literature,* in which anomalous internal bast arises in a very different way, being developed entirely secondarily, through the activity of a cambium, gradually extending itself inward at the nodes, and entering the pith through the gaps in the fibro-vascular ring, which are left by the outgoing leaf-trace bundles.

B. L. R.

5. *Die Gattung Phyllostylon und ihre Beziehungen zu Samaroceltis.* (Oestr. bot. Zeitschr., Dec., 1890.)—Dr. P. FAUBERT, the author of this short article, having been fortunate enough to obtain fruiting specimens of *Phyllostylon Brasiliense* Capan, finds that they correspond closely to plants upon which the new genus *Samaroceltis* has recently been founded. The conclusion is naturally drawn that the two genera must be united under the older name *Phyllostylon.* While studying these plants Drs. Taubert and Urban have discovered a Cuban form of *Phyllostylon* almost identical with a Paraguay species. This is an additional point in proving a relationship, which seems to exist between the flora of the West Indies and the southern United States on the one hand, and of Paraguay and the Argentine Republic on the other, a peculiarity of botanical geography for which no adequate explanation has as yet been offered. B. L. R.

6. *Eine Notiz über das Verhalten der Chlorophyllbänder in den Zygoten der Spirogyraarten;* by VINCENT CHMIELEVSKY. (Bot. Zeit. 1890, viii, pp. 773–780).—Owing perhaps to the greater importance ascribed to the cell-nucleus, the conduct of the chloroplaslids, during reproduction among the *Conjugatæ*, seems until now to have received but little attention. It has long been supposed that the chlorophyll-bodies of the two conjugating cells in some way unite, both contributing to the substance of the new chloroplastid of the zygospore. In the interesting paper just named, the author shows that this idea is altogether unfounded. In the species of *Spirogyra* studied by him, the chloroplastid of the zygospore develops directly from that of the conjugating cell within which the spore is formed (female cell), while the chlorophyll of the other conjugating cell takes no part in this process, but gradually loses its color, disintegrates, and after remaining sometime in the spore as a minute mass of brownish pigment, finally disappears altogether. These facts add, as the author concludes, a striking argument for the theory that hereditary traits are transmitted entirely by the agency of the nuclei, the vegetative parts of the cells being, in this regard, entirely neutral. B. L. R.

* Cf. Annales du Jard. bot. de Buitenzorg, vol. viii, pp. 102–111.

Index to Volumes XXXI–XL.

AN EXTRA NUMBER giving a full index to volumes XXXI–XL, and forming pp. 505–548 of volume XL, was issued in January. Sent only to those who specially order it—price seventy-five cents.

APPENDIX.

ART. XIX.—*The gigantic Ceratopsidæ, or horned Dinosaurs, of North America;** by O. C. MARSH. (With Plates I–X.)

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Two years ago, at the Bath meeting of the Association, I had the honor to present to this section a paper in which I compared the principal known Dinosaurs of Europe with those of America.† In this communication, I referred to some peculiar reptilian remains from the Gosau formation of Austria, and compared them with certain Laramie fossils from America, about which I hoped soon to have more definite information. As an indication of the rapidity with which knowledge of ancient life is advancing, it may interest you to know what has been learned, in two years, concerning this single group of the remarkable reptiles known as *Dinosauria.* This group, I have termed the *Ceratopsidæ*, and I shall speak especially of the forms I have recently investigated, and hope to describe more fully later, under the auspices of the United States Geological Survey.

The geological horizon of the *Ceratopsidæ*, in America, is a distinct one in the upper Cretaceous, and has now been traced nearly eight hundred miles along the eastern flank of the Rocky Mountains. It is marked almost everywhere by remains of these reptiles, and hence I have called the strata containing them, the Ceratops beds. They are fresh-water or brackish deposits, which form a part of the so-called Laramie, but are below the uppermost beds referred to that group.

* Read before Section C of the British Association for the Advancement of Science, at the Leeds meeting, September 4, 1890. See also this Journal (3), vol. xxxvi, p. 477, December, 1888; vol. xxxvii, p. 334, April, 1889; vol. xxxviii, p. 173, August, 1889, p. 501, December, 1889; and vol. xxxix, p. 81, January, 1890, p. 418, May, 1890.

† Report of the British Association for the Advancement of Science for 1888, p. 660. London, 1889. Abstract, this Journal (3), vol. xxxvii, p. 323, April, 1889.

The fossils associated with the *Ceratopsidæ* are mainly Dinosaurs, representing two or three orders, and several families. Plesiosaurs, crocodiles and turtles of Cretaceous types, and many smaller reptiles, have left their remains in the same deposits. Numerous small mammals, also of ancient types, a few birds, and many fishes, are likewise entombed in this formation. Invertebrate fossils and plants are not uncommon in the same horizon.

The Skull.

The skull of *Triceratops*, the best known genus of the family, has many remarkable features. First of all, its size, in the largest individuals, exceeds that of any land animal hitherto discovered, living or extinct, and is only surpassed by that of some of the Cetaceans. The skull represented natural size in two of the diagrams was that of a comparatively young animal, but is about six feet in length. The type specimen of *Triceratops horridus* was an old individual, and the head, when complete, must have been seven or eight feet in length. Two other skulls, nearly perfect, represented by life-size sketches, and several others from the same horizon, have almost equal dimensions.*

Another striking feature of the skull is its armature. This consisted of a sharp, cutting beak in front; a strong horn on the nose; a pair of very large, pointed horns on the top of the head; and a row of sharp projections around the margin of the posterior crest. All these had a horny covering of great strength and power. For offense and defense, they formed together an armor for the head as complete as any known. This armature dominated the skull, and in a great measure, determined its form and structure. In some forms, the armature extended over portions of the body.

The skull itself is wedge-shaped in form, especially when seen from above. The facial portion is very narrow, and much prolonged in front. In the frontal region, the skull is massive and greatly strengthened to support the large and lofty horn-cores which formed the central feature of the armature. The huge, expanded, posterior crest, which overshadowed the back of the skull and neck, was evidently of secondary growth, a practical necessity for the attachment of the powerful ligaments and muscles that supported the head (Plate I, figures 1–4).

The front part of the skull shows a very high degree of specialization, and the lower jaws have been modified in connection with it. In front of the premaxillaries, there is a large, massive bone not before seen in any vertebrate, which I have called the rostral bone (*os rostrale*). It covers the anterior margin of the premaxillaries, and its sharp inferior edge is continuous with their lower border. This bone is much compressed, and its surface very rugose, showing that it was covered with a strong, horny beak. It is a dermal ossification, and corresponds to the pre-dentary bone below.

* The large diagrams shown when this paper was read are most of them represented by reduced figures in the accompanying Plates, I–X.

The latter, in *Triceratops*, is also sharp and rugose, and likewise was protected by a strong, horny covering. The two together closely resembles the beak of some of the turtles, and, as a whole, must have formed a most powerful weapon of offense.

In one skull figured (Plate I, figures 1–2), the rostral bone was free, and was not secured. This was also true of the pre-dentary bone and the nasal horn-core. Hence, these parts are represented in outline, taken from another specimen in which they are all present, and in good preservation. In another skull represented (Plate I, figure 4, and Plate II, figures 1–3), the rostral bone and nasal horn-core are in position, and firmly coössified with the adjoining elements.

The premaxillary bones are large, and much compressed transversely. Their inner surfaces are flat, and meet each other closely on the median line. In old specimens, they are firmly coössified with each other and with the rostral bone. Each sends upward a strong process to support the massive nasals. Another process, long and slender, extends upward and backward, forming a suture with the maxillary behind, and uniting in front with a descending branch of the nasal. The premaxillaries are much excavated externally for the narial aperture, and form its lower margin. They are entirely edentulous.

