a worthy continuer of his work, inspired with his ideas and his method.

"We believe, therefore, that the Physico-mathematic Society of Kazan may legitimately decree to him the Lobachevski prize. —P. Mansion."

To Professor Hilbert I am particularly, personally indebted. My 'Rational Geometry' is an attempt to give every teacher, every scholar the benefit of coming after him, the priceless advantage of living since the outpouring of his genius.

Monsieur Barbarin has honored me with his genial friendship.

I suppress the temptation to institute comparisons or discuss a decision.

GEORGE BRUCE HALSTED,
Membre d'honneur du Comité Lobatchefsky.

THE TROPHOBLAST: A REJOINDER.

THE name *Trophoblast* was used for the first time by me in the meeting of the Anatomical Congress at Würzburg in 1888, and its earliest definition is found in the report of that meeting in Nos. 17 and 18 of the *Anatomischer Anzeiger,* Bd. III. We there read, concerning a very early stage of the hedgehog (p. 510):

"Die äussere Wand der Keimblase ist verdickt (drei bis vierschichtig) und besitzt wabige Lacunen. Für diese äussere (epiblastische) Schicht sei der Name *Trophoblast* gewählt."

In a footnote we find in addition (p. 511):

"Es ist meiner Ansicht nach zweckmässig, sich bei der Säugethier-embryologie diesen Namen zu wählen, um damit den nicht zum Aufbau des Embryos verwendet werdenden Epiblast anzudeuten * * *."

It is evident from the citations here given that the names outer epiblastic wall of the mammalian blastocyst and trophoblast are synonyms. Later researches have been directed towards the question how in other mammals than the hedgehog the separation between the epiblast of the embryonic shield, *i. e.,* the formative epiblast and the trophoblast, comes about.

In the same Bd. III. of the *Anatomischer Anzeiger,* on p. 907, mention is again made of the hedgehog's 'geschlossene Trophoblastblase (wie ich den primären Epiblast, von dem sich durch Abspaltung der Epiblast des Fruchthofes nach innen abhebt, zu benennen vorschlug).'

Again, in the article on the placentation of *Erinaceus* in Vol. 30, Pt. 3 (1889), of the *Quart. Journ. of Microsc. Science,* where the definition was reproduced, it is insisted upon (p. 298) that "the use of the name trophoblast will render unnecessary such circumlocutory expressions as 'outer epiblastic layer of the blastocyst,' 'primitive exochorion,' etc." Further argumentation on p. 299, in which the allantoidean and the omphaloidean trophoblast is defined, leaves not the faintest doubt as to what the name *trophoblast* has originally stood for.

Five years later (1894), in an article, 'Spolia nemoris,' which appeared in Vol. 36 of the *Quart. Journ. of Micr. Science,* I again insisted (p. 111) that 'new and valid reasons are thus accumulated for designating the outer layer of precociously segregated epiblast cells that form the wall of this vesicle [the early mammalian blastocyst] by a separate name, [for which] I have proposed the name of trophoblast.' Somewhat further is added (p. 112): 'in *Tupaja* and *Tarsius* portions of the trophoblast undergo very active proliferating processes preparatory to the placentary fixation of the blastocyst, whereas in my former papers I have described the same activity for *Erinaceus* and *Sorex.*'

Finally, in 1895 (*Verhandl. der Kon. Akad. v. Wetenschappen te Amsterdam,* Vol. IV., No. 5, p. 18), I reaffirm that:

'die von mir Trophoblast genannte Keimschicht ist * * * die äussere schicht der Säugethierkeimblase welche vor der definitiven Ausbildung des formativen Epiblastes dieses sowie die Hypoblastanlage umhüllt und an der Bildung des Embryos überhaupt keinen Antheil nimmt.'

In this last paper I have for the first time asserted that in my opinion the Sauropsidan arrangement, as well as that of the Ornithodelphia, can not possibly be looked upon as ancestral to what we find in the monodelphic (and didelphic) mammalia and that, on the contrary, the trophoblast (*l. c.*, p. 57, No. 7) is a precociously segregated larval envelope which encloses an inner cell mass, out of which the embryo is going to be built up. I have at the same time drawn a comparison between the mammalian trophoblast and the 'Deckschicht' in amphibian development and have also drawn attention to those cases where remnants of a trophoblastic layer could be detected in the Sauropsida.

