R.A.M.C., has demonstrated the scientific truth of this. He has shown in a way which must carry complete conviction, that cases of benign and malignant tertian malaria, even very grave cases with cerebral symptoms, in all of which, as his results show, quinine had proved quite useless to stem the disease and to prevent relapses, from *one to three* injections of pancreatic enzymes sufficed not merely to kill all the parasites, but to cure the patient. Relapses in the patients—which had been the rule in very nearly all the cases—did not occur after this brief treatment, and the men (British soldiers) were able to return to duty *at once*, even in some instances on the day of the second or third injection. That is to say—and it is a matter for great scientific satisfaction—the original work, which I began in 1888, has now resulted in the easy and complete conquest of malaria. What this means can be understood from the facts concerning the treatment of malignant malaria, which at present is the rule in the Army. This entails a course of treatment by quinine lasting at least *four months*, and very often, if not always, even then the patient is not cured. But I understand that during this time the soldier is regarded as unfit for active service, and sometimes 25 per cent. of a regiment stationed in the tropics may be in this condition. In contrast to this the pancreatic treatment of malignant malaria in the hands of Major Lamballe entails not more than *three injections*, costing at the outside three shillings, it need not last *two weeks*, and the patient can return to duty at once, and so far as we know is then free from all danger of relapse, but *not* immune to a new infection. The facts here outlined indicate that, properly applied, that which cures malignant malaria *must* cure cancer.

J. BEARD.

8 Barnton Terrace, Edinburgh, August 30.

[I AM delighted that my brief reference to Dr. Beard's work should have elicited this interesting letter. He might also have referred to the astonishingly successful treatment of surgical tuberculosis by the pancreatic ferments, which was reported upon by Baetzner in the special tuberculosis number of *The Practitioner* recently. (Being abroad, I cannot give the reference.) When Dr. Beard refers to the malaria parasite as an asexual generation, he must, of course, be thinking of only one-half of its complete reproductive cycle. It would be interesting to make clinical observations as to the action of trypsin and amylase upon the sexual and asexual stages of these parasites respectively. As for cancer, I shall never be able to believe that the good results I saw under Dr. Beard's method of treatment six years ago were not causally connected with it. And if it be true, as is now asserted, that the leucocytes, our defenders against morbid cells, normally produce trypsin, perhaps the last has not been heard, after all, of this daring and original theory of Dr. Beard.—C. W. SALEEBY.]

Note on the Dicynodont Vomer.

IN a paper on Dicynodon now being printed by the Royal Society we have already described the bone which Dr. Broom now regards as the "typically mammalian median vomer." It is the bone which he has described previously as the anterior continuation of the basisphenoid, but without recognising the groove on the dorsal surface. No trace of a suture exists between it and the basisphenoid. To us it seemed, as stated in our paper, that the form of this bone, so far from confirming Dr. Broom's views, rendered his interpretation of the grooved bone in Diademodon even more doubtful than before.

That the bone generally recognised as the vomer in Dicynodon had a paired origin we readily admit, and

we had already set forth reasons for this view in a paper now in MSS. on the structure of the skull in a small unnamed Dicynodont genus; as we have pointed out in our paper on Dicynodon, the vomer is paired in the guinea-pig, and had probably a paired origin in mammals.

IGERNA B. J. SOLLAS.

W. J. SOLLAS.

Oxford, September 6.

An Aural Illusion.

I AM not aware that the following curious particular has been noticed.

If a sounding body has a velocity greater than that of sound in air, it will outstrip its previous sounds as it goes, and leave them to follow in its wake. Let it be supposed that such a body ceases sounding directly it passes an observer. In this case the sound waves of the greatest intensity will be the first to act, and those of the least intensity, the last. Hence the modulation of the sound will be reversed, and will have the character of a *diminuendo*, which we associate with sound that comes from a receding body. In such circumstances, therefore, it would seem to the observer that the source of sound had been travelling away from, instead of towards, him; an illusion touching the swell of the sound, and so the apparent direction of the sounder, quite distinct from those pitch effects which are duly taken cognisance of by Doppler's principle.

NORMAN ALLISTON.

THE NINTH INTERNATIONAL PHYSIOLOGICAL CONGRESS.

THE triennial International Physiological Congress, which was held at Groningen on September 2 to 6, was unanimously voted by those who attended it to be one of the most successful scientific congresses held during the present year. The number of workers engaged in physiological investigation being not very large, the congress, although larger than might have been anticipated, was of manageable size, and since physiologists on the whole are not a fluctuating body, everyone felt at ease and *en famille*.

It would be impossible to speak too highly of the admirable manner in which the president, Prof. Hamburger, with his characteristic precision, provided for the welfare and convenience of all those who attended the congress and who gave demonstrations in the laboratories; these latter are beautifully equipped, and leave nothing to be desired.

