region, and (2) by the rapid acceleration of growth at its margins. The latter process is associated with the extremely rapid formation and vacuolation of irregular groups of genetically related cells and soon results in the typical vaginate form of the cataphyll initial. In contrast, the cells of a young foliage-leaf primordium are more meristematic in staining reaction, and prominent vacuoles are absent from the cytoplasm. The basic histogenetic divergence in such a primordium is evidenced by its early and rapid increase in radial thickness. This type of growth results primarily from the cambial-like activity of a vertical strip of cells beneath the adaxial epidermis and leads to the typical semi-terete form of the foliage-leaf initial. Following this critical period of histogenetic divergence between cataphyll and foliage leaf, rapid morphological and anatomical specialization occurs. Marginal growth continues actively in the scale primordium and is accompanied by the rapid centrifugal and acropetal maturation of a simple type of mesophyll traversed by palmately-branching procambial strands. Conversely, the continued increase in radial thickness of the foliage-leaf initial results in the gradual differentiation of an anatomically complex leaf axis or phyllopodium from the adaxial margins of which two or three pairs of lateral leaflet primordia arise in acropetal succession, the terminal portion of the primordium differentiating into the terminal leaflet.

In conclusion, it must be stated that the early conditioning histogenetic stages in both cataphyll and foliage leaf are preceded by a formative phase in which little or no cytological differences can be detected between their respective primordia. Whether such anlagen are "indifferent" or "determinate" in potentiality remains the central unanswered question in the problem of foliar determination. From this standpoint the problem is not necessarily morphological in appeal. In reality, it challenges, in theory as well as technique, modern genetics and physiology.

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MULTIPLE BIRTHS IN ANTHROPOID APES

SUCH meager information as is available indicates that the frequency of multiple births diminishes in the order primates from the Prosimiae to man. It is reported that twins and triplets may be borne by lemurs, although single births are the rule. The occurrence of twins has been observed also in marmosets and baboons, less certainly in gibbons, and there is high probability that multiple births occasionally occur in many, if not all, of the New and Old World monkeys. For the great apes (orang-outan, chimpanzee and gorilla) we have discovered no published accounts of multiple births. This is not at all surprising in view of the following facts: (1) When a wild female ape carries two infants there ordinarily is no assurance whatever that she bore either, still less both, of them; (2) there have been relatively few anthropoid births in captivity, and of those less than a score have been reliably observed and reported; (3) the frequency of multiple births in man is known to be low, ranging from 1.1 to 1.2 per cent. Our experience in breeding chimpanzees in captivity justifies the surmise that the lack of records of multiple births in captive primates is due primarily to the unfavorableness of nutritional, hygienic and social conditions to normal reproductive process.

Because of the facts which we have presented and our desire to supplement our present information by accumulating all pertinent observations, we wish to report the birth of chimpanzee twins in our laboratories.

Between September 11, 1930, and November 21, 1933, ten seemingly normal births occurred in the chimpanzee colony at the Anthropoid Experiment Station of Yale University, Orange Park, Florida. Of these infants all except one, which died within twenty-four hours after birth, are living at the date of writing. With one exception, the births were single. Fraternal twins, a male and a female, were born on June 26, 1933, after an estimated gestational period of 210 ± 5 days. Although somewhat prematurely born, they were normal and their development has proceeded typically and uneventfully.

The father of the twins has been in these laboratories since September 15, 1925. He was purchased from a ship's officer on arrival in Boston Harbor from Africa. The mother was received as a gift from Mr. Pierre S. Abreu on May 13, 1931. Previously she had been kept for approximately fifteen years in the primate collection of Mrs. Rosalia Abreu in Havana. The estimated age of the father at the date of birth of the twins is eleven years, that of the mother twenty years. She is known to have borne three infants previously. A daughter, born March 24, 1926, now in our colony, is the first chimpanzee of dated birth and positively known parentage and life-history to mature sexually in captivity, so far as we have been able to discover from the pertinent literature. She matured during her eighth year.

The chimpanzee twin birth here recorded is the first to come to our knowledge. True, we have seen chimpanzee infants which were exhibited by showmen as twins. Assertion, however, does not establish fact, and in the only instance in which we were able to make direct inquiry it was promptly admitted, after the nature of our interest had been explained, that the animals were not twins.

