the neck region is short and the head brought nearer the shoulders. This diminution of the size of these vertebræ is not confined to any one, but is shared by them all. The second, however, has a very large neural spine. The seventh cervical vertebra is peculiar in being closely related to the first dorsal by its transverse processes, and the tubercle of the first rib articulates nearly equally with this cervical and with the first dorsal. The first rib is unusually stout, and its head is somewhat enlarged. The vertebræ of the back and loins do not call for special comment; there are twelve dorsal and seven lumbar vertebræ. It is perhaps worth while to note in passing that the lumbar vertebræ do not present any of those strong processes so noticeable in many of the rodents (as for example Lepus), but they are small and compact. The sacrals are, however, very exceptional in their character. There are five vertebræ in the sacrum. These are immovably anchylosed by their transverse processes into one piece. Their neural spines are widened and thickened at the summits so as to form a longitudinal ridge with only small openings between the spines. In the same way the laminæ of the arches are broadened and flattened to form an area sharply ridged on the margin and which posteriorly meets and anchyloses with a growth from the ischium in a manner somewhat recalling the pelvis of a bird. A somewhat similar condition is to be found in the pelvi of the two-toed sloth, *Chelopus hofmanii*. The first and second sacral vertebræ are immovably grown to the iliac bones by a surface that extends over the entire inner side of the ilium of each side, and the third sacral vertebra joins partially in the formation of this articulation. The fourth is free laterally, as is the hinder part of the third, but these are completely grown to their neighbors, both before and behind. There are seventeen caudals. These are short and stout, and the anterior ones are supplied with strong processes for the attachment of strong muscles.

THE ANTERIOR LIMB.—A stout clavicle is present. The scapula is short and broad, its coracoid portion is drawn out into an unusually long process. The spine of the scapula is very high, and the acromial process is greatly elongate and drawn out beyond the level of the glenoid cavity. (Cf. Bathyergus.) An additional strong ridge traverses the posterior border of the scapula, to which the immense triceps is attached. The humerus is short and stout, its deltoid ridge is very strong and angular, the distal end is very broad and drawn out on either side into huge areas for muscular attachment. There is no entepicondylar foramen (though one is often present in rodents)[2]. The radius and ulna are short and strongly compressed and furnished with sharp angular ridges that traverse their length. The olecranon process of the ulna is very long and strong, as is to be expected from the huge triceps already referred to. A long curving bone, "falciform," is articulated to the radial side of the wrist in addition to the pisiform bone. This is the supporting piece for the great callosity of the wrist. The metacarpals are not of equal size, the first and second being smaller and the middle one being the largest. The first row of phalanges is short, and the second row is reduced almost to a merest rudiment; the distal, ungual, phalanges, however, are large, and the middle one is largest of all. This is with reference to the production of the immense nail, which is the chief one used in the act of digging. This reduction of the proximal phalanges so as to allow a more direct pull on the terminal digit, where the chief resistance comes, is paralleled in the structures of the fore limb of cetaceans, for instance. The reduction of the neck in the gopher is also a similar case.

THE POSTERIOR LIMB.—The pelvic bone has already been partly described in speaking of the sacrum. It is so peculiar that it will require a somewhat detailed description. The accompanying drawings will help to make the matter clearer. The iliac portion of this bone is divided on its ectal surface by a very strong ridge into two parts, above and below the ridge, respectively. This ridge, furthermore, terminates anteriorly in a hook-shaped process which projects obliquely outward and backward. The ischial portion of the pelvis is drawn out into three strong processes, the most anterior of which is, as already stated, anchylosed firmly to the sides of the fifth sacral vertebra. The pubic portion of the pelvis is reduced to a narrow and very slight bone, which, instead of running inward to meet its mate and form a pubic arch, as is general in the mammalia, runs parallel or divergingly, according to the sex of the specimen. In the female there is no symphysis pubis, the two sides being widely divergent, as in birds. In the male the pelvis is much like that of the female, but there is a narrow bridge of bone across the interval between the widely parted parallel pubic bones. The appearance of this leads one to regard it rather as an ossification in tendon than any portion of the pubic bone. I have not as yet, however, had the good fortune to see any embryonic material and have no proof to offer on the homology of this structure.

The femur is not nearly so stout as the humerus. The tibia and fibula are anchylosed, as is usual in Myomorphs. The fibula is very slender. The hinder foot is small and not peculiar, the work of digging being apparently confined wholly to the anterior limb.

