Scientific Representations at the UPR School of Tropical Medicine. I: Images of Science

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The essay examines the scientific representations that prevailed at the University of Puerto Rico School of Tropical Medicine (STM) under the auspices of Columbia University (1926-1949). This article on the STM's scientific endeavors is the first in a historical serial collection about the images and evolution of sciences at the institution. It reviews faculty's principal investigations (by disciplines and research problems), development of research programs, and concomitant scientific productivity and research outcomes. The essay focuses on the emerged scientific representations and the nature of sciences, and has been divided into four sections: 1) images of science, 2) the evolution of science in the first two eras (1926-40), 3) the third and last era unfolding (1941-49), and 4) special studies. This first paper focuses on the scientific images that emerged from an examination of communities' interactions, networks, and academic and foundational documents. The scientific representations have been brought about through the analyses of different sources: academic and research reports, and publications in external and local venues. The most significant findings of this representational inquiry are: the idea of an academic tropical center in the tropics had a shared colonial-metropolis image; the community of common, but unequal, scientific citizens became an integrated epistemological community; interdisciplinary cooperation was the School's research dictum; and an image of a mature science and school of tropical medicine emerged. The richness and varieties of the practices and outcomes of science at the STM are analytically viewed as research schemas, exemplars of knowledge (paradigms), and epistemological fields (epistemes). [*P R Health Sci J 2019;38:127-143*]

Key words: Science history, Scientific journals, Public health history

This essay is part of a historical series about the University of Puerto Rico (UPR) School of Tropical Medicine (STM) under the auspices of Columbia University (1). The purpose of the essay is to address the general questions of the kinds of scientific representations and of the nature of science that emerged and prevailed at the School. The essay has been divided into a set of four articles on the history of science: the first shows the unraveled manifest images of science, the second and third deal with the evolution of the sciences at the School in different epochs, and the fourth reviews special research studies (i.e., methodological, apparatus, epidemiological and field studies). The main themes of the collection are the scientific representations and knowledge exemplars: the emergence of a tradition. This first paper focuses on the scientific images that emerged from an examination of communities' interactions, networks, and academic documents and foundational discourses. Scientific representations are considered here as scientific models or schemata, and images as a synthesis of representations or an iconic figure. An icon, which traditionally has the meaning of an image which carries itself in terms of resemblance, is used here as a kind of an exemplar of knowledge which has been transformed into a symbolic or synthetic exemplification. In general, the analysis of the scientific representations and exemplars of knowledge has been generated by the examination of official reports and faculty's publications in external and local venues. The historical horizons have been organized into three stages: 1926-1931, 1932-1940, and 1941-1949, which take into consideration both senior administrative time periods (e.g., Director's tenures) and the analysis of some serial data (e.g., publications) (2). The article captures the myriad of research networks, persuasive communities, epistemes and legacies (3). The creation of the STM is one of the institutional defining moments of the history of tropical medicine in Puerto Rico (4). This scientific narrative is just a glimpse of that past.

In general, tropical medicine is a discipline that historically has been one of the outcomes of imperial expansions, dominations and colonial relationships. In this sense, the story of the STM is

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not atypical. With few worldwide exceptions, tropical medicine did not develop in an immediate and direct manner for the benefit of indigenous or local populations (5) -although it left a scientific and medical legacy for the study of tropical diseases and for the alleviation and control of their detrimental public health effects upon local populations. However, during the first half of the 20th Century, Puerto Rico was one of the exceptions because anemic peasants in the mountainous coffee and tobacco regions comprised one of those special cases (6).

To assess the science that was produced at the STM, a collaborative exemplar between Columbia University and the UPR, it seems proper to review the initial scientific status of the main institutions that provided the seeds for its development. From an early tropical 'research outpost' of Columbia University in a U.S. possession in the Caribbean, the School's scientific achievements eventually became known worldwide through its own semi-autonomous identity (7). The early relationship between Columbia and the UPR was clearly asymmetrical for several reasons. At the time, Columbia was one of the main academic centers of science in the U.S. (8), while the UPR was in the process of a 'massive transformation' geared to becoming an institution of higher learning (9). Furthermore, the local institutional precursor of the STM, the Institute of Tropical Medicine and Hygiene (ITMH), was perceived by its own director as "a modest scientific Insular organization" (10). Thus, the levels of science of each partner in the enterprise were not only different, but also unequal, as expected.