We should be very grateful for information about authenticated multiple births in any of the infra-human primates—prosimians, monkeys and anthropoid apes—but especially for chimpanzee. Possibly we may have overlooked some published records, despite diligent search. As we have intimated, it is impossible to take seriously the word of showmen in this connection. Our informants will oblige us greatly by giving specific references to published data and grounds of authentication in case of unpublished observations.

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PERMIAN SHARKS OF WYOMING AND OF EAST GREENLAND

THE Phosphoria formation of Wyoming has two fish-bearing members, the upper of Permian age. This differs from the lower fauna in that three significant new genera are introduced and *Deltodus* and *Crassidonta* are dropped out. One of the new genera was described as *Dolophonodus uncinatus*.[1] This is an unique barbed tooth or spine with no known related genera.

The members of the Danish East Greenland expeditions of 1926–27 and 1929 collected some fish specimens from marine Permian at Cape Stosch. These were described by Nielsen and the results published in 1932.[2] A new genus and species, *Arctacanthus uncinatus,* of Nielsen is so nearly like *Dolophonodus uncinatus* that they may even be conspecific. Nielsen's species is somewhat larger, the striae on the posterior proximal face divide and do not extend to the margin of the base, and the posterior curvature of the crown is greater. Unless the fish elements represented by these specimens are much more constant in their characteristics than are shark teeth, the two are the same species.

The remarkable similarity of these specimens from widely separated localities indicates an exact correlation between the middle portion of the Phosphoria formation and the Martinia limestone, from which Nielsen's specimens were taken. Marine fish are able to migrate rapidly, and a large degree of confidence can be placed upon them in problems of correlation. A comparison of the other fish species of the two faunas shows a similarity in aspect, but not in species:

PHOSPHORIA

Dolophonodus uncinatus
Janassa unguicula
Campodus variabilis
Cladodus occidentalis
Hamatus phosphoriensis
Ancistriodus serratus
Placoid scales
Ctenacanthus mutabilis
C. browni
Edestus (?) sp.

EAST GREENLAND

Arctacanthus uncinatus
Janassa kochi
Agassizodus grønlandicus
Cladodus sp.
Fadenia crenulata
Copodus (?) sp.
Placoid scales
Undeterminable fin-spine

The fish member of the Permo-carboniferous in East Greenland lies immediately beneath the Productus limestones.[3] There is a general resemblance between that fauna[4] and the fauna of the Pustula member of the Phosphoria, in the top of which lies the fish-bearing bed.[5]

There remains an interesting question of priority in regard to the new genus which the two localities have in common. The writer's paper is dated February-March, 1933, and actually came off the press in March. Nielsen's paper is dated 1932, but was not received in this country until the middle of August, 1933.[6] Either paper may have actual priority and the generic name of the other paper becomes a synonym. By a strange coincidence, the specific name is the same in the two papers. If it is desired to distinguish the specimens of the two localities, these of the later paper must be given a new specific name and must be referred to the genus of the prior paper.

Nielsen suggests that the elements in question are the head-spines (frontal claspers) of the male Chimaeroids. The writer can see no basis for this assumption, but would add to his previous suggestion of a possible symphysial position, that there is a possibility that they are rostral teeth of an Euselachian similar to *Onchopristis.*

C. C. BRANSON

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[1] C. C. Branson, "Fish Fauna of the Middle Phosphoria Formation," *Jour. Geology,* xli: 174–183, 1933.

[2] Eigil Nielsen, "Permo-Carboniferous Fishes from East Greenland," *Meddelelser om Grønland,* 86: 3, 1932.

[3] Lauge Koch, "Carboniferous and Triassic Stratigraphy in East Greenland," *Meddelelser om Grønland,* 83: 2, 1931.

[4] H. Frebold, "Das marine Oberkarbon Ostgrönlands; leitende Fauna, Alterstellung, Palaeogeographie," *Meddelelser om Grønland,* 84: 2, 1931.

[5] C. C. Branson, "Paleontology and Stratigraphy of the Phosphoria Formation," University of Missouri Studies, Vol. V, No. 2, 1930.

[6] The chairman of the editorial committee of the Komissionen for videnskabelige Undersøgelser i Grønland has just written me that Nielsen's paper was issued from the press on October 10, 1932. *Dolophonodus* is then a synonym of *Arctacanthus,* and I now refer the Wyoming specimens to *Arctacanthus wyomingensis,* new name.