The maxillaries are thick, massive bones of moderate size, and subtriangular in outline when seen from the side. Their front margin is bounded mainly by the premaxillaries. They meet the prefrontal and lachrymal above, and also the jugal. The alveolar border is narrow, and the teeth small, with only a single row in use at the same time.

The nasal bones are large and massive, and greatly thickened anteriorly to support the nasal horn-core. In two of the skulls figured, these bones are separate, but in older individuals, they are firmly coössified with each other and with the frontals. The nasal horn-core ossifies from a separate centre, but in adult animals, it unites closely with the nasals, all traces of the connection being lost. It varies much in form in different species.

The frontal bones are quite short, and early unite with each other and with the adjoining elements, especially those behind them. The frontal or central region of the skull is thus greatly strengthened to support the enormous horn-cores which tower above. These elevations rest mainly on the postfrontal bones, but the supra-orbitals and the post-orbitals are also absorbed to form a solid foundation for the horn-cores.

These horn-cores are hollow at the base (Plate I, figure 3), and in general form, position, and external texture, agree with the corresponding parts of the *Bovidæ*. They vary much in shape and size in different species. They were evidently covered with massive, pointed horns, forming most powerful and effective weapons.

The orbit is at the base of the horn-core, and is surrounded, especially above, by a very thick margin. It is oval in outline, and of moderate size (Plate I, figure 1, *b*).

The postfrontal bones are very large, and meet each other on the median line. Posteriorly, they join the squamosals and the parietals. At their union with the latter, there is a median foramen (Plate I, figure 3, *x*) which apparently corresponds to the so-called "parietal foramen."* In old individuals, it is nearly or quite closed. When open, it leads into a large sinus, extending above the brain-case into the cavities of the horn-cores. This foramen has not before been observed in Dinosaurs.

The enormous posterior crest is formed mainly by the parietals, which meet the postfrontals immediately behind the horn-cores. The posterior margin is protected by a series of special ossifications, which, in life, had a thick horny covering. These peculiar ossicles, which extend around the whole crest, I have called the epoccipital bones (Plate I, figures 1–4, *e*). In old animals, they are firmly coössified with the bones on which they rest.

The lateral portions of the crest are formed by the squamosals, which meet the parietals in an open suture. Anteriorly, they join the postfrontal elements which form the base of the horn-core, and laterally, they unite with the jugals. The supra-temporal fossæ lie between the squamosals and the parietals.

The base of the skull has been modified in conformity with its upper surface. The basi-occipital is especially massive, and strong at every point. The occipital condyle is very large, and its articular face, nearly spherical, indicating great freedom of motion. The basi-occipital processes are short and stout. The basi-pterygoid processes are longer and less robust.

* The name usually applied to this aperture is misleading, as in *Chameleo* and some other reptiles, the foramen is not in or near the parietal bones. It may more properly be called the "pineal foramen."

The foramen magnum is very small, scarcely one-half the diameter of the occipital condyle. The brain-cavity is especially diminutive, smaller in proportion to the skull than in any other known reptile.

The exoccipitals are also robust, and firmly coössified with the basi-occipital. They form about three-fourths of the occipital condyle, as in some of the Chameleons. The supra-occipital is very small, and its external surface is excavated into deep cavities. It is coössified late with the parietals above, and with the exoccipitals on the sides (Plate I, figure 2).

The quadrate is robust, and its head much compressed. The latter is held firmly in a deep groove of the squamosal. The anterior wing of the quadrate is large and thin, and closely united with the broad blade of the pterygoid.

The quadrato-jugal is a solid, compressed bone, uniting the quadrate with the large descending process of the jugal. In the genus *Triceratops*, the quadrato-jugal does not unite with the squamosal. In *Ceratops*, which includes some of the smaller, less specialized forms of the family, the squamosal is firmly united to the quadrato-jugal by suture.

The quadrato-jugal arch in this group is strong, and curves upward, the jugal uniting with the maxillary, not at its posterior extremity, but at its upper surface (Plate I, figure 1). This greatly strengthens the centre of the skull which supports the horn-cores, and also tends to modify materially the elements of the palate below. The pterygoids, in addition to their strong union with the quadrate, send outward a branch, which curves around the end of the maxillary.

The palatine bones are much smaller than the pterygoids. They are vertical, curved plates, outside and in front of the pterygoids, and uniting firmly with the maxillaries. The vomers join the pterygoids in front, where they appear as thin bones, closely applied to each other.

The transverse bones give some support to the maxillaries, which are further strengthened by close union with the pterygoids. They meet the pterygoids behind, and the palatines in front.

The lower jaw shows no specialization of great importance, with the exception of the pre-dentary bone already described. There is, however, a very massive coronoid process rising from the posterior part of the dentary (Plate I, figure 1). The articular, angular, and surangular bones, are all short and strong, but the splenial is very long and slender, extending to the pre-dentary. The angle of the lower jaw projects but little behind the quadrate.

The Brain.

The brain of *Triceratops* appears to have been smaller in proportion to the entire skull, than in any known vertebrate.

The position of the brain in the skull does not correspond to the axis of the latter, the front being elevated at an angle of about thirty degrees (Plate II, figure 7).

The brain-case is well ossified in front, and in old animals, there is a strong septum separating the olfactory lobes.

Teeth of Triceratops.

The teeth of *Triceratops* and its near allies are very remarkable in having two distinct roots. This is true of both the upper and lower series. These roots are placed transversely in the jaw, and there is a separate cavity, more or less distinct, for each of them. One of these teeth from the upper jaw, represented by enlarged figures (Plate II, figures 8–11), and another tooth here exhibited, are typical of the group.

The teeth form a single series only in each jaw. The upper and lower teeth are similar, but the grinding face is reversed, being on the inner side of the upper series, and on the outer side of the lower series. The sculptured surface in each series is on the opposite side from that in use.

The teeth are not displaced vertically by their successors, but from the side. The crown of the young tooth, also with two strong roots, cuts its way between the alveolar margin and the adjacent root of the old tooth, sometimes advancing between the two roots, as might be expected.

The teeth in this family are entirely confined to the maxillary and dentary bones. The rostral bone, the premaxillaries, and the pre-dentary, are entirely edentulous.

Cervical and Dorsal Vertebræ.

The atlas and axis of *Triceratops* are coössified with each other, and at least one other vertebra is firmly united with them. These form a solid mass, well adapted to support the enormous head (Plate III, figure 1). The cup for the occipital condyle is nearly round, and very deep. The rib of the second vertebra is coösified with it, but the third is usually free. The centrum of the fourth vertebra is free, and the remaining cervicals are of the same general form, all having their articular faces nearly flat (Plate III, figure 2).

The anterior dorsal vertebræ have very short centra, with flat articular ends, and resemble somewhat those of *Stegosaurus*, especially in the neural arch (Plate III, figures 3–4).

The posterior trunk vertebræ have also short, flat centra, but the diapophyses have faces for both the head and tubercle

of the ribs, as in Crocodiles, a feature not before seen in Dinosaurs (Plate III, figures 5–6).

The Sacrum.

The sacrum was strengthened by union of several vertebræ, ten being coössified in one specimen of *Triceratops* (Plate IV). The middle or true sacral vertebræ have double transverse processes, diapophyses being present, and aiding in supporting the ilium. This character has been seen hitherto, in the *Dinosauria*, only in *Ceratosaurus* and some other *Theropoda*.

