contributions upon this phase of the subject are beginning to appear.

Lastly, it is the opinion of the writer that the physiologist has not yet entered upon the greatest task awaiting him, in the translation of the forms of activity shown by the vegetal organism into a system of general physiology, establishing a secure basis upon which coordination of accrued results may be made, a consequent better organization of the forces of attack upon waiting problems, and a more perfect articulation with all branches of biological science secured. The fact that this has not been accomplished is in part accountable for the nebulous ideas concerning the scope and status of the subject among even the botanical contingent.

In conclusion, it is to be said that it is manifestly impossible to do more than outline the developing principles which constitute the science of physiology, and suggest a few of the great gaps which remain to be filled by the efforts of future investigators. Moreover, the constant broadening of the biological sciences will demand a projection of physiological activity to cover widely diverging branches, and the interpretation of forms of activity of protoplasm yet unknown or but dimly recognized.

[Since the paper as above was prepared for the printer, Professor Loeb, in a discussion of the fundamental problems of animal physiology in this Journal (Vol. VII., p. 154, 1898), has called attention to certain facts showing that the fundamental problems in the two branches are in part identical and in part closely parallel. His estimate of the outlook, "At no time since the period following the discovery of the law of conservation of energy has the outlook for physiology appeared brighter than at present," applies to this entire department of biological science.]

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THE MOUTH-PARTS OF THE RHYNGOTA.

Two papers on the above subject have been published within the last year or two, showing that there is yet a very considerable difference of opinion as to the real homologies of the beak and four inclosed lancets which form the Hemipterous mouth. The first of the papers in point of time and very much the most important is by Dr. Richard Heymons, in the *Ent. Nachr.*, XXII., 11, for 1896; the second is by Dr. N. Leon, *Zool. Anz.*, XX., 73, March, 1897.

Dr. Leon carefully describes the beak in several species of aquatic Hemiptera and particularly two little processes from the tip of the second (third) joint, which he homologizes with the labial palpi. It is to be noted that both Leon and Heymons assume it as unquestionable that the beak is a modified labium. In support of his thesis Dr. Leon shows that by proper manipulation the original paired character of the beak becomes evident and he makes the basal joint homologous with the submentum (labial cardines); the second with the mentum (labial stipes), and the third and fourth with the glossa and paraglossa. There is some confusion in the descriptions and in *Gerris* the third joint is made mentum without explanation. The chief point of the paper, however, is in the identification of the two little lateral processes from the so-called mentum as true labial palpi.

I have seen these same processes and would be inclined to consider Dr. Leon's arguments sound, if I did not believe the fundamental assumption that the beak is labial to be incorrect.

Dr. Heymons dismisses these processes from embryological data in the conclusion that 'labial palpi, consequently, are lacking in all *Rhyngota*. The processes discovered on the beak of *Nepa* and *Belostoma* are not really such, but must be regarded as a secondary process of the third joint of the beak.

This paper by Dr. Heymons, based on embryological data, is, however, very important when carefully studied, though in some respects the assumption that the beak is the labium has led, in my opinion, to false conclusions. After disposing of Kræpelin's contention that the inner and partly united pair of lancets represent the mandibles, he states, as his first proposition, that the lateral lancets are produced from the mandibles, which are peg-like, and are withdrawn into the head. This is modified in the seventh proposition, in which it is stated that the so-called mandibles are really only the lobes of the mandibles, of which the stem has become rudimentary. Yet, further, it is limited in the eighth proposition that in the Heteroptera, finally, the mandibular stem is entirely lost and united to the anterior part of the juga; but as this leaves an unattached lancet floating about, we find in the fourth proposition that in the Heteroptera, the maxillary stem is usually divided into two parts. On one, which I call lamina maxillaris, occurs the musculus protractor of the lateral lancets (mandibles). Differently stated, this means that a peg-like process is identified as a mandibular lobe whose stem disappears, which is retracted into the head, where it forms a lancet whose musculus protractor is attached to the stem of the maxilla! Now a lobed mandible is a rarity in insects, and where a lobe does occur it is either an insignificant appendage or is firmly united to the base. An absence of the lobe is the rule, everywhere; in no mandibulate is the lobe ever the only part represented. Here we are supposed to see the stem disappear and the lobe developed into an appendage attached to the maxillary stem.