When the STM was established, Pedro Gutiérrez Igaravídez, director of the ITMH and one of the most important local scientists, felt that the School "was organized with utter disregard of the members of the Institute" and, therefore, he declined Columbia's appointment as a member of the faculty. He thought that the "soul of the People is absent from said School" (11). The tension between so-called "persons not natives of this Island" and the local medical scientists would acquire different nuances throughout the life of the institution (12). The principal scientist of the ITMH and of the field of U.S. tropical medicine on the Island, Bailey K. Ashford, was in favor of the U.S. university model of scientific and educational prestige and power, setting aside the solidarity with his own local colleagues (13). In a sense, he agreed with Columbia's delegate pathologist, Alwin Pappenheimer, in charge of inspecting the ITMH facilities and considered by him an "expert emissary... a very keen observer." Ashford mentioned that Pappenheimer "felt that if the school were going to amount to anything, it would have to be first American, first Columbian-and then afterwards make every possible concession to local desires." Ashford recognized, with utter respect, that their local medical companions "wanted a helpful cooperation from the great northern University" but "they could not accept a master." However, he regarded their outlook as "the idealist who felt that all things Puerto Rican should be managed by Puerto Ricans" (14). This situation could be characterized as an exemplar of an asymmetrical relationship where the value judgment of 'big' positive science and knowledge production, enthralled by imperial images of prestige and power, prevailed, and was embraced as a kind of a *realpolitik* decision ('politics based on practical objectives rather than on ideals'). To unveil these shadows, Ashford himself mentioned the omission during the inauguration discourses of the local "underlying forces and efforts which has given life to the School" (i.e. Anemia Commissions and ITMH). This could be considered a combination of the "ugliness and the practical" that even a "spiritual value" could not "take away" (15).

The STM had a significant presence of local faculty from its beginning (e.g., 1926-27; local: 2 professors & 14 instructors, external: 3 professors), even with an inherent internal unbalanced power relationship, particularly in the areas of general medicine and public health. Columbia contributed with the support and appointment of an expert directorship (an internationally recognized tropical medical scientist) and a few basic science researchers closely linked to that institution, combined with the institutional policy of bringing visiting professors from several U.S. universities. Columbia also established the policy of providing opportunities for special studies to members of the faculty from the onset, which was maintained until the STM closure. The School's joint enterprise also practiced an effective strategy of gathering the enthusiastic support of the local community of physicians and medical scientists-a significant group were staff members of the Puerto Rico Health Department (HD). From its foundations, the STM also instituted the practice of engaging a small group of technicians, laboratory assistants, and graduate students as collaborators (e.g., coauthors or main authors) with some eventually becoming future prominent basic scientists at the School. Historically, interdisciplinary and interdepartmental cooperation was one of the trademarks of their effective and successful research programs. The STM made an unequivocal effort to intertwine initial research projects with the local health needs of the population (e.g., that afflicted most of the population), but pragmatism or circumstantial criteria (i.e., "determined by circumstances" or by convention, "as in the past") gradually oriented the scientific programs. However, the School always had the complete support and cooperation of the 'insular' HD in these endeavors (16). The integration of medical science and public health also characterized this collaborative project of colonial tropical medicine in the first half of the 20th Century (17).

Community Interactions and Scientific Networks

One of the paths available to explore the kind of science that was practiced at the STM is the assessment of information that can be related to scientific networks and persuasive communities (18).

A. Community Interactions: Local (Weekly public conferences and clinics) and External Relations (Visiting professors)

Interactions of three types of communities (i.e., local: outreach; internal: faculty and students; and external: visiting professors), each one with different levels of granularity or

detail, have been studied through two main academic activities of the School: the topics of the 'Weekly Public Conferences and Clinics' and the disciplinary nature of the fluid cadre of 'Visiting Professors' (19). The public weekly conferences and clinics could be considered a kind of epistemic projection (local output) of the faculty of the school toward the local community (mainly medical), while the nature of the areas covered by visiting professors reflect the epistemic contribution (external input) of a changeable community of outside experts mainly to the school's faculty and students (20).

First, a quantitative analysis was performed of the main topics of the 'weekly academic conferences and clinics' offered by members of the faculty that were open to the medical and interested community (21), and second, of the disciplinary areas or purposes of the 'visiting professors' (22). The analysis used four general categories: science (basic, experimental, or medical), clinical medicine, tropical diseases, and public health. The main objective was to characterize the nature of some of the diverse community interactions and scientific networks actively present at the institution and to assess the kind of scientific profile or image of the school they manifested. That is, the scientific images of the School's academia was reaching out to the local medical community by providing output expertise, and the academia was receiving expert's input from other parts of the world (the majority came from the U.S.). Table 1 summarizes these interactions.