The main support of the pelvis was borne by four vertebræ, which evidently constituted the original sacrum. In front of these, two others have only simple processes, and apparently were once dorsals or lumbars. Three vertebræ next behind the true sacrum have also single processes, and the fourth, or last of the series, has the rib process weak, and not reaching the ilium (Plate IV). Seen from the side, the sacrum is much arched upward, and the neural spines of the true sacrum are firmly coössified. In the median region, the sacral vertebræ have their centra much compressed, but the last of the series are widely expanded transversely. The whole appearance of the sacrum is remarkably avian. The neural canal of the sacral vertebræ has no special enlargement, thus differing widely from that in *Stegosaurus*.

The Caudal Vertebræ.

The caudal vertebræ are short, and the tail was of moderate length. The first caudal has the anterior face of the centrum concave vertically, but flat transversely, and a short, massive neural spine with expanded summit (Plate V, figures 1–3). In the median caudals, the centra have biconcave articular faces, and weak neural spines. The distal caudals are longer than wide, with the ends nearly round, and concave.

The Scapular Arch and Fore Limbs.

The scapula is massive, especially below. The shaft is long and narrow, with a thin edge in front, and a thick posterior margin above the glenoid fossa. The distal portion has a median external ridge, and a thick end (Plate VI, figure 1, *sc*).

The coracoid is rather small, and in old individuals may become united to the scapula. It is sub-rhombic in outline, and is perforated by a large and well-defined foramen. No indications of a sternum have yet been found in this group.

The humerus is large and robust, and similar in form to that of *Stegosaurus*. It is nearly as long as the femur in one individual, proving that the animal walked on all four feet. The radius and ulna are comparatively short and stout, and the latter has a very large olecranon process.

There were five well-developed digits in the manus. The metacarpals are short and stout, with rugose extremities. The distal phalanges are broad and hoof-like, showing that the fore feet were distinctly ungulate (Plate IX, figures 1–6).

The Pelvis.

The pelvis in this group is very characteristic, and the three bones, ilium, ischium, and pubis, all take a prominent part in forming the acetabulum. The relative size and position of these are shown in the diagram (Plate VII, figure 1), which represents the pelvic elements as nearly in the same plane as their form will allow, while retaining essentially their relative position in life.

The ilium is much elongated, and differs widely from that in any of the known groups of the *Dinosauria*. The portion in front of the acetabulum forms a broad, horizontal plate, which is continued backward over the acetabulum, and narrowed in the elongated, posterior extension. Seen from above, the ilium, as a whole, appears as a nearly horizontal, sigmoid plate. From the outside, as shown in the diagram, the edge of this broad plate is seen.

The protuberance for the support of the pubis is comparatively small, and elongated. The face for the ischium is much larger, and but little produced. The acetabular face of the ilium is quite narrow.

The pubis is massive, much compressed transversely, with its distal end widely expanded, as shown in the figure (Plate VII). There is no post-pubis. The pubis itself projects forward, outward, and downward. Its union with the ilium is not a strong one, and is similar to that seen in the pubis of *Stegosaurus*.

The ischium is smaller than the pubis, but more elongate. Its shaft is much curved downward and inward, and in this respect, it resembles somewhat the corresponding part of the pubis of the ostrich. There is no indication that the two ischia met closely at their distal ends, and they were probably united only by cartilage.

A comparison of this pelvis with that of *Stegosaurus* shows some points of resemblance, but a wide difference in each of the elements. The pubis corresponds, in its essential features, to the pre-pubis of *Stegosaurus*, but the post-pubis is wanting.*

* One pubis recently discovered, and represented in Plate VII, has a short, splint-like process, which may, perhaps, be a remnant of a post-pubic element, although it does not have the position of the post-pubic bone in other Dinosaurs.

The Posterior Limbs.

The femur is short, with the great trochanter well developed. The shaft is comparatively slender, and the distal end much expanded. The third trochanter is wanting, or represented only by a rugosity (Plate VIII, figure 1).

The tibia is of moderate length, and resembles that of *Stegosaurus*. The shaft is slender, but the ends are much expanded. The fibula is very slender, and the distal end was closely applied to the front of the tibia (Plate VIII, figures 2–3). In adult individuals, the astragalus is firmly coössified with the distal end of the tibia, as in *Stegosaurus*.

The metatarsal bones which were functional are rather long, but massive. Their phalanges are stout, and the distal ones, broad and rugose, indicating that the digits were terminated by very strong hoofs (Plate IX, figures 7–12).

All the limb bones and vertebræ in *Triceratops*, and the nearly allied genera, are solid.

The Dermal Armor.

Beside the armature of the skull, the body also in the *Ceratopsidæ* was protected. The nature and position of the defensive parts in the different forms cannot yet be determined with certainty, but various spines, bosses, and plates have been found, that clearly pertain to the dermal covering of *Triceratops*, or nearly allied genera. Several of these ossifications were probably placed on the back, behind the crest of the skull (Plate X), and some of the smaller ones may have defended the throat, as in *Stegosaurus*.

The remarkable extinct reptiles here briefly described present many characters which separate them widely from all other known Dinosaurs. Some of these characters are evidently the result of a high degree of specialization, but there are others that cannot be thus explained. The specialization evidently began in the skull, and there reached its greatest development. The peculiar armature of the skull has a partial parallel in the genus *Phrynosoma* among the recent lizards, and *Meiolania* among the extinct turtles. A suggestion of the parietal crest may be seen in the existing *Chameleo*, which offers other points of resemblance in its skull and skeleton. These features, however, indicate only a very remote affinity, and it is among the Dinosaurs alone that this group can be placed, as a distinct family, in the order *Ornithopoda*.

The main characters which separate the *Ceratopsidæ* from all other known families of the Dinosauria are as follows:

(1) A rostral bone, forming a sharp, cutting beak.
(2) The skull surmounted by massive horn-cores.
(3) The expanded parietal crest with its marginal armature.
(4) The teeth with two distinct roots.
(5) The anterior cervical vertebræ coössified with each other.
(6) The posterior dorsal vertebræ supporting, on the diapophysis, both the head and tubercle of the rib.

The *Ceratopsidæ* resemble, in various points, the *Stegosauria* of the Jurassic, especially in the vertebræ, limbs, and feet. The greatest difference is seen in the skull, but the pelvic arch, also, shows a wide divergence. In the *Ceratopsidæ*, there is no marked enlargement of the spinal cavity in the sacrum, and there is no post-pubis.

The characters above given are based upon fossils which I have personally investigated, including the type specimens of *Ceratops* and *Triceratops*, on which, mainly, the family *Ceratopsidæ* was established. The material now at my command includes the remains of many individuals, among which are portions of about twenty different skulls, and some of these are nearly perfect. In the memoir now in preparation, I shall fully describe and illustrate all the more important of these specimens, and likewise discuss their relations to allied forms.

The generic names, *Agathaumas*, *Cratæomus*, *Monoclonius*, and one or two others, have been given to fragmentary fossils, which may belong to this group, but these remains, so far as made known, appear quite distinct from those here described.

In conclusion, let me say a word as to how the discoveries here recorded have been accomplished. The main credit for the work justly belongs to my able assistant, Mr. J. B. Hatcher, who has done so much to bring to light the ancient life of the Rocky mountain region. I can only claim to have shared a few of the dangers and hardships with him, but without his skill and energy, little would have been accomplished. If you will bear in mind that two of the skulls, represented in the diagrams before you, weighed nearly two tons each, when partially freed from their matrix, and ready for shipment, in a deep, desert cañon, fifty miles from a railway, you will appreciate one of the mechanical difficulties overcome. When I add that some of the most interesting discoveries were made in the hunting grounds of the hostile Sioux Indians, who regard such explorations with superstitious dread, you will understand another phase of the problem. I might speak of even greater difficulties and dangers, but the results attained repay all past efforts, and I hope at no distant day to have something more of interest to lay before you.