To English physiologists this particular physiological congress is of especial interest, since it is now twenty-five years since the congress was founded at the suggestion of the Physiological Society; the late Sir Michael Foster, its first president, was one of those who was most directly connected with its foundation, and it was as a fitting tribute to his labours that his portrait was chosen as the frontispiece for the special Festschrift, edited by Prof. Hamburger and Dr. Laquer. In this volume an excellent *résumé*, arranged according to subject, is given of the work of the congress during the past twenty-five years; this is preceded by the opening address of the president, Prof. Hamburger, at the present congress.

The congress numbered about 400 members, of whom about sixty were British, and the social

events were numerous. On September 1 the visitors received in De Harmonie a warm welcome from the Dutch physiologists and the Medical Association of Groningen. The following evening there was a reception in the large hall of the University buildings by the Queen's representative and the Dutch Government. On Wednesday, at the "Sterreboosch" Park, the guests enjoyed the hospitality of the municipality of the town, and on the next day, at the Paterswolder Lake, that of the Ex-Senator M. J. E. Scholten. On Thursday evening there was also an excellent entertainment at the theatre and in De Harmonie. On the last evening a banquet terminated the congress. But the hospitality was not confined to the above-mentioned events; many members enjoyed private hospitality during their stay, and, as stated by Prof. Starling, all the people in the town were so cordial that "we felt that we were not merely the guests of the physiologists, but of every bargee and every tram conductor in the town." There was a special ladies' committee, and several excursions were arranged for the ladies who attended the congress.

To commemorate the occasion of the congress, the Dutch medical journal, *Nederlandsch Tijdschrift voor Geneeskunde*, issued a special number, largely devoted to physiological communications, and to the history of the development of physiology in Holland. The same journal also had a special medal struck, and duplicates were presented to all members of the congress. The medal bore the portrait of the famous Dutch physiologist, Donders, executed by the well-known sculptor Pier Pander; on the back were the words, "Aan de leden van het IX^e Intern. Physiologen Congres. te Groningen, aangeboden door het Nederlandsche Tijdschrift voor Geneeskunde September MCMXIII."

("Offered to the members of the IXth International Physiological Congress in Groningen, by the *Nederlandsch Tijdschrift voor Geneeskunde* September 1913.")

The demonstrations and communications were very numerous, and it was not possible for one person to see and hear much more than one-third of the whole programme, which occupied most of the mornings and afternoons. The English physiologists contributed largely to the demonstrations, which, as in the meetings of our Physiological Society, had precedence over merely oral communications. The demonstrations of Profs. Starling (heart-lung preparation) and Sherrington (rhythmic reflex produced by antagonising reflex excitation by reflex inhibition) are familiar to English physiologists. A demonstration which attracted much interest was that of Prof. Abel and Dr. Rowntree, of Baltimore; this consisted in an apparatus for what may be termed "vivi-diffusion," and must be accounted one of the most distinct improvements in physiological technique which have been seen in recent years. The apparatus is called the "artificial glomerulus," and consists of a series of collodion tubes arranged in parallel, and surrounded by warm Ringer's solu-

tion; there may be from sixteen to forty-eight tubes in the apparatus, and through this system blood from a chloralosed and hirudinised animal is led. The blood flows out from an artery or vein (e.g. from the carotid artery, or from one of the tributaries of the portal vein) through the apparatus, and returns again to the circulation of the animal by a vein (e.g. the external jugular vein or the femoral vein). Such a circulation can be carried out under sterile conditions, and may be continued for sixteen hours with ease, and in favourable circumstances for much longer. At intervals the fluid surrounding the collodion "glomerulus" is run off and replaced by fresh Ringer's solution. The solution thus run off will contain all the diffusible substances of the blood other than the saline constituents of Ringer's solution, and on evaporation these may be recovered. In this manner it is possible to detect the presence of substances which are only present in minute traces in the circulating blood; thus, at the end of sixteen hours considerable amounts of amino-acids and of urea can be recovered from the dialysate; sugars and a polypeptide substance are also present. It is worthy of note that, as regards efficiency, the artificial kidney thus made compares very favourably with the animals' own kidneys; thus, when salicylates are given, the artificial glomerulus may excrete as much or more than the kidneys in a given time. It is hoped that a surgical application of this principle will prove of value. The applications of the method to the study of intermediary metabolism are obvious, and interesting results have already been obtained in this direction.

Another interesting demonstration was that of Prof. Benjamin Moore and Dr. Webster, who showed that when carbon dioxide was passed through solutions of such inorganic colloids as uranic oxide or ferric oxide in high dilution, in presence of sunlight or of light from the mercury arc, formaldehyde is formed, and may be detected by Schryver's test. They discussed the relation of this phenomenon to the question of the first appearance of organic matter on the globe.

