facilities will be made available in the United States to the dentists of Latin America. Perhaps our conferrees in Central and South America will find it possible to invite some of the dentists of the United States to visit their countries. New schools are being built, new methods are being developed in dentistry throughout Latin America and I am sure that the dentist of the United States can not only give but can receive much from our neighbor countries.

Ultimately this must have a beneficent result not only for our conferrees in the respective countries but in helping to establish a good neighbor policy which will really result in the development of good neighbors.

ADVANCES IN MEDICAL PROTOZOOLOGY IN THE AMERICAS

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Because of the microscopic size of protozoa, they remained almost unknown to man until magnifying lenses were used for their study. It was Leeuwenhoek, using very rudimentary lenses which he had made himself, who brought to light the fascinating world of micro-organisms in the latter part of the 17th century. While studying water in a dish he discovered (1676) the free-living protozoa. Soon afterwards he discovered protozoan parasites in the bile of the rabbit, and in 1781 while examining his own feces he found Giardia lamblia, the first parasitic protozoon of man known to science.

The study of free protozoa—"animalcules" and "infusoria" as they were soon called—developed rapidly. Scientists were fascinated by their variety and beauty to such an extent that by 1718 Joblot had published in France what Woodruff has named "the first treatise on protozoology." The parasitic protozoa were not thus favored, and although sporadic observations were made during this period, it was not until the second half of the 19th century that investigators became really interested in them. It should not be forgotten that Pasteur's first work, from 1865 to 1870, on germs capable of causing disease in another living being, was really in regard to the sporozoan now known as Nosema bombycis, the silk-worm parasite. Pasteur laid the foundations for the control of this plague.

A few years previously, in 1849, a Russian, Gros, had discovered the first human parasitic ameba, Endamoeba gingivalis, which inhabits the human mouth, and in 1857 Malmsten, in Sweden, found Balantidium coli in the intestine, where it may cause various types of dysentery. Nevertheless, the discovery of parasitic protozoa aroused but little interest. Medical protozoology was still to be born.

In fact, it might be said that the discovery of the dysenteric ameba, by Lösch in Russia in 1875, even though erroneously interpreted, was what actually gave impulse to the study of parasitic protozoa in man. This interest reached its climax, insofar as the intestine is concerned, in 1903 when Schaudinn clearly differentiated and named with their present designations Endamoeba histolytica, the cause of amebic dysentery, and Endamoeba coli, the harmless commensal of the human intestine. Although now it is known that Schaudinn committed serious errors in this, as in much of his work, his contributions helped to clear the chaos surrounding the knowledge of intestinal amebas and to give impetus to their methodical study.
The discovery in 1880, by Laveran, of the malarial organism, and by Danilewsky in 1885 of the existence of similar parasites in birds, and the work of Ross and Grassi and their coworkers from 1895-1898 in demonstrating the sexual cycle of plasmodia as well as their transmitting rôle, establishing the basis for malaria control, awakened increased interest in the study of parasitic protozoa in man. Since then medical protozoology has developed until reaching its present status as an important branch of science, with hundreds of laboratories and thousands of competent workers devoted to its study throughout the world. As it would be almost impossible to review, even briefly, in one short paper the principal advances in medical protozoology, only the salient points touching the American continent and American investigators will be dealt with.

Any review of protozoology in the New World must begin with the brilliant figure of Joseph Leidy, the genial physician, anatomist, parasitologist and palaeontologist of Philadelphia, who in 1879 brought out his "Fresh-water Rhizopods of North America," the first monograph published in the Western hemisphere on a protozoic group. Especially interesting was Leidy's discovery of a parasitic ameba in the gut of the roach, which he called *Endamoeba blattae* in his book. This has originated considerable warm discussion, still unsolved, as to whether parasitic amebas of man should be included in the genus *Endamoeba* Leidy 1879, or in the genus *Endamoeba* Cassagranti and Barbagallo, 1895.

In speaking of amebas, it must not be forgotten that Councilman and Lafleur in 1891 in Baltimore were the first to study thoroughly the pathology of the disease, introducing the terms "amebic dysentery" and "amebic liver abscess" which are now accepted in medical literature. This does not apply to their name *Ameba dysenteriae* for the causative organism, which, notwithstanding the contrary opinion of some prominent protozoologists, does not seem justified. About the same time Manual Tousssint was carefully studying the pathology of amebiasis in Mexico, where Fernando Altamirano had earlier, though in very general terms, called the attention of physicians to the importance of the study of protozoa.