EXPLANATION OF PLATES.

PLATE I.

FIGURE 1.—Skull of *Triceratops flabellatus*, Marsh; seen from the left side.
a, nasal opening; *b*, orbit; *c*, supra-temporal fossa; *e*, epoccipital; *h*, horn-core; *h'*, nasal horn-core; *p*, pre-dentary; *q*, quadrate; *r*, rostral bone.

FIGURE 2.—The same skull; seen from behind.
d, dentary; *p*, parietal; *pd*, pre-dentary; *s*, squamosal.

FIGURE 3.—Skull of *Triceratops serratus*, Marsh; diagram; seen from above.
d, epijugal bone; *f*, frontal; *fp*, postfrontal; *j*, jugal; *m*, maxillary; *n*, nasal; *pf*, prefrontal; *pm*, premaxillary; *x*, pineal foramen.

FIGURE 4.—Skull of *Triceratops prorsus*, Marsh; seen from the front.
All the figures are one-twentieth natural size.

PLATE II.

FIGURE 1.—Anterior part of skull of *Triceratops prorsus*, Marsh; side view; one-eighth natural size.

FIGURE 2.—Front view of same.

FIGURE 3.—The same; seen from below.
h', nasal horn-core; *n*, nasal; *na*, narial aperture; *pm*, premaxillary; *r*, rostral bone.

FIGURE 4.—Pre-dentary of same individual; side view; one-eighth natural size.

FIGURE 5.—Top view of same specimen.

FIGURE 6.—Bottom view.
a, anterior end; *b*, upper border; *d*, groove for dentary; *s*, symphysis.

FIGURE 7.—Cast of brain-cavity of *Triceratops serratus*, Marsh; side view; one-half natural size.
c, cerebral hemispheres; *cb*, cerebellum; *m*, medulla; *ol*, olfactory lobe; *on*, optic nerve; *p*, pituitary body.

FIGURE 8.—Maxillary tooth of *Triceratops serratus*; outer view; natural size.

FIGURE 9.—The same tooth; side view.

FIGURE 10.—The same tooth; inner view.

FIGURE 11.—The same tooth; seen from below.

PLATE III.

FIGURE 1.—Anterior cervical vertebræ of *Triceratops prorsus*, Marsh; side view.

FIGURE 2.—Fourth cervical vertebra of same series; back view.
a, anterior face of atlas; *d*, diapophysis; *n*, neural canal; *p*, posterior face of fourth vertebra; *r*, rib; *s*, neural spine of axis; *s'*, neural spine of third vertebra; *s''*, neural spine of fourth vertebra; *z'*, posterior zygapophysis.

FIGURE 3.—Anterior dorsal vertebra of same species; side view.

FIGURE 4.—The same vertebra; front view.

FIGURE 5.—Posterior dorsal vertebra of same species; side view.

FIGURE 6.—The same vertebra; front view.
a, anterior face of centrum; *h*, facet for head of rib; *p*, posterior face of centrum; *s*, neural spine; *t*, facet for tubercle of rib; *z*, anterior zygapophysis.
All the figures are one-eighth natural size.

PLATE IV.

FIGURE 1.—Sacrum of *Triceratops prorsus*, Marsh; seen from below; one-eighth natural size.
a, anterior face of first sacral vertebra; *p*, posterior face of last sacral vertebra; *s*, neural spine of last vertebra; *z*, anterior zygapophysis of first vertebra; 1–10, transverse processes, left side.

PLATE V.

FIGURE 1.—First caudal vertebra of *Triceratops prorsus*, Marsh; side view.
FIGURES 2–3.—Front and back views of same vertebra.
FIGURE 4.—Median caudal of same species; side view.
FIGURES 5–6.—Front and back views of same vertebra.
FIGURE 7.—More distal caudal of same species; side view.
FIGURES 8–9.—Front and bottom views of same vertebra.
FIGURES 10–12.—Distal caudal of same species; side, front, and bottom views.
a, anterior face of centrum; *c*, face for chevron; *n*, neural canal; *p*, posterior face of centrum; *r*, rib; *s*, neural spine; *z*, anterior zygapophysis; *z′*, posterior zygapophysis.
All the figures are one-eighth natural size.

PLATE VI.

FIGURE 1.—Right scapula and coracoid of *Triceratops prorsus*, Marsh; side view.
FIGURE 2.—Right humerus of same species; front view.
FIGURE 3.—Left ulna of same species; front view.
cr, coracoid; *g*, glenoid fossa; *h*, head; *o*, olecranon; *r*, radial crest; *r′*, face for radius; *s*, suture; *sc*, scapula.
All the figures are one-eighth natural size.

PLATE VII.

FIGURE 1.—Pelvis of *Triceratops flabellatus*, Marsh; side view; one-twelfth natural size.
a, acetabulum; *il*, ilium; *is*, ischium; *p*, pubis.
FIGURE 2.—Pubis of *Triceratops prorsus*, Marsh; side view; one-eighth natural size.
FIGURE 3.—The same pubis; top view.
FIGURE 4.—The same; side view.
a, proximal end; *b*, face for ilium; *c*, pubic process; *d*, distal end.

PLATE VIII.

FIGURE 1.—Left femur of *Triceratops prorsus*, Marsh; front view.
FIGURE 2.—Left tibia of same species; front view.
FIGURE 3.—The same tibia; distal end; back view.
a, astragalus; *c*, inner condyle; *c′*, cnemial crest; *f*, face for fibula; *h*, head; *t*, great trochanter.
All the figures are one-eighth natural size.

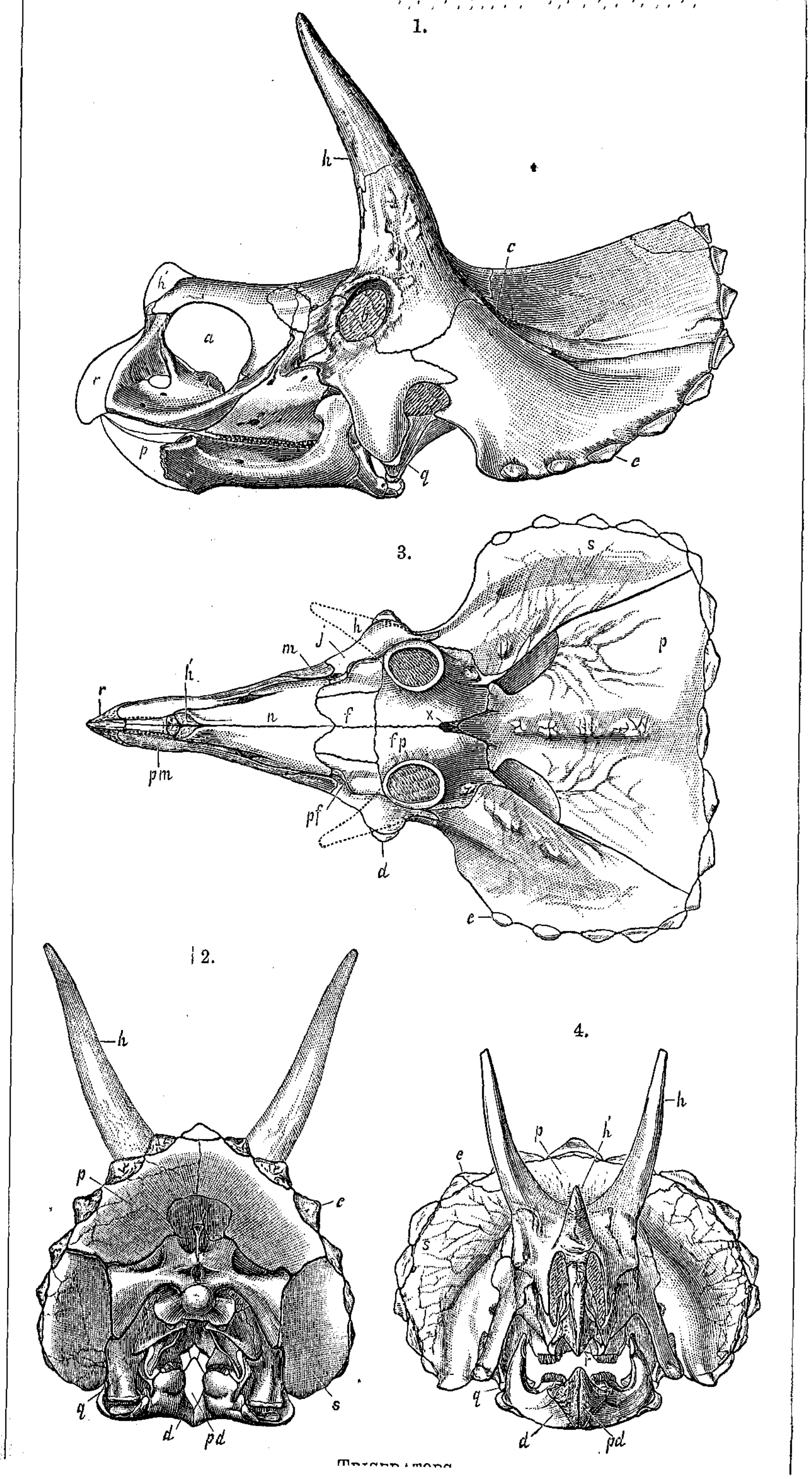
PLATE IX.