Dr. Carlson, of Chicago, showed that it is easy to demonstrate on man the presence of rhythmic and of so-called "tetanic" contractions of the walls of the stomach during fasting. For this purpose two long indiarubber tubes are swallowed until their lower ends reach the stomach. One of the tubes serves for the introduction of substances into the stomach, and the other ends in a thin rubber sound which is inflated, and which, when connected with a water manometer, serves to record the contractions of the stomach. Dr. Carlson maintains that these contractions give rise to the sensation of hunger by stimulation of the afferent nerves of the stomach wall, that they are initiated by local automatic mechanisms, and that they are inhibited by various substances which stimulate the nerve endings in the gastric mucosa (gastric juice, acids, alcohol, &c.). Prof. Asher, of Berne, claimed to have demonstrated the presence in the vagus of secretory fibres to the kidneys,

and Prof. Noyons, of Liège, showed curves which be believed indicated that there is an antagonism between the internal secretion of the pancreas and adrenalin. The demonstration by Prof. Magnus, of Utrecht, on the influence of the position of the head on the posture in decerebrate rigidity and in normal rabbits was very interesting. The effects are in part due to reflexes from the neck and partly to labyrinthine reflexes.

A novelty of great interest to those interested in painting was the demonstration by Mr. A. H. Munsell, of Boston. This was a quantitative classification of pigment colours based upon measurements by a daylight photometer, Maxwell discs, and the trained discrimination of the painter. The photometer uses the daylight adapted eye, and reads in terms of the Weber-Fechner law.

A somewhat surprising communication came from Prof. Hürthle, of Breslau, who has made a careful study of the variations in pressure and velocity in various arteries during the pulse wave in living animals, and in dead animals perfused by means of an "artificial heart." From these experiments the conclusion is drawn that the arteries are rhythmically contractile, and that their contraction aids the circulation of the blood. It would be interesting to see these experiments repeated with a dead animal perfused from a living heart prepared according to Starling's method.

Many interesting apparatus were shown; among these may be mentioned the now well-known apparatus of Prof. Krogh, of Copenhagen, for the investigation of various respiratory problems; that of Dr. Franz Müller, of Berlin, for the determination of the minute-volume output of the heart in man by a simple application of the nitrous oxide method; the "Kurvenkino" devised by Prof. Straub, of Freiburg, by means of which tracings made on smoked glass in the laboratory may be projected on a screen with realistic effect (apparatus made by Jaquet, of Basel); and the apparatus of Dr. Rohde, of Heidelberg, for the measurement of the oxygen usage of the frog's heart under various conditions of contraction. Dr. Laqueur also showed a projection method for exhibiting the movements of the intestines to a large audience.

The great event of the congress so far as communications are concerned was the closing lecture, which was given by Prof. Pawlow, of St. Petersburg, on "Die Erforschung der höheren Nerventätigkeit," in which he dealt with the subject of conditional reflexes, to which he has devoted the latter third of his active scientific career. Prof. Pawlow is of the opinion that psychology in its present condition can be of little service to the physiologist. The physiologist must remain a physiologist, and must investigate his problems by the recognised methods which have been so fruitful in other fields—he must study the brain as an integrated working organ, and must build up his knowledge independently of the psychologist. The study of reflex action as a purely physiological topic has already yielded valuable results on treatment by the methods of experimental physiology. It is rendered clear by the work of the Pawlow school that we must extend

our ideas of reflex action and recognise that besides the elementary function of carrying out ready-formed reflexes, the nervous system has another equally important and fundamental function—that of the formation of new reflexes. It is a generally recognised property of living organisms to adapt themselves to their surroundings, or, in other words, to respond in suitable manner to what were previously indifferent agencies. So far, the reflexes which have been most studied by Pawlow have been those concerned with the secretion of saliva in dogs. Various stimuli can be given so as to affect different sense-organs in different cases, and at the same time the animal is fed, or acid introduced into its mouth; after a short period of such treatment a new reflex has been introduced, for now on application of the accompanying ("conditional") stimulus alone, without the introduction of the food or acid ("unconditional stimulus"), a reflex secretion of saliva occurs. Such reactions have all the characters of the true reflexes, and are equally simple in character, and not, as might seem at first sight, complicated processes grafted on to an unconditional reflex. The intricacy of the conditional reflex is due not to the complex nature of the neural processes involved in the reflex, but to the ease with which it can be inhibited; innumerable conditions in the nervous system itself and in the outer world modify it in this way, and thus investigation of the phenomena is not easy. In close relation to the formation of a conditional reflex is the function of the analysis of the sensations which reach the organism from the outer world, and from which some components are selected by the process of analysis; it is only these selected components which are really utilised in the construction of the new reflex. It seems, then, that by careful study of these reflexes we have the means for acquiring an accurate knowledge of the functional activity of the analysing mechanism. The chief problems which have been investigated are those concerned, firstly, with the origin of the conditional reflexes, and secondly with the mechanism of analysis of sensations. These reflexes can be formed in relation to strong as well as to indifferent stimuli; thus powerful electric stimuli applied to the skin, when the reflex has been trained, do not lead to movements of defence or aggression as is at first the case, but merely to the feeding reflexes of which the flow of saliva is the easiest to follow. This is to be explained as due to the formation of new nerve paths, determined by different excitability of the various nerve centres. Thus the stimulation of bone cannot be made to yield the conditional reflex, since the centres connected with painful stimulation of bone are more powerful than those connected with alimentation.