There must also be recalled the epochmaking investigations of Walker and Sellard, 1911-1913, on amebiasis in the Philippines, which cleared up many obscure points in regard to the differentiation of the different amebas parasitic in the human intestine and their relation to disease; as well as the cytological studies of Kofoid and coworkers; the compilation by Boeck and Stiles of some of the first and most exhaustive statistics on incidence of amebiasis; the studies of Craig, culminating in his magnificent works, "Amebiasis and amoebic dysentery," 1934, and "The etiology, diagnosis and treatment of amebiasis," 1944; the excellent work of Faust and coworkers at Tulane University, especially their experimental work with dogs; the varied and extensive investigations of Melency and Frye in Tennessee, especially in epidemiology; and the studies of Boeck and Drbohlav in 1925, of Cleveland and Collier at Harvard five years later, and still later of Rees and coworkers, on culture methods for amebic parasites.

Picado in Costa Rica; Carini and F. Amaral in Brazil; Kouri and Basnuevo in Cuba; Briceño-Rossi and Iriarte in Venezuela; Beltrán and Larenas, Bustos, Ramírez, Bernal, Blanco, and others in Mexico, have contributed much to our knowledge of intestinal protozoa. Bacigalupo in Argentina introduced in 1938 the use of atabrine in the treatment of lambliasis, and Escorial in Peru, since 1904 has emphasized the pathogenicity of human intestinal flagellates, recommending his method of using turpentine in the treatment of these parasites. González Magaburu, likewise of Peru, has also worked in this field.

In regard to blood parasites, one must first recall the excellent monograph by Smith and Kilbourne (1893) on Texas cattle fever (tick fever). It not only de-
scribed the cause (protozoa of the Babesidae family) but still more important, it established the complete life cycle of the parasite, demonstrating the rôle of the tick as the transmitting agent. The extraordinary interest of this work lies not only in its contribution toward solving the problem of the disease in question, but also because it was the first scientific report establishing beyond doubt the relationship between an arthropod and a protozoan disease. It preceded by some years the work of Ross and Grassi on the rôle of the mosquito in malaria.

As to malaria, it must be remembered that it was McCallum in 1897 who discovered the exflagellation process of microgametocytes in Haemoproteus, and in the same year Welch, after going into the pathology of malaria, clearly established as a different species the *Plasmodium falciparum* which causes malignant malaria. Later many and very important contributions to malariology were made in the Americas, by such men as Barber, M. Boyd, Coggeshall, Craig, Hegner, the Taliaferros, Manwell, and others in the United States; and in Mexico, Matienzo in Tampico and Cavüño in Mexico City, who in 1892 confirmed Laveran’s parasitological discoveries. Torres, who later summarized existing knowledge in an important monograph, and still later, Bustamante, Soberón and Parra, Vargas, Beltrán and Larenas, Meneses-Hoyos and Peñaléz, who all contributed much to our knowledge of malariology; in Guatemala, Jacobsthal, who has studied the problems of the possible preference of the merozoïdes for reticulocytes; and in Venezuela, Arnoldo Gabaldon, who has created an exemplary service for the combatting of malaria; much has also been done in this line by Alvarado in Argentina, Sutter in El Salvador, and Ayroza-Galvão, Fonseca, Unti, Mangabeira and others in Brazil.

The history of animal malaria was summarized by Hewitt in his recent magnificent monograph on “Avian malaria” (1940), in which the work of various investigators in this hemisphere stands out. Hegner, Manwell and the Taliaferros, in the United States may be considered in the first rank among pioneers. Later Wolfson, Esckridge, Coatney, Young, Hermann, G. Boyd, Roudabush, and many others made important contributions. It was in 1935 that Huff and Bloom described *Plasmodium elongatum*, avian parasite which not only infects the red cells of the blood, but all other blood cells as well. Recently (1944) Huff and Coulston described the initial cycle of the development of *Plasmodium gallinaceum* in chickens, from the penetration of the sporozoite into the organism of a vertebrate host to the moment of the appearance of the parasites in the erythrocytes, a problem which had puzzled investigators after the abandonment of Schaudinn’s erroneous affirmation regarding the direct penetration of the sporozoite into the red corpuscle after being injected into the organism by the mosquito.

In 1944, Lucena, in Brazil, published a good monograph on avian malaria. Versiani and Furtado-Gomes, in the same country, discovered during the same year a new domestic chicken plasmodium, *Plasmodium juxtanucleare*, which Beltrán and coworkers also found in Mexico about the same time. The importance of this finding lies in the fact that in view of the usefulness of chickens in the laboratory, it is desirable to have some other plasmodium besides *Plasmodium gallinaceum* parasitic in them, as the latter (isolated by Brumpt in Ceylon in 1935) has not yet been found in the Americas. Many other investigators have also made important contributions on bird plasmodia, whether studying the blood parasites of local birds in various places, or carrying on cytological or experimental investigations of known species.