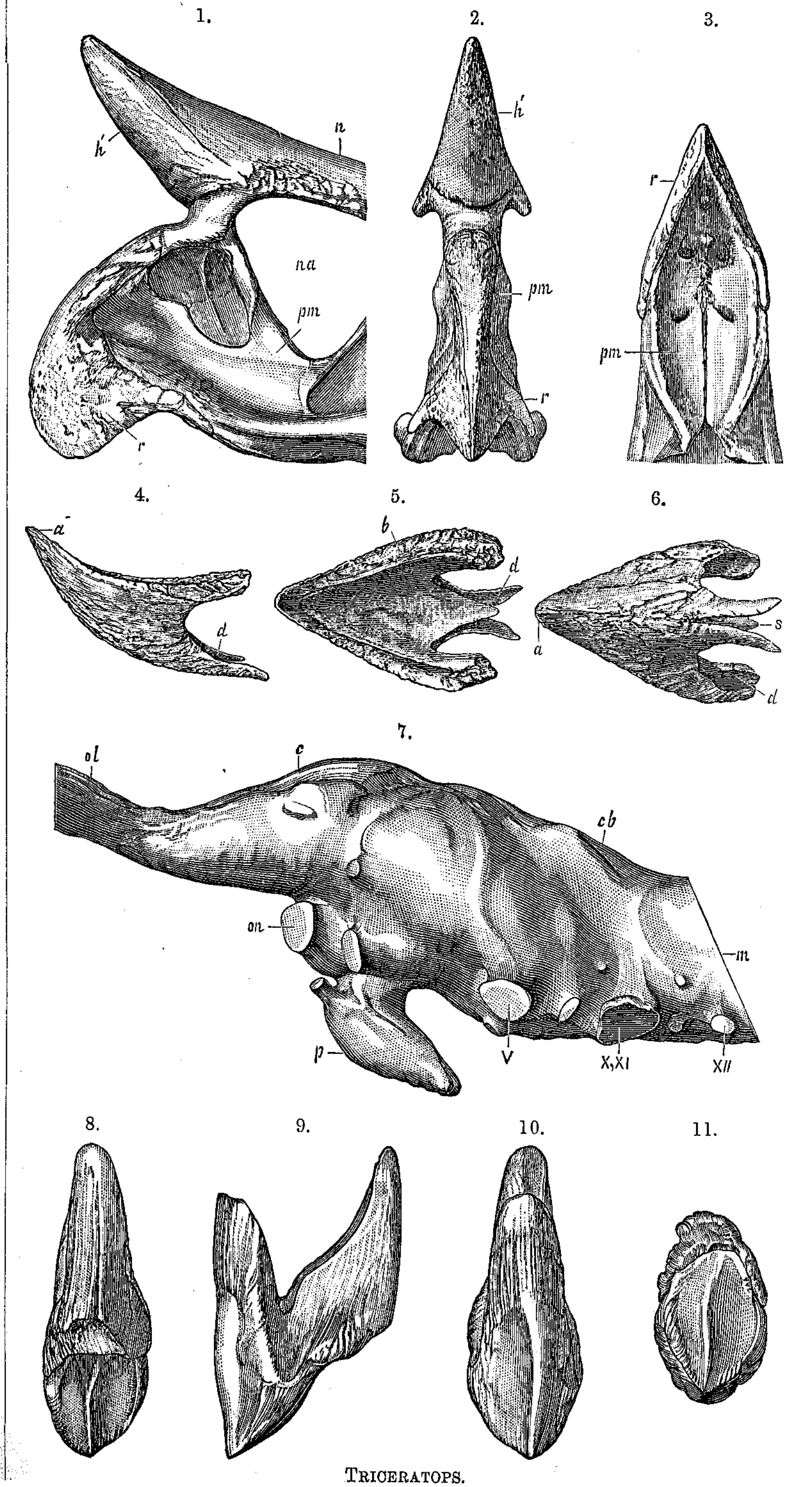
FIGURE 1.—Metacarpal of *Triceratops prorsus*, Marsh; front view; one-eighth natural size.
FIGURES 2–3.—The same; side and back views.
FIGURE 4.—Terminal phalanx of manus of *Triceratops flabellatus*, Marsh; front view; one-fourth natural size.
FIGURES 5–6.—Side and back views of same.
FIGURE 7.—Metatarsal of *Triceratops prorsus*; side view; one-eighth natural size.
FIGURES 8–9.—Front and side views of same.
FIGURE 10.—Ungual phalanx of *Triceratops horridus*, Marsh; front view; one-fourth natural size.
FIGURE 11.—The same; side view.
FIGURE 12.—The same; posterior view.

PLATE X.

FIGURE 1.—Dermal spine of *Triceratops*; side view; one-eighth natural size.
FIGURES 2–3.—Front and top views of same.
FIGURE 4.—Dermal plate of *Triceratops*; top view; one-eighth natural size.
FIGURE 5.—Bottom view of same.
FIGURES 6–7.—Side and end views of same.
FIGURES 8–10.—Dermal plate of *Triceratops*; top, bottom, and side views; one-eighth natural size.
FIGURE 11.—Dermal ossification of *Triceratops*; side view; one-half natural size.
FIGURE 12.—Front view of same.

Am. Jour. Sci., Vol. XLI, 1891. Plate I.