An important condition for the upbuilding of a conditional reflex is that the particular conditional stimulus used must precede, or accompany, not follow, the unconditional stimulus (food or acid). If it follows the unconditional stimulus, inhibitions are set up, and this inhibition has also been studied. It is also of great importance that the stimulus employed be strictly isolated from inci-

dental ones; in some of the earlier investigations it appeared that the real conditional stimulus was given by the operator himself, by some peculiarity of odour or movements, and not at all by the stimulus which he believed he was employing. For this reason the animals are now always isolated in special rooms, which no person enters during the course of an experiment, all the conditions and observations being controlled from without by means of electrical or pneumatic arrangements.

With regard to the inhibitory processes to which the reflexes are so subject, there may be distinguished three kinds of inhibition. Firstly, we have the inhibition during sleep. Secondly, the inhibition by means of the arrival of other stimuli which have an inhibitory effect (external inhibition). Thirdly, there is a variety which is called "internal inhibition." This is developed as a result of special relations between the conditional and unconditional stimuli by means of which the particular reflex has been prepared. When, for instance, the conditional stimulus is not followed by the customary unconditional one for some time, it becomes converted into an inhibition.

When in the developed reflex the conditional stimulus is not followed (or "confirmed") by the unconditional one, the type of inhibition is called "extinction"; when in working out the reflex the unconditional stimulus only follows some minutes after the conditional, the inhibition which intervenes is called "retardation." "Conditional inhibition" is seen when the conditional stimulus, when accompanied by an indifferent stimulus, is not followed by the unconditional stimulus; lastly, "differential inhibition" is seen in the fact that stimuli approaching closely to the conditional stimulus, and which at the commencement are effective, become eventually inactive. That all these phenomena are really due to inhibition can be shown by the fact that under appropriate conditions the inhibition may be removed, and the effect manifested ("Loshemmung").

The powers of discrimination of the analysors are greatly increased during the development of the reflex, and the conditional stimulus becomes more and more limited and specialised until finally it corresponds to a very small part of the analysing mechanism. Experiments in which definite parts of the cerebral hemispheres have been removed have taught that the cerebrum is the organ which is responsible for the upbuilding of these new reflexes. Want of space renders it impossible to

give an account of these experiments on the results of partial extirpation of the cerebrum, since these were given in such brief outline in the lecture that further abstraction is not possible. It is to be hoped, however, that Prof. Pawlow will soon give to the world a book on the subject similar to his famous work on the "Work of the Digestive Glands," since practically all the abundant literature on this new subject is only to be obtained in the Russian language at the present time.

The next International Physiological Congress will be held in Paris in 1916, with Prof. Tigerstedt, of Helsingfors, as President.

C. LOVATT EVANS.

THE DUAB OF TURKESTAN.¹

IN its opening sentence this book raises an important question, of the propriety of appropriating a word belonging to a language foreign to us and using it, in a sense equally foreign to

FIG. 1.—Mudspate-track opposite Veshab in the Zarafshan Valley. From "The Duab of Turkestan."

its native country, in order to express a concept at variance with its original sense. The word *doab*, signifying originally the confluence of two streams, and secondarily the tongue of land between them, has been introduced by Prof. W. M. Davis for a portion of a coastal plain lying between two rivers which never unite, but flow independently to the sea; in the form "duab" it is used by Mr. Rickmers for the country lying between two rivers, the Oxus and Jaxartes, which flow independently into the Sea of Aral, and includes not only the area of plain, which would come under Prof. Davis's use of the word *doab*, but the whole of the mountain region bounded on either side by the main streams of the two rivers.

¹ "The Duab of Turkestan: A Physiographic Sketch and Account of some Travels." By W. Rickmers Rickmers. Pp. xv+564+plates+maps. (Cambridge: University Press, 1913.) Price 30s. net.