publication of the Carnegie Institution, and in a closing paragraph says:

> One of the truest tests of the intellectual status of a country is found in its ability to quickly realize the importance of a work of the first class. Since this book came out I have asked a number of naturalists whether they had read it, and so far have failed to find one who has given it more than superficial attention.

It had appeared to me for some time that botanists in the United States were in something the same case as the zoologists in regard, on their part, to the one successful series of demonstrations that have yet been made of the production of mutants of plant species by means of definite chemical stimuli. It was, therefore, a pleasure in reading SCIENCE for June 7 to find that Dr. James B. Pollock (presidential address before the Michigan Academy of Science) had clearly recognized the significance of recent experimental work with plants, which, perhaps, still more fully than Tower's work on beetles, has established the mode of origin of certain species. To quote from Pollock: "De Vries offers no explanation as to how these new characters are produced, but MacDougal has succeeded in producing new modifications by artificial means . . . injecting various substances into the capsules of plants experimented upon, before the eggs were fertilized," leading to the "important conclusion that in an early stage of development of the plant egg it may be so profoundly modified that the adult plant resulting from it is decidedly different from what it would have been had the egg not been so modified, and the modifications thus produced are transmitted to the next generation through the seeds."

With this very definite presentation of the subject I am disposed to assume that the work referred to is, after all, well known to botanists, but that thus far only here and there one has taken occasion to refer to it in generally accessible publications. Be this as it may, I wish to heartily second the efforts of Professor Cockerell in calling attention to the epoch-making character of Tower's experimental study of the potato beetles and their allies, and to place with them the equally important work of MacDougal, recording at the same time my conviction that there is no line of biological investigation, with which I am acquainted, that better deserves support or the abandonment of which would be a greater loss to science. I can hardly think, however, that the Carnegie Institution, one of the chief functions of which is to discover just such "leads" and provide for their following through to a successful issue, will abandon either of these investigations, already the most fruitful in actual results that have been undertaken since the "Origin of Species" appeared.

V. M. SPALDING

TUCSON, ARIZ.

## SPECIAL ARTICLES

### PATAGONIA AND ANTARCTICA[1]

IT seems that the study of the fossil fauna of South America should attract the attention of the congress, at this time when increasing efforts are being made to enter into touch with the problems of the antarctic world.

Since the discoveries of Carlos and Florentino Ameghino, numerous works on the fossil fauna of Patagonia have been published. We have been enabled to add some contributions to this literature from the rich collections sent by A. Tournoüer to the Jardin des Plantes.

Up to the present time, the researches in the northern hemisphere, whether in the United States or in Europe and Asia, have shown an agreement in the development of life. The progress of evolution has been so uniform that we find beings of the same epoch in almost the same stage of evolution on different parts of our hemisphere. Thus, from the stage of the development of fossil animals and knowing their genus or species, we can often estimate for geologists the age of the deposit (terrain) in which they are found.

Patagonia has just shown us that this is

[1] Paper read before the seventh International Zoological Congress, translated by L. M. F.

not the case in the southern hemisphere. The fauna of Casarmagu (or of Cerro Negro) is related to that of Torrejon and Puerco, about which the scientists of the United States have made some remarkable revelations, and also bears a resemblance to the fauna of de Cernay near Reims, discovered by the late Dr. Lemoine. The fauna of later epochs, the Deseado, Coli-Huapi, Santa Cruzian and Pampean, has not a single genus comparable to those on our hemisphere, and shows an arrest in the development. No mammal has become a paridigitate pachyderm, a ruminant, a soliped like ours, a proboscidian, a placental carnivore or an anthropoid ape. To be sure, the bones are homologous and many of them resemble the bones of our animals. But the association of the characters is very different. For example, in *Pyrotherium* the hind quarters resemble those of proboscidians, but the forelegs show an entirely different attitude. In limb structure *Astrapotherium* recalls the dinoceros of the United States, but its dentition is different. *Colpodon* and *Nesodon* differ less in their dentition from our Ungulata than from other animals, but they have carnivore limbs and their tridactyl hind foot is plantigrade. The gigantic *Homalodontherium* shows still better the association of ungulate and carnivore characters. Many more examples could be given showing to what extent the fossil mammals of South America are specialized and how little they resemble in appearance the fauna of the northern hemisphere.