Table 1. STM. Community interactions (1926-1949): Main topics by academic activities

Topics	Weekly conferences/clinics Local output (n=383)	Visiting professors External input (n=210)
Clinical medicine	191 (49.8%)	93 (44.3%)
Science	111 (29.0%)	51 (24.3%)
Tropical diseases	43 (11.2%)	26 (12.4%)
Public health	38 (10.0%)	40 (19.0%)
Totals	383 (100%)	210 (100%)

The proportional amounts of both kinds of differential interactions (such as conferences-clinics and visiting professors, or between local-output versus external-input) shows three types of patterns: first, differences are moderately distinct with respect to the categories of Clinical Medicine and Science in favor of the case of public conferences and clinics; second, proportions are almost similar in the aspect of Tropical Diseases in both kinds of activities; and third, differences are larger and distinct in the area of Public Health in favor of the visiting professors (23). It should be noted that the differentiation of public health visiting professors from those who focused on tropical medicine occurred in two distinct periods: during the first ten years (from 1926-27 to 1937-38; no report of the 1932-33 session) tropical medicine inputs were more frequent (9 vs. 3), whereas throughout the last 11 years (from 1938-39 to 1948-49) the situation was inverted in favor of public health visitors (17 vs. 37) (24).

In general, these scientific/professional activities of the School offer the following epistemic profile: a) the majority of the activities were in the category of clinical medicine, b) followed by basic and medical science aspects, and c) then by tropical diseases or public health themes. This scientific profile could be associated to the reality of a graduate School that had two medical branches: a laboratory science centered on tropical medicine and a hospital that housed patients with tropical and other types of correlative diseases. Nevertheless, it is interesting (and unexpected) that in both types of interactions and influences (i.e., inputs and outputs) the pattern is similar in favor of a more general, less specialized, medical knowledge. For example, the combined average proportion in both kind of activities, of both the clinical medicine and public health more general topics together (62%) is higher than the science and tropical diseases specialized topics jointly (38%); and the themes of the clinical medicine topic were mainly general clinical aspects of medicine (e.g., appendicitis, cancer, cardiovascular and respiratory systems) in contrast to the more specific themes related to tropical medicine such as experimental, basic science, and tropical diseases topics. With respect to types of visiting professors, at the end, the topical inversion between emphasis on public health versus tropical diseases is explained by the intensification of public health training during the second half of the lifetime of the School. It seems that the School needed more of the expert input on tropical diseases at its origins, while at the end it required more input on public health. Nonetheless, the offer of public conferences and clinics to the local medical community continued with a more balanced output between tropical diseases and public health themes (11.2% vs. 10.0%).

B. Publications in External and Local Journals (25)

While the previous analysis offers some insights about the scientific outputs and inputs of different kinds of expert agents and communities within the STM, research publications of the faculty (which also includes collaboration with visiting scientists) in external (i.e., non-local) journals is considered one of the most important measures of the level of scientific achievements and developments at the School. Thus, to better understand the kind of science practiced by the STM faculty, an analysis of their publications in journals outside the island was performed (26).

The ratios of 'external' versus 'local' publications were elaborated using two types of collections: Collected Papers (1926-38) and Director's Reports (1939-49) (27). A preliminary analysis of the incremental ratios by year suggested the use of the following periodization for further inquiries: 1926-31, 1932-40, and 1941-49; since there was a significant increase (leap) in the number of external publications between each of these eras (28). However, the general increase reflects not only an increment in external publications, but also in local publications. Table 2 portrays the ratios and proportions of external and local publications.

Table 2. STM. Publications in external and local journals (External/Local ratio) by periods

Period	Ratio Ext/Loc	n	% Ext	% Loc	Average*
1926-31	21:83	104	20.1	79.9	17.3
1932-40	47:138	185	25.4	74.6	23.1
1941-49	128:203	331	38.7	61.3	36.8

*Average of total publications in the period per year.

This table shows, first, that the absolute number of all the School faculty's publications increased steadily and significantly, including articles in both external and local venues; second, as expected, local publications (taking into consideration that the STM also has its own scientific journal) predominated in all periods; and third, the proportion of publications in external or non local journals increased continuously, while the proportion of those published in local ones decreased gradually. Thus, the productivity of the school increased continuously throughout the years, and it seems that this achievement also may reflect a kind of knowledge that transcended the local community in a significant manner.