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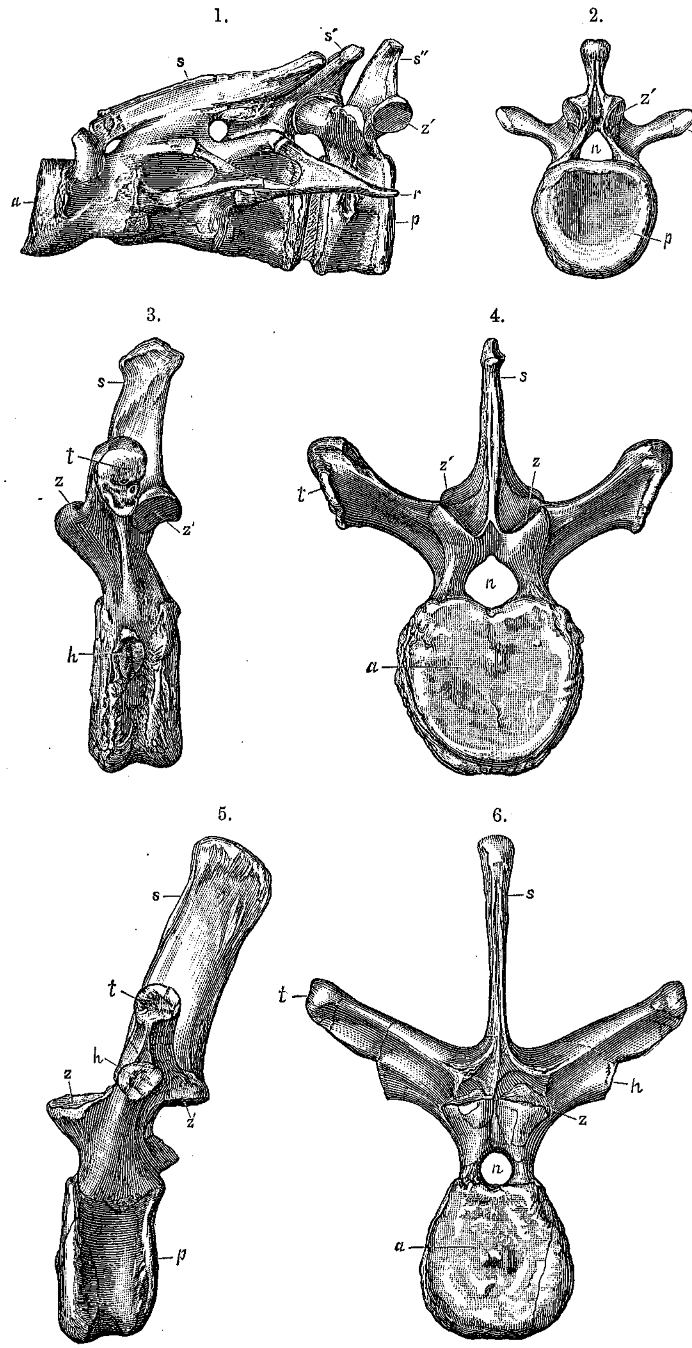

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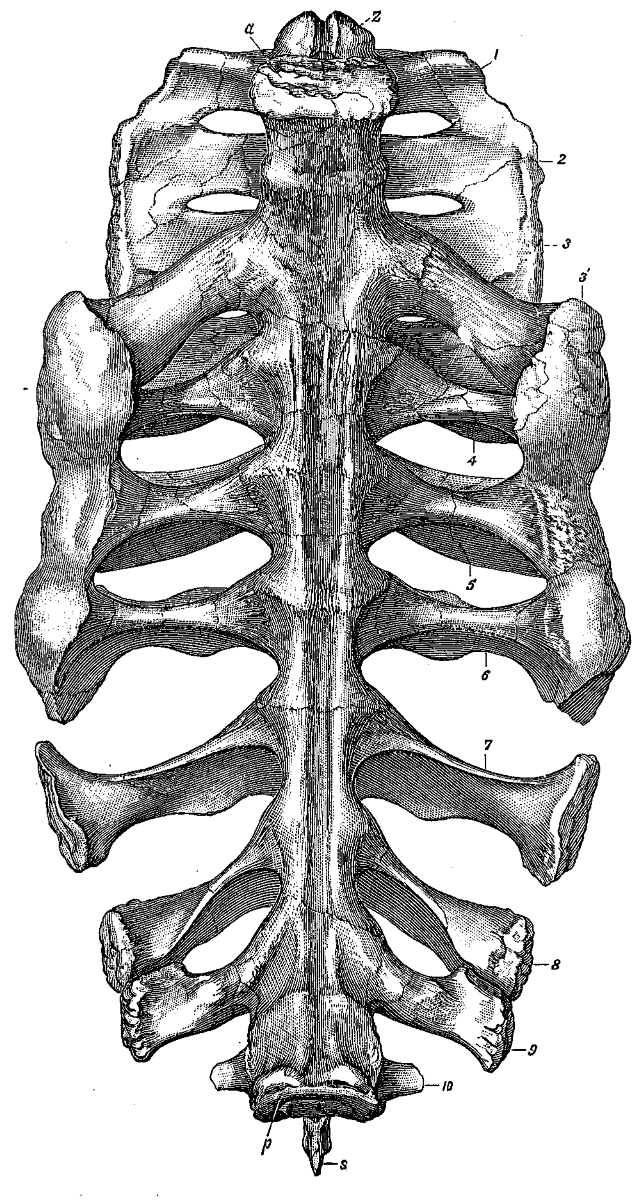

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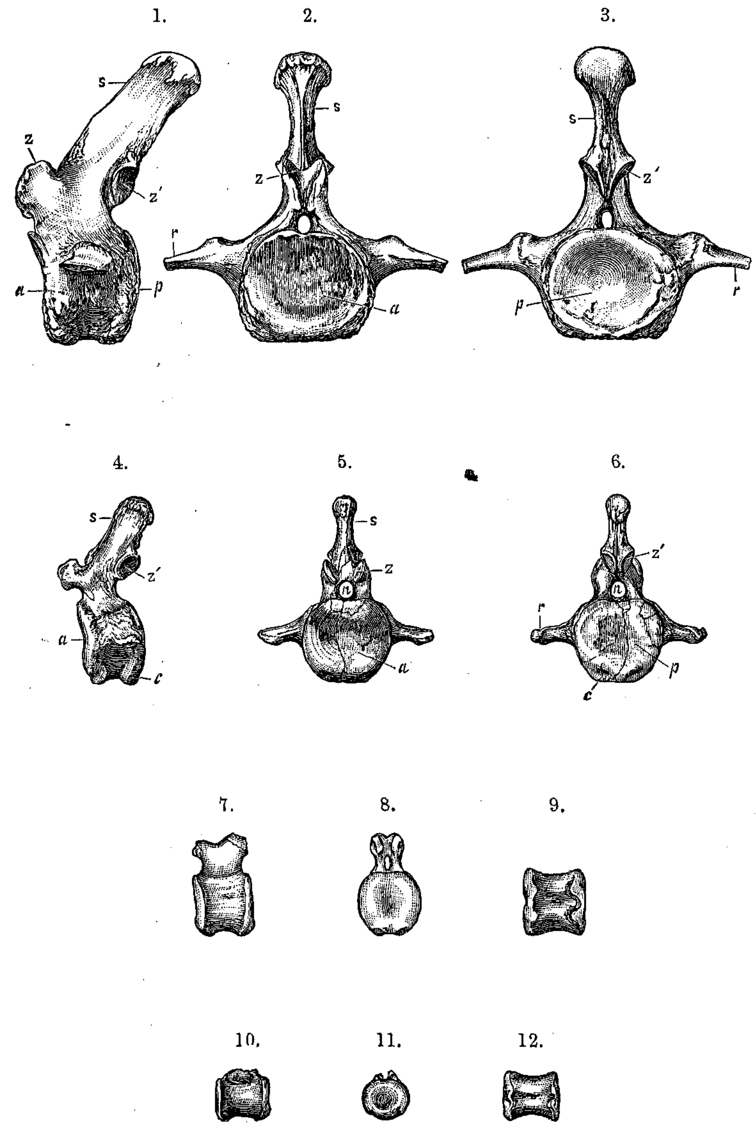