In 1944, Thomson and Huff made some important contributions on parasitic plasmodia of saurians in the United States and Mexico, some of which, especially *Plasmodium mexicanum* of the common lizard (*Sceloporus ferrari-perezi*), are of great interest because of a peculiar life cycle.
The study of the leishmanias, especially of those causing cutaneous leishmaniasis, has also made great advances in this hemisphere. In the first place, it was an American investigator, Wright, studying in Boston a patient from the Old World, who discovered in 1903 the *Leishmania tropica* which he considered the cause of Oriental sore; this is today accepted by all workers. Later Lindenberg, Carini and Paranhos in 1909 found in Brazil that a skin condition common in woodsmen was the same one known in the Old World and caused by *Leishmania tropica*. Seidelin, in 1911, came to the same conclusion regarding "chiclero ulcer" in Yucatan, Mexico. However, during the same year Vianna in Brazil, basing his opinion on clinical study, decided that the American leishmania was different from the European, and proposed the name *Leishmania brasiliensis*, which is now almost unanimously accepted.

The study of American leishmaniasis has naturally been undertaken chiefly by our own investigators or by foreign scientists working in this continent, as Brumpt in Brazil and Seidelin in Mexico. The greater part of the work has been done where the disease is most prevalent, as in Brazil, where Aragão, in 1922, for the first time reported the possibility of this parasite being transmitted by insects of the genus *Phlebotomus*. Very important work has also been carried on in that country by Pessoa, Pestana, Pondé, Marques da Cunha, Meyer, Montenegro, Gomes, Francia-Martins, and many others. In Peru, Escomel has for years been bringing out the difference between the damp jungle form (espundia) and the dry, high altitude form (uta) of this disease. Weiss (1943) published a well-documented monograph on the disease in Peru. In Venezuela, Tejera, Briceño-Rossi, and Iriarte have made important contributions. Peña-Chavarria has been studying the problem in Costa Rica. Not very much has been done in Mexico, though in addition to Seidelin's original work there may be mentioned that of Incháustegui, Farfán-López, Martínez-Pompeyo and others from Yucatan, as well as the epidemiological studies of Beltrán and Bustamante and the experiments of Beltrán and Larenas.

In 1945 Stewart and Pilcher in the United States described what they believed an autochthonous case of leishmaniasis in Texas. Even though the disease has not apparently reached any appreciable proportions in that country, some investigators have made valuable contributions, such as the serological studies of Noguchi in 1924 for the differentiation of the various species of leishmania, the excellent epidemiological study by Shattuck (1936) to establish the possible relationship with *phlebotomus* as a vector, and the laboratory investigations of Packchanian, Gelman and others.

It is appropriate to close this summary of the American contributions to protozoology with *American trypanosomiasis*, the problem of this hemisphere alone. In 1909 the great Brazilian parasitologist, Carlos Chagas, carefully studied the disease, as yet unidentified, and published a complete description of it as well as of its cause, so that it later, with all justice, came to be named for him—Chagas' disease. Later investigations have shown that this disease is widely spread in our Continent. In Brazil, after Chagas, Emanuel Dias, Vianna, and many others have studied it. In Argentina, where it is also prevalent, Salvador Mazza founded the Mission for the Study of Regional Argentine Pathology, in Jujuy, which has been occupied mainly with Chagas' disease and which has already published an imposing array of monographs. Romania has worked on the problem there. In Uruguay, Talice was the first to find the disease, and has published an excellent paper on it. In Venezuela, Briceño-Rossi and Iriarte have attacked the problem, as have several investigators in Colombia. In Mexico, Mazzotti reported in 1936 the existence of infected Reduvidae, and later discovered two human cases; he
has made an exhaustive study of the distribution and taxonomy of the vectors. Martínez-Baez has gone thoroughly into the pathologic anatomy of experimental infections with *Trypanosoma cruzi*. In the United States, where so far no human cases have been reported, infected insects have frequently been found, and Kofoed, the Woods, Usinger, and others, have done a good deal of work on the subject.

As may be seen, the contribution of the Western Hemisphere to the advancement of medical protozoology, has been considerable. At present, work is being carried out in numerous centers and by groups of workers, among the most important of which there may be mentioned: in the United States, the National Institute of Health and its branches and field workers, including Rees, Coatney, Young, and others; the Universities of Tulane, with Faust, D'Antoni and coworkers; Chicago, with Taliaferro, Huff, Coulston, etc.; California, with Kofoed and Kirby, Illinois, with Kudo; Harvard, with Cleveland, Sanders, Tyzzer, Strong, Shattuck, and others; Michigan, with Coggeshall, Porter, and others; Pennsylvania, with Wenrich, Stabler and others; and Rochester, with Manwell; Iowa State College, under Becker; the Georgia State Department of Health, with Andrews; the U. S. Army Medical Department (Simmons, Russell, MacCoy, and others); and the Rockefeller Foundation, with M. Boyd, and many others.