C. Content Analysis of Publications of the Faculty in External Journals

Of the 196 articles published by the faculty in external forums, six were book chapters and fifteen were articles published in foreign periodicals other than U.S. Journals (29). Two types of analyses have been made of the majority of the publications, which were in U.S. journals. First, external publications during the established periods were studied according to two general topics which distinguished articles with a more 'scientific' nature from those that were more 'clinical and disease' oriented. Second, the articles published in external journals were analyzed regardless of the type of research (i.e., topics), whether the subject of the inquiries was diseases or health conditions. Table 3 summarizes the content analysis of the topics in external venues.

Table 3. STM. Content analysis of the topics in external publications* by periods

I. Period (1926-31)	
Sciences (8:21; 38.1%):	*Clinical/Diseases (13:21; 61.9%):*
Bacteriology (3), Virology (1), Entomology (1)	Hematology (6), Mycosis (3)
Mycology (1), Climatology (1), Methodology (1)	Virology (2), Parasitology (2)
II. Period (1932-40)	
Sciences (32:47; 68.1%):	*Clinical/Diseases (15:47; 31.9%):*
Experimental (9), Methodology (5), Parasitology (5)	Bacteriology (7), Parasitology (6)
Nutrition (4), Bacteriology (2), Entomology (2)	Public Health/Hospitals (2)
Climatology (2), Primatology (2), Zoology (1)	
III. Period (1941-49)	
Sciences (91:128; 71.1%):	*Clinical/Diseases (37:128; 28.9%):*
Parasitology (20), Experimental (18), Entomology (17)	Parasitology (15), Bacteriology (6)
Nutrition (15), Methodology (13), Biochemistry (5)	Public Health (6), Hematology (5)
Primatology (2), Bacteriology (1)	Virology (2), Mycology (2), Vet (1)

*A total of 196 articles.

In the first period of the School (1926-31), with respect to publications that went beyond the main vessel of the local STM-Journal (30), bacteriology, a 19th Century classical science of medicine (31), prevailed among basic sciences, but not by much. Clinical hematology, mainly sprue research associated with B.K. Ashford's main work at the School, was the most important international projection at the time. Virology had some presence, because of E.B. McKinley's reviews of the field of 'filterable viruses,' but it waned until some minor revival surged at the end by pathologist and virologist E. Koppisch. Mycosis also resonated, somewhat related to Ashford's other disciplinary interest, but it would start to be progressively associated mainly with dermatologist A. Carrión, from the same department. The second period (1932-40) showed a significant increase (from 21 to 47) in external publications, with experimental and methodological research reflecting an already mature science present at the School. Parasitology, the science most associated with the paradigm of tropical medicine (with protozoology, helminthology, and entomology), claimed its hegemony among basic and clinical medical sciences at the School, already most associated with research on schistosomiasis; but bacteriology maintained its level of presence, and nutritional biochemistry started its methodical course. In the third period (1941-49), which showed an impressive increase in external publications (from 47 to 128), both basic and clinical sciences evidenced the existence of a full blown and mature tropical medicine school, with parasitology (n=35), experimental medicine (n=18), entomology (n=17), methodology (n=13), and the correlated sciences of nutrition and biochemistry (n=20) characterizing and dominating the entire scientific scenario and the production of knowledge. Public health (n=6) and hematology (n=5)-(now flora studies with some revival of sprue research)-maintained an important but muted presence; even with public health dominating the educational and training aspects of the School in the 1940s.

With these images in mind, we must ask which diseases or health conditions were the subject of inquiry in the articles published in foreign or external journals, regardless of the type of research. Table 4 summarizes most frequent articles by health conditions.

As already mentioned, tropical sprue was the main research subject in external publications during the first period, with some presence also at the end. During the second period, the focus of attention were: tropical lymphangitis, trichinosis (both experimental and natural), and nutritional studies, with schistosomiasis research emerging. In the last period, nutrition and schistosomiasis were definitely the main subjects of study, with a renewed interest on filariasis.

To assess the nature of the external publications, we will analyze those journals that published

Table 4. STM. Most frequent articles by diseases or health conditions by periods

I. Period (1926-31)
-Tropical sprue (chronic malabsorption syndrome) (5 articles) -Mycosis (fungal disease) (2 articles) -Encephalitis (viral brain inflammation) (2 articles)
II. Period (1932-40)
-Lymphangitis (inflammation of lymphatic vessels) (5 articles) -Two experimental induced diseases, leprosy and trichinosis (ingesting inadequately cooked infected meat) (3 articles each) -Trichinosis and schistosomiasis (3 articles each) -Nutritional studies (5; one experimental)
III. Period (1941-49)
-Nutrition (16 articles) -Schistosomiasis (12 articles; 3 experimental) -Filariasis (infection with filariae) (7 articles; 1 experimental) -Tropical sprue (5 articles)

higher number of articles from the STM faculty (i.e., most preferred or used periodicals). There were five periodicals with frequencies equal or higher than ten publications (32), as Table 5 shows.