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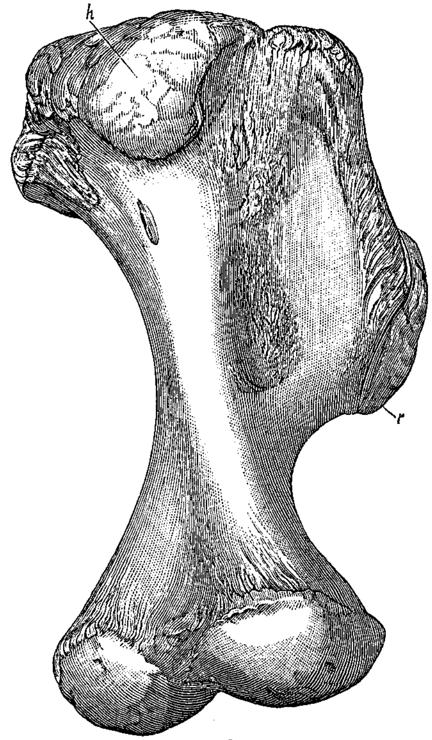

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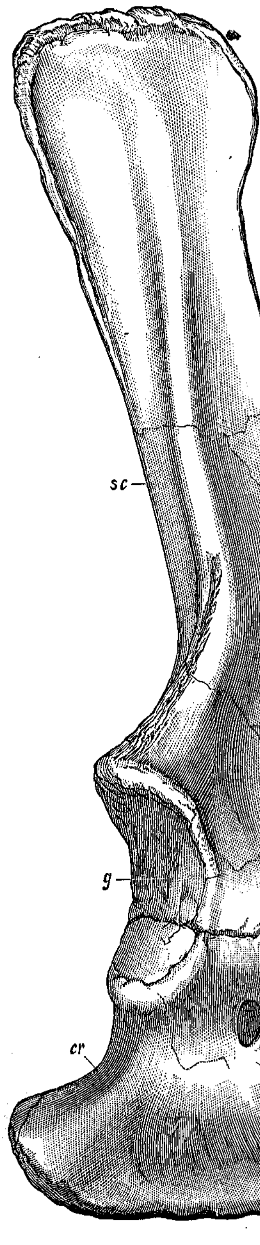

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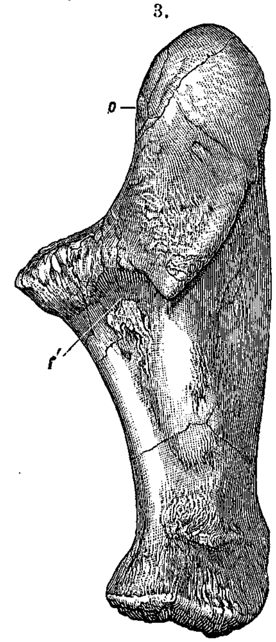

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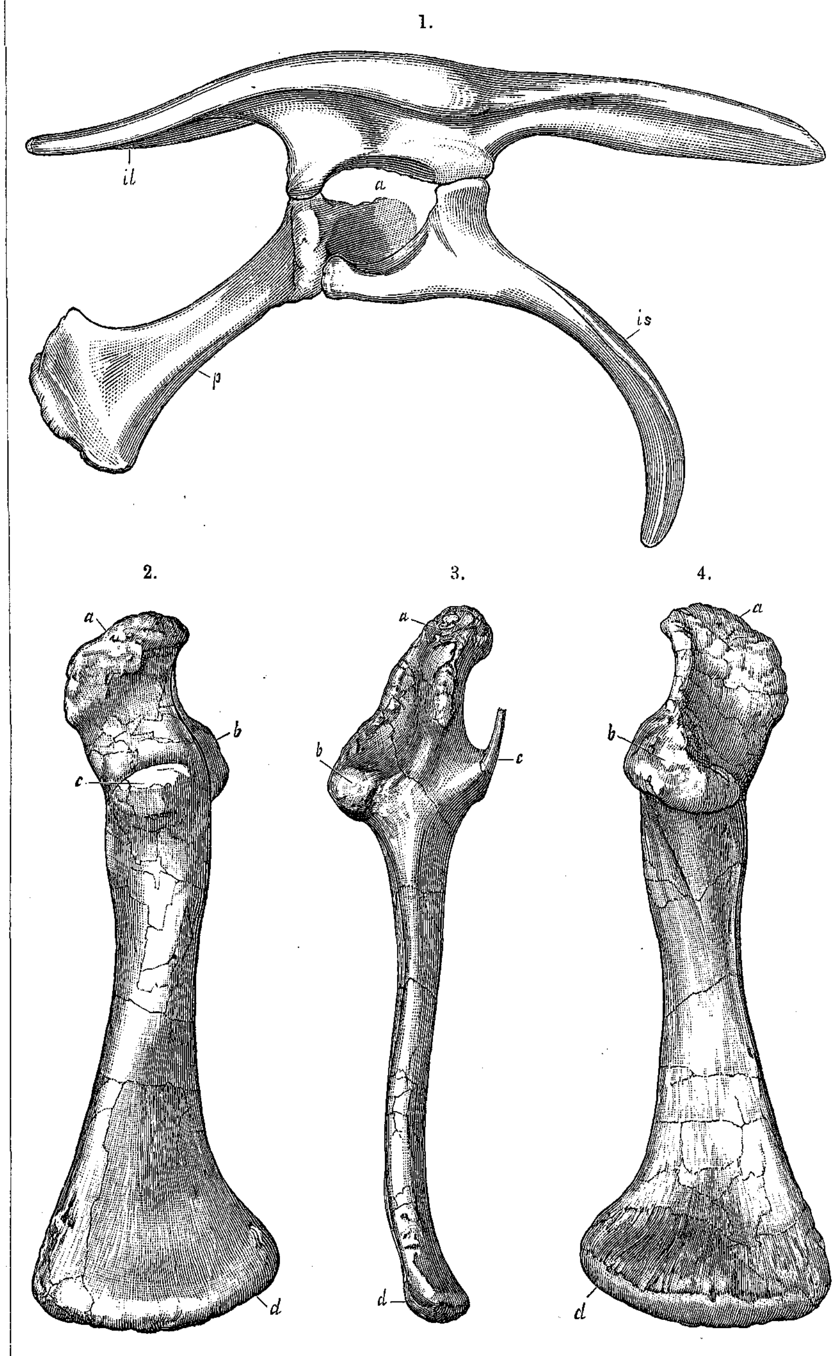