Only in 1902, however, have I gone yet further back, and leaving the recent amphibia out of the ancestral line, I have attempted to draw a comparison between the trophoblast (and the other fœtal membranes coexistent with it) of the Amniota and larval envelopes of invertebrate predecessors (*Verhandl. der Kon. Akad. v. Wetenschappen te Amsterdam,* Vol. VIII., No. 6, 1902, p. 53). Alinea! It has now been shown that since the first introduction of the name *trophoblast* sixteen years ago my own definition and interpretation of it has not undergone any alteration, although advances have been made in the appreciation of its theoretical significance.

And it is for this reason difficult for me to understand that the name has been misunderstood both by embryologists and by gynæcologists, even to such an extent that the writing of the present article seems necessary to prevent further confusion.

So, for example, Charles S. Minot's definition of the trophoblast on p. 100 of his 'Laboratory Text-book of Embryology' (1903) as 'a special layer of cells developed on the outer surface of the ectoderm of the mammalian blastodermic vesicle' is both wrong and misleading. Several statements in the same paragraph on p. 107, *e. g.*, that the trophoblast is sometimes developed only later; that it disappears when the placenta is being formed, etc., are likewise in complete disaccordance with the original definition, such as it was substantiated by the different quotations given above.

In attempting to explain for myself how Minot can have fallen into this error—from which consultation of the papers above quoted would have withheld him—I can not but suppose that Bonnet's 'Grundriss der Entwickelung der Haussäugethiere' must have led him astray. In this we find on p. 31 a woodcut (Fig. 17), in which the trophoblast (Bonnet's primärer Ectoblast) is represented as a separate layer outside of the ectoderm of the monodermic blastocyst of the hedgehog and which woodcut is marked 'nach Hubrecht,' although I never published anything of the kind, nor in my writings have ever, as we have seen above, given the slightest justification to an interpretation so entirely inconsistent with my own views which have repeatedly been expressed without any ambiguity. Already on p. 19 of my paper of 1895* have I called attention to the fact that Bonnet's woodcut was a misrepresentation of my own views and have on Plate IV., Fig. 81, reproduced a hardly known figure of Kölliker's of the rabbit's blastocyst, which, on the contrary, is in complete accordance with those views. Misrepresentations, however, are hard to kill.

In Hertwig's 'Handbuch der vergl. Ent-

* *Verhandel. Kon. Akad. Amsterdam,* Vol. IV., No. 5.

wickelungslehre der Wirbelthiere' (Bd. I., S. 917) and in Weber's 'Säugethiere' (S. 284) similar transpositions of my intentions in insisting on the recognition of a distinct trophoblast have not crept in. I cite from Hertwig:

"Die verschiedene Entwickelung der Trophoblastes hat Hubrecht in folgenden Sätzen kurz zusammengefasst." "Die von mir Trophoblast genannte Kiemschicht ist für die Anheftung des Säugethierkeimes an die mütterlichen Gewebe in erster Linie bestimmt: dabei entwickeln sich zu gleicher Zeit in der mannigfaltigsten Weise lokalisierte oder über die ganze Oberfläche sich orstreckende Wucherungen, welche zur Ernährung des Embryos dienen." "Der definitive formative Epiblast welcher als sogenannte Keimscheibe oder Embryonalschild auf der oberen Fläche der Keimblase hervortritt, ist zur Zeit seines ersten Auftretens nie an der Oberfläche gelegen, sondern immer von Trophoblastzellen überlagert.

"Die Art und Weise wie diese Ueberlagerung des formativen Epiblastes durch Trophoblastzellen ein Ende nimmt, ist sehr verschieden; entweder entsteht zwischen Epiblast und Trophoblast ein persistierender Raum, welcher etwas später zur Amnionhöhle wird (*Erinaceus, Arvicola*), oder es tritt eine engere Verwachsung von den Epiblastrandern mit dem Trophoblast ein, worauf ein Durchbruch der deckenden Trophoblastzellen erfolgt, welche letztere später zu Grunde gehen (*Tupaja*, Maulwurf, vielleicht auch Fledermaus und Schwein) oder endlich, es wird die trophoblastische Deckschicht oberhalb der Keimscheibe sehr erheblich abgeflecht, wodurch der formative Epiblast und der Trophoblast dem Anschein nach in engstem genetischem Verbande stehen, während in Wirklichkeit der Verband zwischen dem peripheren Bezirk des Trophoblastes und seinem als Deckzellenschicht zu bezeichnenden Abschnitt auch hier die primäre, die anfänglich kontinuierliche Verbindungsweise gewesen ist (*Lepus, Sorex.*)" "Der Entwickelungsgang kann eine Abkürzung erfahren, indem die Amnionhöhle innerhalb eines vom Trophoblast verfrüht abgetrennten Epiblastzellenkörpers spontan erscheint (*Cavia, Pteropus*)."