Table 5. STM. External journals with higher frequencies of publications by periods

Journals	1926-31	1932-40	1941-49	Totals
Proc Soc Exp Biol Med	6	13	15	34
Am J Trop Med	2	6	6	14
Science	0	4	9	13
J Infectious Diseases	0	2	10	12
J Parasitology	0	2	8	10

The question now is what kind of articles were published in those journals with higher frequencies of publications, but focusing this time on disciplines and main researchers.

The interdisciplinary nature of the journal *Proceedings of the Society for Experimental Biology and Medicine*, the official journal of the Society since 1903 (33), covering "all fields of biomedical research," perhaps explains its incremental prevalence among all periods that encompass STM's lifetime. This preponderance speaks of a solid presence of an experimental science in biology and medicine at the STM (34). Thus, the most preferred general view regarding this journal shows an initial particular interest in virology, followed by a temporal intermediary emphasis in bacteriology with parasitology and nutrition coming along, and a final image of bacteriology (strong on methodological aspects and on flora studies) and parasitology (varied) (35).

The American Journal of Tropical Medicine and Hygiene, established in 1921, and one of the most important periodicals in the field of tropical medicine, was published by the American Society of Tropical Medicine and Hygiene (36). In general, it was the second most preferred journal (with 14 papers) of the STM faculty. With some minor presence in the first period (i.e., sprue), it became an important periodical during the second period mainly for the nutritional research done by the Chemistry Department. The journal maintained a steady, but relatively minor presence in the third period for research associated to parasitology with filariasis (antigens) and schistosomiasis studies (37).

The next three most preferred journals, *Science*, *The Journal of Infectious Diseases*, and *The Journal of Parasitology*, which had no presence during the first period (1926-31) and only a minor one in the second period (1932-40), attained a more important role during the last period (1941-49). *Science*, first published in 1880, was the peer review journal of the American Association for the Advancement of Science. While its major focus was on original scientific research, it also published general information in all areas of interest of science and technology for its worldwide base of subscribers (38). As a general scientific periodical, it had a broad variety of articles during the second period: climatology, experimental leprosy, parasitology, and primatology. This original diffuse presence gave way to a less varied one for the third period, with a couple of scientific articles in three disciplines: zoology (J. Oliver-González, one), chemistry (C.F. Asenjo), and parasitology (W.A. Hoffman, one), a couple of an administrative nature (P. Morales Otero), and one article on sprue (T.D. Spies). Thus, at the end, this particular scientific image sustains a trend toward the correlated sciences of parasitology-zoology, and chemistry-nutrition (39).

The Journal of Infectious Diseases and *The Journal of Parasitology* basically represented the medical scientific trend toward parasitological studies that were emerging during the second era of external publications and that became predominant in the last period. *The Journal of Infectious Diseases* was the fourth most generally preferred periodical (with 12 articles); it was a peer review medical journal of the Infectious Diseases Society of America, established in 1904 (40). In general, faculty publications in this periodical were mainly parasitological studies. Its modest presence emerged during the second period (1932-40) through two publications in the areas of veterinary medicine (*Brucella abortus* by P. Morales Otero) and parasitology (*Trichinella spiralis* by J. Oliver-González). It had a more important presence in the last period (1941-49: 10 articles) in the area of parasitology, with a variety of themes: except for one article in experimental leprosy (C. Krakower, P. Morales Otero and J.H. Axtmayer), the rest were related to ascaris, Trichinella, schistosomiasis, filariasis, animal parasites, and functional antigens, with J. Oliver-González as co-author in all of them (41). *The Journal of Parasitology* (10 articles) emerged as a most preferred venue for publication by the STM faculty at a time (~1933) when it became the journal of the American Society of Parasitology (42). Similar to *The Journal of Infectious Diseases*, it had a minor presence during the second period (1932-40) with one study on Schistosoma and another on cattle parasites on the Island. The third period (1941-49) was part of the parasitology era in the STM basic medical sciences with six parasitological studies

(J.F. Maldonado, J. Oliver-González) and two entomological investigations by I. Fox (43).

Academic Images of Science

Before delving into the history of the scientific representations at the STM through an analysis of research reports and publications, let's first explore the following dimension: what does curriculum reports (i.e., Announcements) and organizational aspects (i.e., departments, units) reveal on the history of the sciences at the STM? (44).