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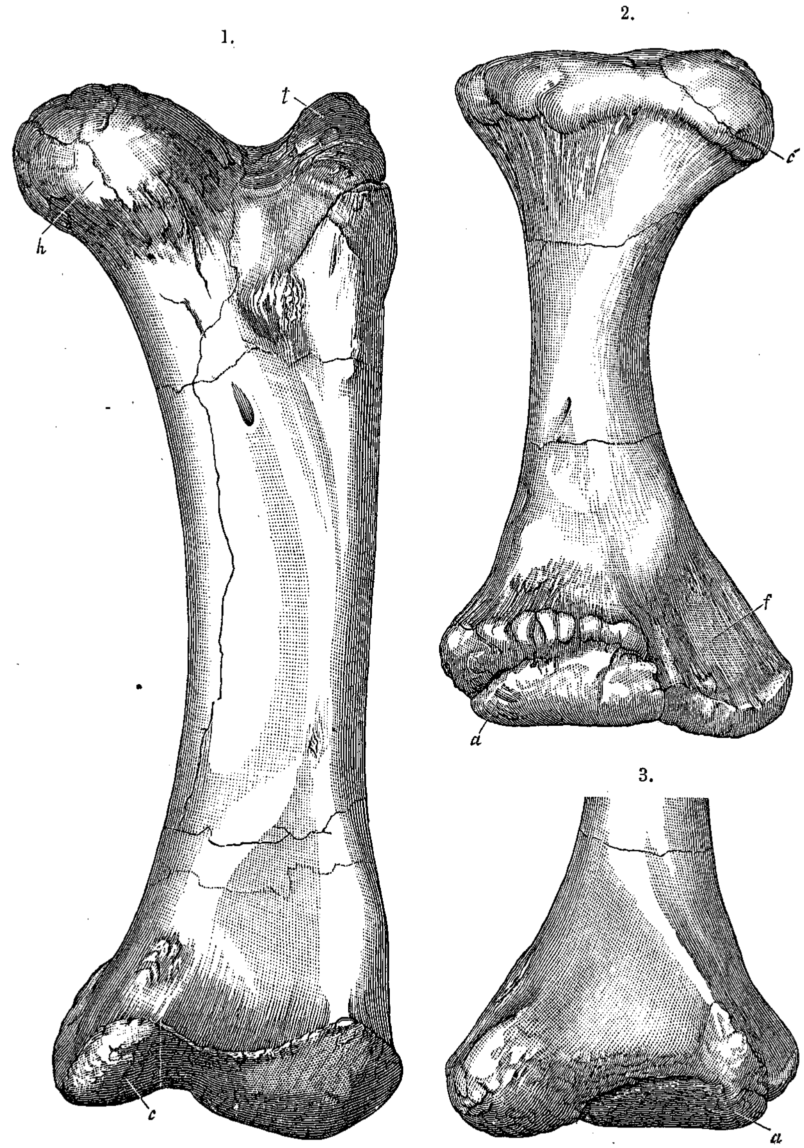

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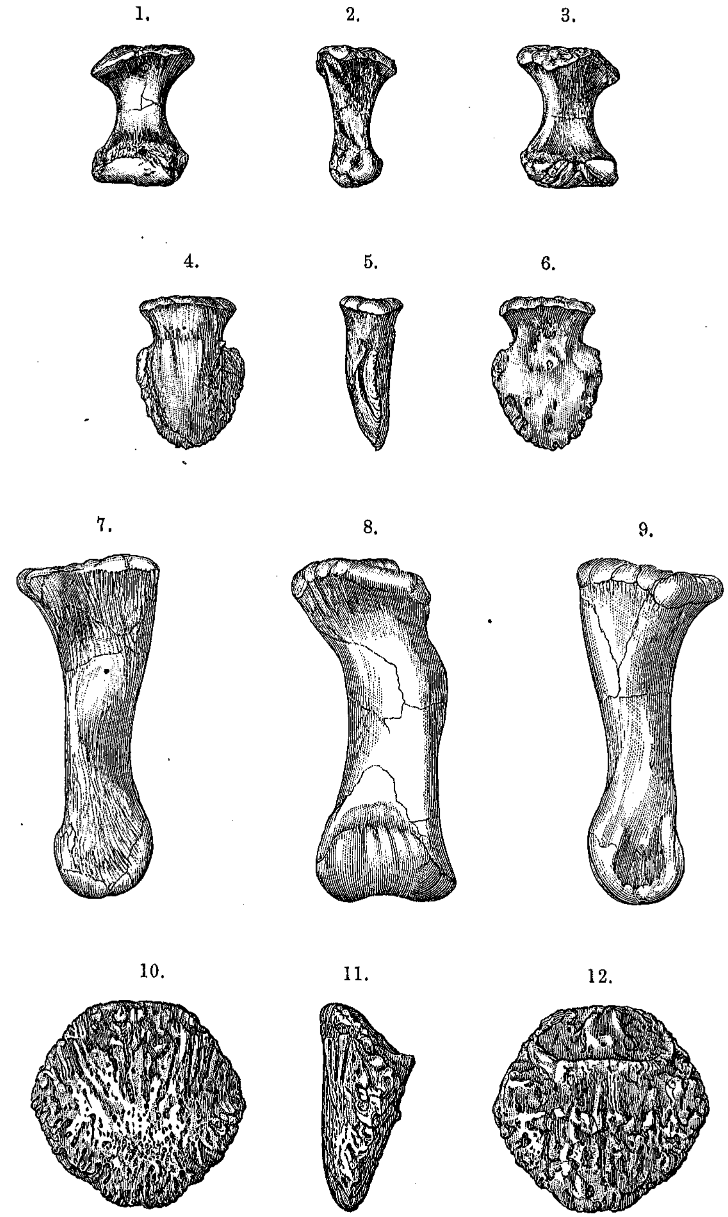
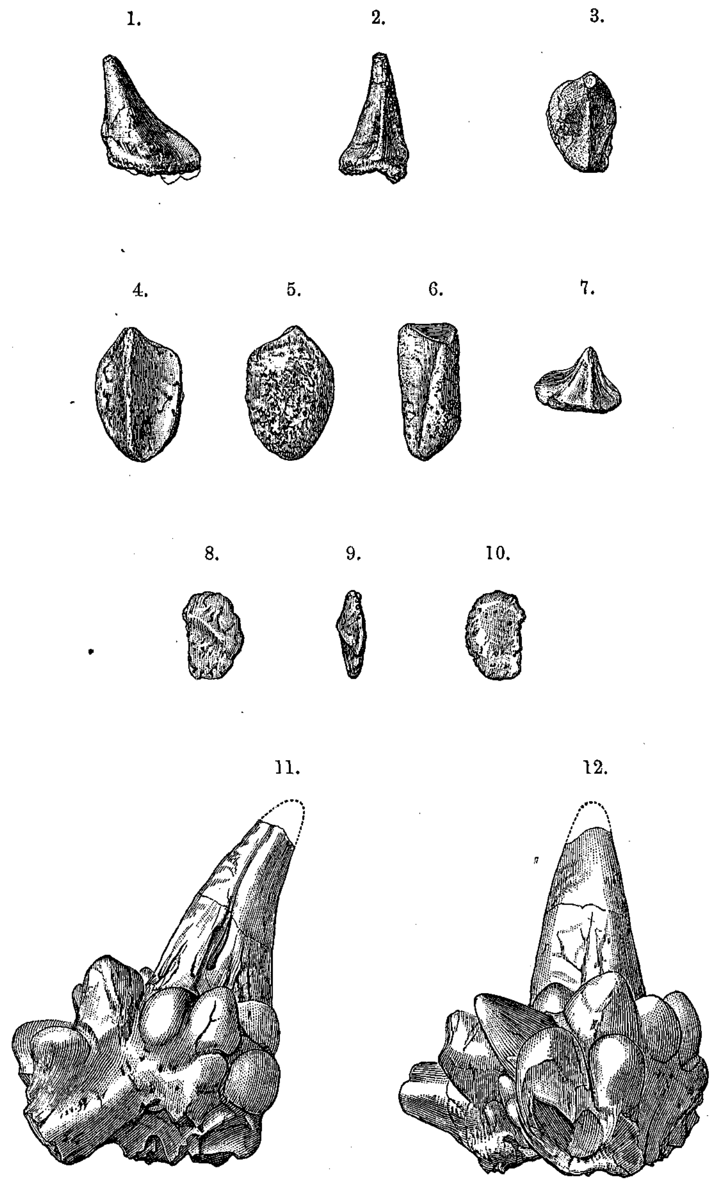
Am. Jour. Sci., Vol. XLI, 1891. Plate IX.



Triceratops.



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