This statement is of considerable importance to explorers of the antarctic world. When the Institute of France commissioned some of its members to collect information for the next voyage of Dr. Jean Charcot, I published a note in which I pointed out what they might expect to discover in Antarctica, judging from what we know of the paleontology of South America.[2]

I noted that the existence of the various large animals of Patagonia can not be accounted for in conditions analogous to the actual ones. In the Eocene period, the Deseado has powerful quadrupeds: *Pyrotherium, Astrapotherium, Homalodontherium, Colpodon, Palæopeltis* and many other herbivorous genera. This presupposes a luxuriant vegetation and hence a degree of warmth which is in marked contrast to the present cold climate. Furthermore, it presupposes an extent of territory very different from the present narrow space of Patagonia; for it is an admitted fact in zoology that the size of mammals is in direct proportion to that of their habitat. The fauna of Deseado and of Coli-Huapi, which came immediately after, can not be explained unless Patagonia is the remnant of a vast antarctic continent.

In the Miocene period appeared the fauna of the Santa Cruzien with its quantities of large *Nesodon, Astropotherium, Homalodontherium,* diversified Edentates and so forth. It is equally impossible to understand this fauna if it did not live on an antarctic continent.

In the period of the Pampas the terrestrial fauna became more powerful than all the former ones. *Megatherium, Mylodon, Lestodon, Scelidotherium, Glyptodon, Toxodon* and *Macrauchenia* in life size must have constituted one of the most imposing sights in the history of the world. This fauna is the most difficult of all to account for, if it did not live on an immense antarctic continent with a rich vegetation and warm climate. Since South America is only 1,000 kilometers from Antarctica, it is improbable that this region was at that time under ice and submerged. In his report of the expedition of the *Belgica,* Mr. Cook has written: "*The Soundings taken between South America and the South Shetlands and those made in Antarctica show clearly the existence of a continental plateau.*"[3]

Hence a determination of the age of the Pampas is of great importance for a closer knowledge of the antarctic continent; this

[2] Institut de France, Académie des sciences, "Instructions pour l'Expédition antarctique organisé par le Dr. Jean Charcot. Palæontologie," par Albert Gaudry, p. 19, 1907.

[3] Cook, "Kis le Pole Súd, Expédition de la Belgica," 1897–9, p. 8.

should give us information about the time when the antarctic lands sank for the last time and became covered with ice.

The age of the Pampas is difficult to determine by means of the mammals indigenous to Southern America since they differ so much from those of our country that a comparison of the two teaches us nothing. However, among so many remarkable facts shown by the paleontology of the new world, one of the most singular is the invasion of the genera of the northern hemisphere, the Mastodons, *Hippidium,* tapir, llama, peccary, *Machairodus,* bear, etc., among the animals of the Argentine Republic which show an absolutely different physiognomy.

The best known of the new comers, *Mastodon Andium* is not quaternary in Europe nor in the United States. Cope found it in the Pliocene of Blanco, Texas. The *Mastodon angustidens* and *Pentelici* of the European Tertiary are not far removed from it.

*Hippidium neogœum* and the species of *Hippidium* with eye-pockets (?) known as *Onohippidium,* are more nearly related to the pliocene forms of our country (*Equus stenonis*), than to the Quaternary horses. Dr. Matthew has said: "*The teeth of Hippidium are like those of Phiohippus (upper Miocene) from which it is supposed to be descended.*"[4]

The genus Tapir, unknown in the quaternary, is well distributed in the European Pliocene; it might have sprung from *Tapiravus* of the upper Miocene.

In the simplicity of the dentition of its molars the peccary is an archaic type; it is found in the upper Miocene.[5]

The llama (*Auchenia*) is possibly derived from the *Pliauchenia* of the Pliocene of Blanco.

*Machairodus,* in the United States and in Europe, has left numerous tertiary remains. Mr. Boule has reported on the *Machairodus aphanistes* of Pikermi and *Machairodus neogœus.*[6]

*Ursus bonariensis* which has persistent præmolars and shortened molars differs less from the tertiary bear of our country than from *Ursus priscus* and *U. spelœus* of the quaternary.

If to these citations we add the fact that no elephant has appeared in Southern America, we may suppose that the invasion of the forms of the northern hemisphere took place in the pliocene and not in the quaternary. Dr. Osborn has pointed out recently that the invasion of the Edentates of South America and the migration of the North American mammalia into South America, was quite characteristic of the pliocene phase in the United States.[7] It is important to note that, according to the lists of fossils, divided into numerous stages by Mr. F. Ameghino, it is only from the time of the lower Pampéen that the animals of the north multiplied.[8] They are not present in the beds of Mt. Hermoso.