A. First Period: 1926-1931

The courses of the first academic session (1926-27) included, first, the fundamental sciences of bacteriology/mycology/pathology (in an integrated manner), chemistry (food nutrition), and medical zoology (parasitology and entomology); second, the clinical sciences of 'tropical medicine and surgery'; and third, the hygiene field under the label of 'public health and transmissible diseases' ('communicable' instead of 'transmissible' was used after the second session). While the basic sciences and the clinical areas of tropical medicine and surgery had three or four courses (each area, with the exception of medicine, included a methodology and a research course), the domain of public health had eight courses (i.e. administration, engineering, rural sanitation-uncinariasis, malaria prevention, plague prevention, leprosy, tropical epidemiology and research). The initial curriculum reflects, first, the singular importance of basic sciences and public health research (but not necessarily clinical), and, second, the foundational educational presence of public health. This can be explained because of the highest number of public health faculty members (47%, or 9/19 of all faculty and 64%, or 9/14 of the instructors) (45).

Few changes occurred in the curriculum in the second academic session (1927-28). In the basic sciences pathology became independent from a still integrated course of bacteriology/mycology/immunology-added. The courses of medical zoology were now listed as helminthology and entomology, protozoology, and research, which reflect some kind of scientific denominational revision. The clinical sciences of tropical medicine and surgery added courses on 'Seminars in Tropical Medicine' and 'Clinical-pathological Conferences' (later this will be placed in pathology). Public Health dropped the plague and leprosy courses and added one in communicable diseases, which is indicative of the first disease paradigm shift at the School (uncinariasis and malaria will follow) by leaving the emphasis of those conditions to the practical public health services of prevention and control, or at most, in the future, to research done in cooperation with the HD (46). In the third academic session (1929-30) the bacteriology and mycology courses were separated, and the first one included a course on 'Filterable Virus and Rickettsia Diseases,' which was offered by the second School Director (1928-31), bacteriologist and virologist E.B. McKinley (MD Michigan 1922). The clinical-pathological conferences were properly placed in the pathology course. The field of medical zoology was again revised, which evidence, the presence of visiting professor of parasitology W.H. Taliaferro (University of Chicago) that offered the course on Immunology of Parasites, and the addition of the first field study course at the School. Public health added a course on laboratory methods (47). The Announcement of 1931-1932 did not reflect any changes in the curriculum (48).

B. Second Period: 1932-1940

In the 1934-35 academic session the only significant curriculum change occurred in medical zoology, continuing the School's intriguing dialectical re-conceptualizations of this field. The department was now denominated Parasitology, which could be related to the presence of the third STM Director (1931-42), parasitologist G.W. Bachman (MA Columbia 1923; PhD Chicago 1927) (49). Later, in 1941-42, it returned to its original name; 1942 being the last year of Bachman's directorship.

In the Report of the Dean of June 1934 the STM Hospital merited a critical ambivalent comment: "... the University Hospital continues to be one of the major problems as well as a particular asset. As it is now constituted by law, the hospital serves a large part of the needs for 39 municipalities in the northwestern part of the Island..." (p. 37) (50). The organizational complexities of integrating and maintaining the University Hospital definitely required changes at all levels. The Hospital, since its opening in 1929, grew naturally for many years due to the demands of the referral of patients with tropical diseases from the entire country, and its assignment as a regional hospital obviously demanded an institutional reorganization.

Two other institutional units of the School emerged around 1938 (51): a) Studies of Ultraviolet Solar Radiation (52), and b) the Cayo Santiago Primate Colonies (53). The establishment of the primate colonies program was the dawn of a great UPR scientific program placed under the administration of the STM for the benefit of universal science (54).

Work began on the construction of two new wings to the School and the University Hospital in November 1938, which eventually "housed" a Library and, interestingly, a future Department of Physiology which never saw its birth. Physiological medical research was almost absent at the School, with the exception of some biophysical studies on tropical climatology (55). The Department of Tropical Medicine and Surgery changed its name to Clinical Medicine and Surgery in 1939, which signaled a major shift in the field of medicine at the locus of the hospital (56). It may be that the hospital actual sense of the distribution of 'cosmopolitan forms' of diseases overshadowed those of tropical nature, or that the field of medicine was defined in a more modern and general manner, or both (57).

