteristic properties, and so ceasing to be recognisable. This latter view has, hitherto, been chiefly adopted, some observers ascribing the place of change to the muscular tissue, and especially to the liver and other cellular organs, while others have deemed it to occur in the blood itself.

The author does not agree with either of these views, owing to the circumstances that when peptone is introduced into the circulation in some other way than by absorption from the intestine, by direct injection for instance, the greatest part escapes unchanged in the urine. This would point to the intestinal mucous membrane itself as the place of actual transformation.

In the first place, it was necessary to ascertain the normal distribution of peptone in the body at successive stages of the process of digestion, so as to exclude the possible influence of other organs besides the intestine and the blood, on the destiny of peptone.

The experiments were made upon dogs fed upon flesh, which was killed at different periods of the digestive process by means of blood letting. The amount of peptone was then determined in the various organs. The blood, heart, lungs, stomach, large and small intestines, liver, pancreas, spleen, mesenteric glands, mesentery, kidneys, and brain were severally examined. The method followed by the author is given in the present and also in a previous memoir (**4**, 264), to which the reader is referred for details.

The results of these experimental observations showed that only in one locality was peptone to be constantly found, in the intestinal mucous membrane. The proportions varied in different parts of the alimentary tract.

In the stomach the amount of peptone did not appear to have any ratio to the progress of digestion, save that in the case of long deprivation of food it sank to the limits of recognition. In the small intestines, on the contrary, a regular increase in the amount of peptone up to the eleventh hour after food was given was observed, followed by a diminution; the formation of peptone in the small intestine was *pari passu* with its absorption by the mucous layer. These observations agree with those of Schmidt-Mülheim, and likewise with those of Panum and Falck, in which the excretion of urea in flesh-fed dogs attained its maximum at the same period. This analogy between the formation of peptone and excretion of urea would favour the acceptance of the view that much of the absorbed peptone is at once broken up into its final products.

The total amount of peptone in the alimentary walls, including stomach and intestines, is more than double that present in the blood as a whole. The proportion of peptone found in the walls of the small intestine was 14 times greater than that in the walls of the stomach. On the other hand, the proportion of peptone in the gastric cavity was 15 times that present in the gastric mucous membrane. Either the stomach plays a much less part in the absorption of peptone than the intestine, or the absorbed peptone disappears more quickly from its mucous membrane.

Next to the intestinal tract, the blood exhibits a pretty regular proportion. Schmidt-Mülheim had already shown that in the case of dogs 24 hours after being fed, the blood contains no peptone.

Although in the majority of cases the blood is found containing peptone, yet on three occasions out of eleven, negative results were yielded from four to six hours after food. It would appear that the circulation of unchanged peptone is not indispensably necessary to nutrition. The peptone present in the blood is never of significant amount, ranging from 0·029 to 0·055 per cent. with a well marked maximum seven hours after food. Experiments tend to establish the fact that the peptone in the blood is not dissolved in the serum, but is associated with the red corpuscles.

When peptone was absent from the blood it was never present in the spleen. Contrary to the results of Plzós and Gyergyai, peptone could not be detected in the liver or mesenteric glands.

From the above observations it is inferred that the transformation of peptone takes place either in the mucous membrane itself or immediately after reception by the blood. D. P.

The Proportion of Peptone in the Gastric Mucous Membrane. By F. Hofmeister (*Zeitschr. Physiol. Chem.*, 69—73).—During the act of digestion, the stomach of the dog is opened along the smaller curvature, spread out and then divided by a suture carried from the pylorus to the cardiac end into two halves as nearly as possible symmetrical. It might be anticipated that when the viscus was carefully freed from adhering contents, both portions would yield equal proportions of peptone. This however, is true only when both are simultaneously immersed in boiling water. Should one be left undisturbed for a time, its peptone will be found to diminish in a remarkable manner, and even wholly disappear.

This disappearance of peptone is a vital act, taking place according to the stage of digestion with unequal rapidity, and arrested by heating for a few minutes to 60° C. If the stomach, previously extracted and wiped dry, be placed in the moist chamber for one or two hours at 40°, the mucous membrane is further observed to secrete a fresh layer of mucus, and the muscular contraction to restore the stomach to its original condition.