If the musculus protractor is attached to part of the maxillary stem, which I have no doubt is the case, why not consider the lancet maxillary, and as lacinia, or inner lobe? This would make its attachment and association perfectly normal. Does it not seem just a little absurd to claim that such organs as the mandibles can become practically maxillary appendages?

The second proposition is that the median (inner) lancets are not made up by the maxillæ in toto, but only by their lobes, which are also peg-like and retracted into the head. The third proposition is in part that the trunk of the maxilla after the retraction of the lobes agrees in essentials with the palpi maxillaris of other insects. That is exactly what it ought to do if the lancet is the produced palpifer which I believe it to be.

Dr. Heymons proves, therefore, to my mind, that one pair of lancets is palpifer from the maxillary palpi, the other lacina from the stem of the maxilla; and this is exactly the conclusion which I reached from comparative studies. The muscles from both lancets are supplied from maxillary structures exclusively.

The fifth proposition is that 'rudimentary maxillary palpi are recognizable at the roots of the beak'. In Nepa, for instance, they are approximately onion-shaped and placed before the juga. This it seems to me indicates that the beak is also maxillary, but the ninth proposition is that the beak is derived from the third (hinder) embryonic pair of jaws. The development teaches that in the Rhyngota this pair remains simple. On the labium neither palpi nor lobes, nor any structure that may be considered such, occur. Labial palpi, consequently, are lacking in all Rhyngota.

If these embryonic processes forming the beak are really those of the labium, would not the entire absence of lobes or appendages be an unusual character? Assuming them to be, as I believe, the maxillary galea all difficulty vanishes.

The truth is, Dr. Heymons started with the conviction that he must find three em-

bryonic pairs of jaws, and he found three pairs of processes, which he so identified. Now I have shown elsewhere that the maxillæ are formed of three lateral parts, each of which may be distinct and has its own range of variation; and if we assume that the three pairs of processes observed by Dr. Heymons are all maxillary the Hemipterous mouth becomes quite clear and the attachments of the lancets and the location of the rudimentary maxillary palpi at the base of the beak is normal.

I have previously expressed my belief that the Rhyngota are not descended from a mandibulate stem and that they separated from the archetypal form before the mouth structures were definitely formed anywhere. They were emandibulata from the start, and as such are now equivalent in rank to all the other orders of insects (excluding Thrips) combined. Nor was any labial structure ever developed in this order, and all trace of such is now lost, in the adult at least.

If we study Dr. Heymons' paper in the light of these suggestions it is the most important contribution to our knowledge of the mouth parts of the Rhyngota that has recently appeared.

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*THOMAS JEFFERY PARKER.**

Thomas Jeffery Parker, who died at Warrington, New Zealand, on November 7, 1897, was the eldest son of the late William Kitchen Parker, F.R.S., the world-renowned comparative osteologist. He was born in the S. W. district of London on October 17, 1850, and educated there, and his scientific training was received at the Royal School of Mines during the years 1868–1871. Leaving that institution with distinction, Parker became science master at the Bramham College, Yorkshire; and Mr. W. B. Lockwood, now assistant surgeon at Bartholomew's Hospital, London, may be named, as an anatomist who in his schoolboy days came under his influence. In 1872, at the special request of Huxley, Parker returned to London, to fill the office of demonstrator of biology at the then newly established Science College at South Kensington, now known as the Royal College of Science, London, and he held the post until his appointment, in 1880, to the professorship of biology at the University of Otago, Dunedin, New Zealand. As a teacher Parker will remain memorable in association with the development of the now universally adopted Huxleian method of laboratory instruction in biology, known and recognized throughout the world as the 'type system,' which marked the introduction of rational methods into the teaching of biological science. So earnestly did Parker enter into the task of development of this under his great master that he early became the means of effecting conspicuous changes in its methods, and he will be remembered in history as the man to whom were mainly due its progress beyond the experimental stage and the foundation, in connection with it, of the first teaching-collection of specimens and illustrative anatomical drawings based upon it—the prototype of all since established in various parts of the world.

Among Parker's published works there stands conspicuous his 'Zootomy,' a didactic laboratory treatise, and his 'Lessons in Elementary Biology,' now translated into German, a book for the study and the fireside. Both take high rank among scientific manuals in the English language and both were the direct outcome of his connection with Huxley and his educational work, and the last-named takes rank as the most important treatise for the elementary student that has appeared since

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