In the domain of public health, a major institutional change occurred at the beginning of the 1940 academic year: the establishment of the Department of Public Health. It took fourteen years for the discipline to be conferred a distinctive academic designation. This could only means that the public

Vitamin Assay Laboratory, report of the Director 1938 (colu_0037). Archives and Special Collections at the Augustus C. Long Health Sciences Library of Columbia University, School of Tropical Medicine under the Auspices of Columbia University, Annual Reports of the Director.

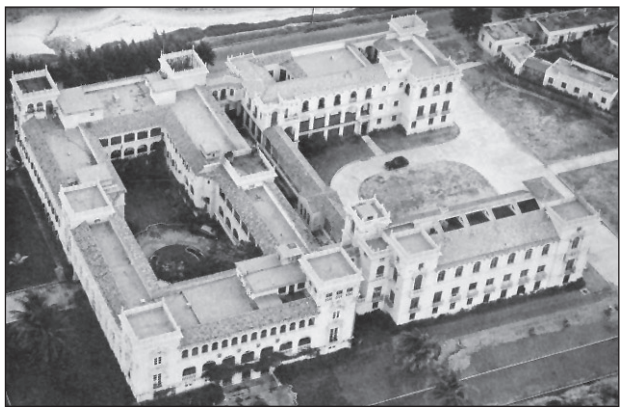
health discipline traversed an academic path from an oblique or cryptic organizational presence into a full visible and esteemed academic department. However, as we have already seen, the field of public health had since the beginnings a discernible educational and conceptual framework that permeated the whole institutional climate of the School, while also receiving strong organizational support from the insular HD (58). This major departmental innovation foreshadowed a future significant educational transformation of the STM. From being a non degree-granting postgraduate school of tropical medicine (that offered certificates and advanced credits in tropical medicine), the educational branch of the School gradually would become a predominant public health personnel-training site at the master degree level (i.e., MS in Public Health, Sanitary Sciences, and Public Health Engineering) and reoriented its offer of short courses (i.e., sanitary inspectors) and certificates (i.e., public health practice, public health nursing, and medical technology) (59). Nevertheless, hospital services, and basic and clinical research on tropical diseases and other medical conditions, as well as research on public health issues and community field studies would continue unabated until the closure of the School.

C. Third Period: 1941-1949

The name of the medicine department changed again in 1940, this time to 'Clinical Medicine and Surgery and the University Hospital' (60). Its name changed once more in 1943 to 'Clinical Medicine,' with two subdivisions of surgery and pediatrics, while the hospital staff acquired a distinct and separate unit, with a nursing subdivision (61). It appears that the organizational complexities of running both institutions in an integrated and functional manner forced these changes. The foundational goal of preserving and protecting the academic aspects of research also may have played a significant historical role. The complexities provoked by the start and rapid growth of the hospital services, with the conscious effort of promoting and maintaining cooperation between the School and the Hospital, already were manifested in a simpler manner since the 1929-30 academic year (62). However, in the 1944-45 Announcement there is a wide variety in the School's staff lists (63).

The reconceptualizations (or institutional ambiguities) manifested in the first two historical periods in the fields of medical zoology and parasitology is reiterated in the last epoch in mycology and dermatology. In 1938 the name of the Department of Mycology was modified to Mycology and Dermatology (64), changing to Dermatology alone in 1942 (65), while reversing names in 1946 (Dermatology and Mycology) (66) and maintaining both intact in 1948 (67). However, in the last course announcement of 1945-46 the sole label of Dermatology was still used (68). In the 1941-42 academic session, the bacteriology course regained its immunological companion, and the parasitology course was placed again under the general heading of medical zoology (69). A kind of fluidity in academic management is the brighter side of these institutional reconceptualizations.

Another unit was established at the School in 1943, associated with the war efforts, under the auspices of the "Blood Bank of Civilian Defense." The services provided to the hospitals justified the continuation of the Blood Bank as "a permanent institution" at the School (70). It maintained its operation until the end of the life term of the STM, reporting both research and routine activities (71).



School of Tropical Medicine, report of the Director 1943 (colu_0008). Archives and Special Collections at the Augustus C. Long Health Sciences Library of Columbia University, School of Tropical Medicine under the Auspices of Columbia University, Annual Reports of the Director.

An interesting but intriguing change occurred in the 1945-46 academic session. The Department of Public Health courses now appeared under the heading of Hygiene (72). Since the creation of the department in 1940 and its first mention in a Report of the Director in 1941 (73), it was not until the Report of the Director of 1944 that the Department of Public Health was once again mentioned (74). This time it was said that the organization of the department was completed, under the leadership of G. Arbona. The 1945 Director's Report alluded to the name change of the department (75). It is possible that at the time an interest in academic distinction was forthcoming between hygiene and the correlated applied notions of sanitary and public health measures and services (76).