Since the transformation of peptone also takes place in the stomach of bled animals, it follows that the blood has no share in the result. The cause is to be sought for in chemical changes which have their seat in the gastric mucous membrane. An explanation is thus afforded of Salvioli's experiments (*Archiv. f. Physiol., von Du Bois Reymond*, 1880, Supplement Band 112), in which it was observed that peptone introduced into the intestine disappeared in a few hours without being detected in the efferent venous blood, whilst no such disappearance took place when blood injected with peptone circulated through the intestinal vessels. It also proves that the property of assimilating peptone belongs not merely to the stomach, but is a common characteristic of the intestinal mucous membrane.

Whether this assimilation is accompanied by a re-formation of albumin or by a complete disintegration, or in what part of the mucous layer it takes place, whether in the epithelial cells of the glandular portion, or the lymph cells of the adenoid tissue, has not yet been determined. But to this the author hopes shortly to proceed.

D. P.

On the Oxygen Pressure under which at a Temperature of 35° the Oxyhæmoglobin of the Dog begins to give up its Oxygen. By G. HÜFNER (*Zeitschr. Physiol. Chem.*, **6**, 94—111).—From the experiments of J. Worm Müller, it appeared probable that the highest limit of oxygen pressure at which a solution of oxyhæmoglobin yields its loosely combined oxygen did not exceed much more than 20 mm. of mercurial pressure.

To decide this question, further experiments were undertaken in which the method adopted differed from that of Worm Müller so far that equal quantities of freshly prepared, and as nearly as possible equally concentrated, solutions of hæmoglobin were employed. These were thoroughly saturated with oxygen, and then under similar conditions of time and temperature shaken with double the volume of a mixture of nitrogen and oxygen, in which the proportions of the latter gas ranged systematically from 0·0 per cent. to 4 per cent.

It was to be expected that the amount of oxygen given off during agitation under otherwise equal conditions, would decrease in proportion to the amount of oxygen present in the mixture of gases, so that it appeared possible by varying this latter amount to find the value of the pressure beyond which a solution of oxyhæmoglobin of certain concentration ceases to yield its oxygen.

For a figure and description of the apparatus used, as also of the process, the reader is referred to the paper itself. It is highly probable that when oxyhæmoglobin and free absorbed oxygen are simultaneously present in a solution, it is only the latter which is used up in oxidation, and not directly the molecule combined with the hæmoglobin. Hence, in a concentrated solution of oxyhæmoglobin, the hæmoglobin may be in combination with oxygen, while the aqueous medium itself is no longer saturated with the latter. When such a solution is shaken with a mixture of gases, the oxygen pressure of which exceeds a certain limit, a diminution of this pressure takes place.

The substances which may consume the absorbed oxygen in such a solution of oxyhæmoglobin are not far to seek. Well purified colouring matter of blood may contain nevertheless traces of fat or lecithin, even particles of albumin, and it is possible that ultimately the oxyhæmoglobin may as an albuminate itself, be seized upon by the free oxygen. In the author's experiments such oxidation actually did take place, as the production of small quantities of carbonic anhydride (0·2 to 0·4 per cent.) showed.

The results proved that at a definite temperature of say 35°, only a small fraction of the amount of oxyhæmoglobin mixture present undergoes dissociation.

According to the theory of probabilities, assuming that other conditions remain unchanged, this fraction should be always the same, however the total amount of colouring matter present might change. Consequently the amount of oxygen yielded should increase with increasing concentration of the solution, and therefore likewise the limit of pressure at which dissociation ceases. Why does the latter not exceed a maximum? In the author's experiments the limit of pressure was as high and even higher in the case of a 6 per cent. solution as in one of 10 per cent. Solutions of greater concentration cannot be prepared on account of the slight solubility of the colouring matter and its instability in concentrated solution.

A diagram is given, in conclusion, showing the several proportions of oxygen which are retained at 35° by 100 cm. of the blood of the dog under different increments of pressure of the absorption of oxygen employed. It illustrates at a glance the vanishing proportion which the simply absorbed oxygen bears to the loosely chemically united oxygen of the blood. D. P.