[2]The statement occurs in Flower and Lyddeker's "The Mammalia Living and Extinct," p. 446, as well as in the article "Mammalia," in "The Ency. Brittanica," from which the former is largely a reprint, that "in all existing forms of rodents the humerus has no entepicondylar foramen." This statement is perhaps true in general, but there are a number of cases where the foramen is normally present. I do not know of any Hystricomorphs in which the foramen is present, and it is not present in the Leporidæ, but in many of the Suromorphs and Myomorphs it is present. I have observed it in the following genera: Sciuropterus, Spermophilus, Cynomomus, Haplodon; and it is absent in Sciuras Tamias, Castor; it is present in the Myomorphs, Hesperomys, Onychomys, Zapus, Dipodomys, Cricetus, and absent in many closely allied forms, such as Mus, Fiber, Myodes, Cuniculus, Geomys, Gerbillus, Georychus, Alactaga.

AN IMPEACHMENT OF "SCHOOL BOTANY."

BY GEORGE H. HUDSON, VICE-PRINCIPAL STATE NORMAL AND TRAINING SCHOOL, PLATTSBURGH, N. Y.

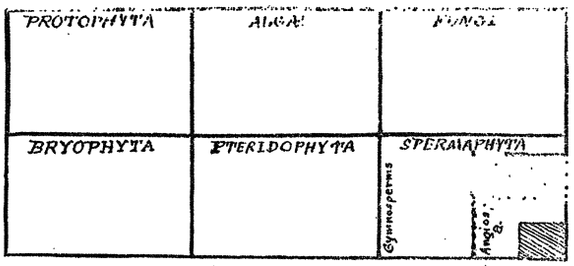
I AM in hearty sympathy with the protest in *Science* for Oct. 20, 1893, entitled "A Mistake in Teaching Botany," and for that reason cannot let the communication under the same title in *Science* of Dec. 8 pass without criticism.

To avoid confusion I wish it to be distinctly understood that the following remarks are made with reference to botany in the high school and not in the kindergarten nor in the elementary schools. Bearing this in mind, let us first take the statement of the critic, on page 318, that "There was, some years ago, a disposition to begin the study of a science at the bottom and work upward, . . . But a few years' test showed the many disadvantages of this method, and the opposite, or older, plan has been readopted." This statement is, to say the least, unfortunately expressed. I have yet to see an arithmetic that begins with cube root and works *downward* to notation and numeration, and I have yet to meet a teacher of this, the oldest of our sciences, who advocates such a course because the opposite "savors of book arithmetic." I know of neither text book nor teacher who would take a high school class in United States history, begin with the Hawaiian affair and reverse the order of events until he had traced backwards the discovery voyage of Columbus and left him petitioning for vessels to enable him to reach the East Indian Archipelago by sailing out into the unknown west; and I know of no reason why a "natural history" of the rise, progress, and condition of animal or vegetable life should take a similar course.

An interesting lesson may be drawn from the com-

parison of an old with a new text book of zoölogy. Take, for instance, Tenney's "Manual of Zoölogy," 1871, and Schiedt's "Principles of Zoölogy," 1892. Of Tenney's 535 pages of text, beginning with man, 360 are devoted to the vertebrata, and a footnote on page 533 disposes of the porifera and protozoa. In Schiedt's work of 298 pages of text the first 70 are devoted to the protozoa, and and the last 13 are all that are allowed the vertebrata. Not only do our recent text books in zoölogy follow the new order, but in all we shall find relatively more space given to the heretofore neglected lower branches of the animal kingdom.

This takes us to the matter of the representation of the field which botany should cover, and here we shall find that our "school botany" has remained so far behind the real growing science of botany as to forfeit even the right to use its title. In the vegetable kingdom, as well as in the animal, science has come to recognize a number of large and important elementary branches. Let the following diagram represent the botanical field,[1] and, remembering what school zoölogy is doing for its separate branches, note the small portion of this large field which is presented to students who imagine that they are acquiring a fair representation of the vegetal kingdom as it exists to-day:



The shaded portions of the field show that part which is thus falsely made to represent the whole. Five great branches ignored, one of the two divisions of the last branch barely mentioned, but 2 out of 7 orders of monocotyledons and about 17 out of 30 orders of dicotyledons represented, and this bit of one-sided patchwork called botany. Ten weeks spent in the study of the external structure and the analysis of fifty or more native butterflies, with the aid of French's "Butterflies of the Eastern United States," would furnish work of precisely the same value in every respect as the work usually done in school botany, but the instructor would in all probability be modest enough to call the study entomology.

The weakness of school botany by no means ends here, however. Examine the matter of classification. Groups of species are in a small part recognized, as are also groups of genera, but the relationships between families are utterly ignored. The higher groups are used as if for the express purpose of perpetuating ancient errors. The gymnosperms are still sandwiched between the allied monocotyledons and dicotyledons, and in a similar manner the choripetalæ are rudely and unnaturally split into the polypetalous and apetalous divisions and the gamopetalæ thrust in between them, the more perfectly to hide their natural relationships. Note the false position still held by the ranunculaceæ, though rightfully belonging to the compositæ, and note also the many instances in which a terminology abandoned by science is most seduously preserved.