In Mexico, the Institute of Health and Tropical Diseases, created in 1939, the first center where a laboratory devoted especially to protozoology was installed, and in which Beltrán and coworkers have worked for the last six years; and other departments of the Institute, where Bustamante has worked on epidemiology of protozoan diseases, Vargas on malaria vectors, and Mazzotti on Chagas' disease; in Costa Rica, San Juan de Dios Hospital, where the late Picado for many years worked on parasitic protozoa; Peña-Chavarria has also made valuable contributions.

In Venezuela, Briceño-Rossi, Briceño Iragorry and Iriarte, at the University, and Tejera, Meyer, and others; in Colombia, the Federico Lleras Institute and the National Epidemiological Institute, with Patiño Camargo and coworkers; in Peru, Escomel and coworkers, and Weiss at the National Institute of Health; in Argentina, the University of Buenos Aires and other Universities, and especially the Mission for Regional Pathology, with such investigators as Mazza, Bacigalupo, Romañá, and Bernardi; in Chile, the University of Concepcion and its Biological Institute, under Ottmar Wilhelm as Professor of Parasitology and Director of the Institute; and in Uruguay, the school created by Gamarra and Gaminara, which has produced such able men as Talice and Schouten and others.

In Brazil, the Oswaldo Cruz Institute, Rio de Janeiro, world famous for many years, and once under the direction of Carlos Chagas; the Biological Institute of São Paulo, founded and directed by H. da Rocha Lima; the Institute of Hygiene of São Paulo; the Evandro Chagas Institute of Belem, and others, as well as the Universities of Rio, São Paulo, Pernambuco, and Recife, which have a great number of brilliant investigators in medical protozoology, including Aragão, Marques da Cunha, Emanuel Dias, Carini, Pessoa, Meyer, Muniz, Versiani, Furtado-Gomes, Pacheco, Travassos, Lobato-Paraense, Ayroza Galvão, Pondé, and Pestana, to mention only a few contemporaries.

In Cuba, the Institute of Tropical Medicine and Parasitology, University of Habana, under Kouri and Basnuevo; and the Finlay Institute, where malaria especially is studied; and in Puerto Rico, the School of Tropical Medicine, an active research center.

In this article there has been attempted only a bird's-eye view of the vast panorama of the development of medical protozoology in this hemisphere. With so great and varied a subject it is difficult to give a complete picture, and there
have doubtless been omitted many references and much information of value, a circumstance almost inevitable for various reasons, among them the difficulty sometimes surrounding the securing of the scientific journals of the various countries and an inability to take in the full significance of developments in parasitology across the distances separating the different Repúblicas. This serves to emphasize the necessity of creating closer contacts among all the centers and scientific workers of our countries. The world conflict just ended brought, as do all great upheavals, some good along with its host of evils, one of these benefits being the focusing of our minds on our continental problems, our natural resources, our diseases, and our investigators and investigations, causing us to think of the Western Continent as a whole. Let us hope that the solidarity born of war shall be maintained and intensified with peace, creating an uninterrupted interchange of information, publications, materials, students, professors, and investigators, crossing and recrossing the hemisphere like tireless shuttles weaving, with the slender thread of Science, the tapestry of mutual understanding, appreciation, and respect, from one end of the New World to the other.

PROGRESS IN THERAPEUTICS

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The most conspicuous feature of present-day therapeutics is undoubtedly its extraordinary fluidity and instability, which make difficult for the practicing physician the proper and well-informed use and understanding of the new resources, and even a mere acquaintance with the newer concepts. In every branch of therapeutics there is the same bewildering succession of means and concepts. Naturally, medical science is always governed by the fundamental principle of adjusting cure to cause as determined by the experimental methods instituted and perfected by the great investigators, particularly those of the past century. But even when submitted to such strict experimentation, the amount of work accumulating daily is so immense, and individual ingenuity so penetrating, that the flood of facts and material becomes enormous: new agents, new aspects of the life phenomenon revealed, new concepts and interpretations. The instability of current therapeutics consists in this very displacement and substitution of new facts and resources by still newer, better, and more adequate facts and resources.

The present-day scientific research, even though based on the experimental cure-to-cause principle set forth by Claude Bernard in his classic text, tends to take on a certain “provisory” character substantially different from the work of scientists of the past century, who always tried to achieve definitive scientific conquests, unshakably interpreted. It is really a curious fact that the improving of scientific methods and greater strictness in experimental procedure should have led to such an instability in therapeutics. Everything points to an even greater flexibility, so that the future physician will govern himself not by strict formulas, but by an eclecticism requiring ever better and more up-to-date knowledge.

Before the war of 1914-1918, a series of fundamental facts and concepts seemed to have been firmly established. There were acknowledged the growing possibilities in specific immunization, asepsis, chemical and cytological methods ap-