I hope that these quotations may dispel eventual doubts about the significance of the term trophoblast.

I have now to consider the application of that term in gynæcology, more especially its application to the placentation of man and of other mammals. I find that its use has become more general with English and American than with German authors, and at the same time it would seem as if also in this case a tendency to misunderstand the real significance of the term has sprung up.

This tendency is very naturally explained when we consider how important a factor for the process of placentation the proliferation of trophoblast cells has been shown to be. This proliferation is especially very luxurious in man (Siegenbeek van Heukelom, Peters) in the hedgehog (Hubrecht), whereas in many other insectivora and rodents its multiform complications are exceedingly varied. In consequence many investigators have been led to believe that the name trophoblast was originally restricted to those proliferating regions, whereas we have demonstrated above that this has never been so. Add to this that the proliferation of cells contributing to the formation of the placenta yet in another way is apt to lead to confusion because such proliferation is in no way limited to embryonic cells, but is also noticed—sometimes to a more considerable extent—in maternal cells belonging to the epithelial lining of the uterus or to the subepithelial maternal tissues. In this way debates have arisen between Strahl and

Lüsebrink on one side and Duval, van Beneden and myself on the other, of which debates the object was to make out in how far the material of the proliferating placenta should be looked upon as maternal and in how far as embryonic, trophoblastic tissue.

These debates will no doubt, in the course of time, as the number of carefully observed cases increases, lead to a unanimous interpretation. As it was, I have myself, for sheer diffidence of attributing too prominent a part to trophoblastic proliferation (of which I was, nevertheless, together with Duval, the first advocate), in one case stopped short of the real solution, and have for the hedgehog restricted the extent of the trophoblast more than was necessary. Since then I have corrected this in a doctor dissertation of one of my pupils (Resink, 1903), but there is no doubt that I am myself thus responsible for a certain amount of vagueness and misrepresentation which has prevailed in the application of the term trophoblast to different placentas, more particularly of man and the monkeys, where the question arose in how far certain syncytial tissues should be looked upon as maternal or as embryonic. Even for pathological anatomy this proved to be a momentous question in so far as the deciduoma malignum, if traced to remains of trophoblast cells, would be very different from other deciduomæ, that found their origin in maternal tissue.

Now that the placentation of *Tarsius, Tupaja, Sorex, Vespertilio, Cercocebus, Talpa, Galeopithecus, Sciurus, Lepus,* a. o., has been more carefully examined (trophoblastic proliferation having been figured by Selenka as early as 1887, for one of the Didelphia [*Opossum*]), divergence of opinion will in a few years hence have been replaced by unanimity also on this head.

And then the application of the name trophoblast to those placental elements that arise from the embryonic layer originally designated by that name will be in no way confusing, but will, on the contrary, contribute to keep before our eyes the intimate relation between the facts as they take place under our eyes and their phylogenetic origin.

With perfect justification Strahl has protested (Hertwig's 'Handbuch der Entwickelungslehre der Wirbelthiere,' I., 2, p. 311) against a misapplication of the terminology, which I have attempted once more to explain in this article, when authors who have insufficiently studied the subject even go so far as to speak of a *maternal* trophoblast beside the embryonic!

I hope that this paper may henceforth render misinterpretations such as are discussed in it impossible.

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SCIENTIFIC BOOKS.

Geographic Influences in American History. By Albert Perry Brigham, Professor of Geology in Colgate University. Boston, Ginn & Co. 1903. Pp. 365.

Professor Albert Perry Brigham, of Colgate University, has made a notable contribution to American geographical literature in his book, 'Geographic Influences in American History,' published by Ginn and Co. The divisions of the book are mainly physiographic, but the author has not allowed this subject undue prominence.

Chapter one is entitled 'The Eastern Gateway of the United States.' The central idea is the development and importance of the Hudson-Mohawk valley—its physiographic origin and its influence upon American history. Its importance in the Revolution and the war of 1812, and the successive waves of immigration which passed through it and left their record in the 'successive layers of geographic names' are well brought out. The interdependence of the valley and the cities which have grown up along it and the conditions of growth of the metropolis at its mouth are discussed.