Small as is the portion presented, and weak as is the taxonomy, still weaker is the outline and coloring with which even that small portion is presented. Here, again, we may draw an interesting lesson through another comparison of zoölogical text books. While in the older works the matter of classification is made of paramount importance, and fills the greater part of the volume, in the new English university extension manual, Thompson's "Study of Animal Life," but 63 out of 369 pages are used for this purpose, the rest being devoted to the presentation of the manifold aspects under which we may view and study the animal kingdom. This book represents the *science* of the nineteenth century. How is it with our school botany? Plant anatomy is represented by merely external features. Of plant physiology, morphology, embryology, phylogeny, geographical distribution, relation to insects, birds, mammals, man, etc., nothing is said. How fascinating is the botany of which Grant Allen gives us such charming glimpses in his "Vignettes from Nature," "Evolutionist at Large," and other sketches; how cold and repellent this usurper. Examine the average course in botany to-day and you could easily imagine yourself back in the time of Linnæus. As if Goëthe, Sprengel, Brown, von Mohl and a host of other workers were yet unborn and Charles Darwin a coming event for which the world is waiting.

Meagre and pitiable as may appear this object, which masquerades as botany, it is by no means yet seen in its nakedness. In some schools, and these by no means few in number, we shall find that "botany" has been reduced to a mere language study through which the meanings of such terms as alternate, terminal, fibrous, linear, oblong, elliptical, ovate, orbicular, obtuse, truncate, and a host of others, are learned. Gray's Lessons are studied in the winter without specimens, and the technical terms committed to memory in spite of the warning of the author himself, who says in the preface (1887), "No effort should be made to commit technical terms to memory. Any term used in describing a plant or explaining its structure can be looked up when it is wanted, and that should suffice."

The matter is really more serious than one would at first suppose. There are, it is true, certain indications which lead us to anticipate improvement. Good text books are beginning to appear. We have those of Bessey, Campbell and Spalding, which show a marked advance in the right direction; but so great is the gulf between these real text books and the limited manuals of a sectional flora, like those of Wood and Gray, that the Regents of the State of New York, basing their questions, as they do, on these manuals, practically prohibit the use of the better text books. It is true that in some places good work, of the character of that in Newell's "Outlines of Lessons in Botany," is being accomplished; and in some schools a bit of real botany is smuggled in through the use of Newell's "Botany Readers," or Hale's "Little Flower People"; but the day is ripe for a general forward movement all along the line.

It is high time that all school teachers, those studying to become teachers, and the children in our high schools as well, knew something of the bacteria, and of the millions of human beings murdered through the ignorant distribution of septic germs. Botany may be made to speak with no uncertain sound concerning the gospel of cleanliness. The compound microscope, to those who have used it, is known to be no obstacle in the way. It is high time that we gave our farmers-to-be a chance in the high school to learn something of the rusts, smuts and mildews which in some years cause the farmers of America to lose as high as a billion dollars' worth of food stuffs. There is an eminently practical side to the question, a side that is too frequently ignored.

I impeach our school botany for lack of logical order in presentation, for giving a disjointed and distorted

[1] The form more properly should have represented seven distinct branches, but for the purpose used this more common arrangement is all-sufficient.

view of the field to be covered, for using an unnatural and antiquated classification and terminology, for ignoring the fields of greatest interest which have been so wonderfully developed during the present century, and for degrading true botany to the position of a mere language study. And I also impeach the men of our nation whose intelligence and special knowledge should make them fit judges in this matter for allowing such a state of affairs to exist without the most vigorous and continued protest, and for allowing a study of such practical value and one which might be made "not inferior as a logical praxis to the study of elementary geometry"[2] to secure but a paltry ten weeks' time for its study even in a large majority of the normal schools of this State.

Let us hear from others on this subject. It is indeed time that the biologists of America awoke to the needs of the situation and did something for the pathognomonic condition of this long neglected patient. It is high time to take school botany out of the ruts of a dead past and place it where it may reflect the living science.

CURRENT NOTES ON ANTHROPOLOGY. NO. XL.

(*Edited by D. G. Brinton, M.D., LL. D., D. Sc.*)

NEW FACTS IN AFRICAN ETHNOGRAPHY.

In 1891 Dybowski was sent by the French Government into the eastern part of French Congo to punish a tribe for the murder of the traveller Crampel. He ascended to the Oubanghi, crossed an elevated plateau, and reached the head waters of streams flowing into Lake Tschad. Approaching this plateau, at about 5° north latitude, he found the dividing limit between the Bantu peoples of the south, and the tribes of the Sudan. The last tribe of the Bantu were the Bondjo, the first of the Sudanese were the Bandziri, a branch of the Niam-niam.