The greater part of the Pampéen beds are Pliocene, but this is no reason why the uppermost should not belong to the quaternary. Mr. Ameghino attributes the lowest beds of the Pampéen which he calls Lujanean (?) to this deposit (terrain). Now in these beds the American animal world shows still more strength, since the quadrupeds from the United States are there side by side with the gigantic animals born in the southern regions. If the age attributed to the Lujanean is correct we must conclude, from our remarks above, that, at the beginning of the quaternary, that is to say in the epoch when Man was living in Europe, the antarctic territory could not have been completely separated from America. It would not be impossible to find buried

[4] Matthew, "Illustrations of Evolution among Fossil Mammals," *Bull. Am. Mus. of Nat. Hist.,* Vol. III., Extr. 1903, p. 24.

[5] Blainville in his "Osteographie" has said that the peccary is the *Sus* with the simplest and most normal dentition.

[6] Boule, "Revision des espèces Européennes de Machairodus," *Bull. de la Soc. géol. de France,* 4me Séries, vol. 1, p. 572, 1901.

[7] Osborn, "Tertiary Mammal Horizons of North America," *Bull. Am. Mus. Nat. Hist.,* Vol. XXIII., p. 251, 1907.

[8] Florentino Ameghéne, "Les formations Sédimentaires du Crétacé Supérieur et du Tertiarès de Patagonie," no. 8, pp. 480–498, Buenos Aires, 1906.

there *Megatherium, Mylodon, Macrauchenia, Hippidium, Mastodon* and many other quadrupeds. Mr. Otto Nordenskjöld has found tertiary plants there; remains of quadrupeds, will also be met with.

The Antarctic world offers a magnificent field for discovery to explorers.

ALBERT GAUDRY

## *QUOTATIONS*

### THE PHYSICIAN IN THE SCHOOL

THE International Conference on School Hygiene, held in London this month, raised many questions which should search the hearts of teachers, parents, and taxpayers in America. Some of these questions we have already been debating. In this city last winter Superintendent Maxwell urged that the eyes of school children be examined, and that glasses be provided—if necessary at public expense—for those whose sight is defective. The shortest way with such a proposal is to give it a bad name and damn it. Accordingly, the plan was received by a part of the press with jeers and cries of "Socialism!" Mr. Maxwell's reply was in effect that we are spending millions a year for teachers, buildings, text-books, and apparatus; and that it is worth while to lay out a little more in order to enable all the children to profit by these facilities. In an article in our own columns last April he said:

> It seems folly to supply books to children who can not read them, or to place children in classrooms when they can not see what is written or drawn on the blackboard. If the sight is defective, the child is hopelessly handicapped. The expenditure of a few thousand dollars for glasses would enable thousands of children who are now unable to do their school work to stand on the same level with their fellows.

These words sum up briefly the whole argument for the physical examination of school children and the attempt to keep them in such health that they can fairly avail themselves of the advantages offered. We can not dismiss the matter with a question-begging epithet. Our American school boards must consider the project on its merits, and decide whether, in justice to the children as well as to the community as a whole, we should not devote more attention to the physical well-being of pupils. —The New York *Evening Post.*

## *CURRENT NOTES ON LAND FORMS*

### OTAGO PENINSULA, NEW ZEALAND

OTAGO PENINSULA is a land-tied island on the east coast of southern New Zealand. An interesting account of its features is given by P. Marshall, professor of geology in Otago University at Dunedin, near the head of the Otago Bay, which the peninsula encloses. ("The Geology of Dunedin, New Zealand," *Quart. Journ. Geol. Soc.*, LXII., 1906, 381–424). The peninsula is a complex mass of volcanic rocks, which, while the district stood towards 1,000 feet higher than now, was submaturely dissected; that is, the valleys, still narrow and of rapid descent in their upper courses, became more open and of gentler descent in their middle and lower courses; and the slopes came to have only moderate declivity. During submergence to its present level, the mountainous mass was cut off from the mainland by the drowning of a connecting ridge on its northwestern side; it thus became an island, about 14 miles long northeast-southwest, and not more than six miles wide, with summits still reaching more than 1,000 feet above the sea, and with much irregularity of outline as would be expected. Since the district assumed this attitude, the exposed headlands, on the mainland as well as on the island, have been cut back in strong cliffs, from 300 to 800 feet high; the smaller reentrants have been filled with beach-fronted sands; the larger reentrants have been more or less completely enclosed by bay-mouth spits and bars; and Otago strait, as the original water passage back of the island might be called, has been closed at its southwest end, under the guidance of the prevailing long-shore current from the southwest, by a beach-fronted sand-isthmus, which converts the strait into a long bay. The southward direction of growth of several bay-mouth spits and reefs suggests that they are controlled by backset eddies, which sweep around the new-built shore lines between the projecting headlands in a direction opposite to that of the main, long-shore cur-