The contrast between these was strangely sharp. The Bondjo are extremely savage, slave dealers, and cannibals by taste, slaves being fattened for killing and their flesh sold in the open market. Nor is it dear, as one can buy a slave in good condition for the dining table for about three dollars. The Bondjo have a hideous appearance, owing to their prognathism and their custom of extracting the front teeth.

The Bandziri, on the other hand, are mild in manners, hospitable to travellers, their color a copper brown, large framed, with thin lips and good features. They are not cannibals, and live sedentary and agricultural lives.

An epitome of the results of Dybowski's journey appeared in a recent number of *Le Naturaliste*, Paris, from which these facts are taken.

THE FAR ASIATICS.

The recent work of Mr. Savage Landor on the Ainu of the northern Japanese Archipelago is exciting a certain amount of attention by the vividness of his descriptions and his ability as an artist. It is doubtful, however, if the latter faculty does not at times carry him too far. An ethnologist of repute, who has travelled among these people, writes that he never saw such hairy specimens as Landor depicts; and certainly they are exaggerated types of what the best authorities have reported.

Mr. Landor has a new theory of the aborigines of the islands in question. He believes that the Ainu, coming from the north, conquered and dispossesed an older race, the Koro-pok-kuru, who were akin to the Eskimos, and had come to Yezo from the Aleutian Islands. It is something in the way of this that the western islands of the Aleutian archipelago were uninhabited when discovered, and showed no trace of a previous population.

In this general territory, Professor Schlegel, of Leyden, continues his labor of identifying the tribes mentioned in the Chinese annals. (See *Science*, Sept. 9, 1892, and Dec. 22, 1893.) He suggests that "the people with black teeth," and those "with black legs" are the Tunguse of the lower Amoor River, who wear black seal skin boots reaching to the body. The "Land of Green Hills," where the foxes have nine tails, he thinks is Corea. A black people, north of the Ainu, referred to as "the wide-awake people," he considers to have been some branch of the Tunguse, darkened by exposure and dirt.

THE ZOREISCH INDIANS OF CALIFORNIA.

An interesting article, likely to escape the notice of American ethnologists, has been recently published on the above tribe in the publication office of the Anthropological Society of Vienna. It includes the observations of Baron von Loeffelholtz made in 1857, with additions of a later date by his son. Taken together, they present a vivid picture of the tribe, which at that date lived on Trinidad Bay, California, about 250 miles north of San Francisco, and was still in a highly primitive condition. For instance, not only were bows and arrows the usual weapons, but the arrow-heads were still manufactured of stone, the method of doing which is minutely described. The tribe was peaceable and honorable in its dealings. Much light is thrown upon its social customs. A short vocabulary is added, from which I see that it was a member of the Yurok linguistic stock. It has since been removed to a reservation and is extinct, or nearly so.

QUESTIONS IN DEMOGRAPHY.

The Eighth International Congress of Hygiene and Demography will be held at Budapest, from the first to the ninth of September next. The demographic part will especially interest the anthropologist. The secretary general, Dr. C. Muller, Rochus Hospital, Budapest, will send full particulars.

The demographic wing includes historical demography, anthropometry, presided over by the well-known scientist, Dr. Aur. Torok, demography of the agricultural classes, of towns, etc., and the statistical study of bodily and mental defects. A number of definite questions are presented for investigation and discussion under each of these headings. It is to be hoped that the United States will not be without competent representatives at this important meeting.

THE NURAGHS OF SARDINIA.

The name *nurhag* is given in Sardinia to certain ancient stone structutes, which are very abundant in parts of the island. The walls are thick, the stones laid without mortar, well fitted together. The entrance is low and leads to interior chambers enclosed with ogival arches, giving the room the shape of half an egg-shell.

The builders and the date of construction of these edifices have been a puzzle from the days of Diodorus Siculus, who mentions them then as very ancient. A writer in *La Nature*, for October, 1893, reviewing the recent evidence obtained by excavation, shows that they were built by a people acquainted with bronze, copper, tin and lead; who wore metal helmets, and used metal swords; and hence lived in the bronze age. Basing his opinion on the character of these relics and supported by some very early classical traditions, he maintains that the builders were Libyans, who came from Africa, seized a portion of the island, populated it, and constructed these solid forts as refuges and defensive works.

To this it may be objected that similar buildings have not been discovered in north Africa; but it is also true that much of the territory there is unexplored; that the Roman occupation used the material of the old buildings for new ones; and that rumors have reached travellers of extensive and ancient stone ruins in the remoter valleys of the Atlas. The theory, therefore, is not without a fair probability in its favor.

[2] "Science Teaching in the Schools," by Wm. N. Rice, p. 10, (D. C. Heath & Co.)