Foundational Images and Representations

A. First Images

Columbia's representatives formulated the School's mission in typical romantic perspective at the inauguration ceremonies. Dean William Darrach, for example, mentioned that the new institution would be dedicated to "the study and teaching of the physical and mental ills of mankind as they occur in the tropics" and that it is "essentially a place for study," for the cultivation of "this spirit of research, this desire for the truth" (77). Director Lambert stated in his first report (1926-27) that the research "will carry the name of the School over the world"; an idyllic prophecy that through the years bore a sense of the real (78). The priority of research over clinical and public health services was emphasized in both statements (79).

An important foundational factor was Columbia's three initial faculty appointments, all paid for by the metropolitan university: R.A. Lambert as pathologist and director (80), D.H. Cook as chemistry professor, and W.A. Hoffman as professor of parasitologist (81). These assignments encompassed three areas of medical science which were thought to provide basic scientific support for research. The other listed appointee, Earle B. Phelps, was a visiting professor (fall of 1926) in Sanitary Science from the Institute of Public Health, Columbia. Locally, the following professorships in clinical areas were represented: Tropical Medicine (B.K. Ashford, initially as collaborator since he was still active in the army, and A. Torregrosa), Mycology (B.K. Ashford), Clinical Bacteriology (F.J. Hernández), and Hygiene and Transmissible Diseases (Health Commissioner P.N. Ortiz). All fourteen instructors (with different specialties) came from the HD staff, but two, ascribed to the HD, became professors of the School courtesy of the International Health Board of the Rockefeller Foundation (82).

One of the first clinical services provided by the STM to the community was the establishment of a much-needed health service which had been absent on the Island, a "Pathological Laboratory" that included performance of autopsies and examination of clinical specimens sent by public and private health institutions around the country. The regular academic clinical-pathological conferences also were a link to the medical community, and pathological studies were part of an almost all-initial research carried out at the School. The chemistry and parasitology departments provided two fundamental basic laboratory sciences, which became part of the studies of prevalent tropical diseases and their social counterparts in nutrition (83).

Interestingly, after the first two years, Director Lambert reported that malaria and uncinariasis were not part of the research program within the school, since they were already the subject of important sanitary control programs at the HD. Future work at the STM on these tropical diseases would be done in collaboration with the HD. The first visiting lecturers were prominent physicians from other universities: Aldo Castellani (Tulane, Tropical Medicine), William T Councilman (Harvard, Pathology), Andrew Watson Sellards (Harvard, Tropical Medicine), and Juan Iturbe (Caracas, Parasitology), evidencing a desire to strategically define the field in an ample manner. Local resident lecturers represented a variety of tropical imageries and several cooperative institutions: tropical surgery (Presbyterian Hospital), tropical climatology (U.S. Weather Bureau), tropical food plants (Agricultural advisor), and tropical plant pathology (Insular Department of Agriculture) (84).

B. Location

To enhance its 'marvels' (85), the STM was physically located in a singular historical Caribbean city (86), in a "unique site" (87). Its scientific imagineer, B.K. Ashford, perceived the place as being more of an antique Greek academy than a traditional school, but "above all... a school of experimental medicine" (88). In the words of one of the first visiting scientists, Francis W. O'Connor, its building was "a combination of the beautiful and the practical" (89). Ashford's preference for a model of "Spanish architecture redolent of the Moor" (90), which "embodies a nostalgic look toward Spain" (91), also could be considered a historical blend of two kinds of imperial images: a dialectical kind of revindication (the Spanish medical tradition) and perpetuation (the colonial state). Nonetheless, the utilitarian and magical 'continuing aura' of the building is still considered today as a monument to a "unique medical citadel" (92).

In its origins, all assets of the former ITMH (1912-24) were transferred to the STM; at the time of its dissolution, the STM (1926-49) became commuted into the present School of Medicine of the UPR. Therefore, historically, location always meant a start and an ending for the STM, a first light and a fall, simultaneously (93). In both instances, however, the change produced an institutional rupture: the earlier one created a schism among the leadership of the local tropical medical scientists associated with the ITMH; the latter demonstrated the strong resistance and resignation of several members of the faculty, including the director of the STM. This model of institutional transformation, of forcing a closure to enable an opening, appears to be not only a historical reality in this case, but also, at the end, one that probably gained more than what it lost (94).

A good measure of the local enthusiasm with the joint venture was the steadfast decision of erecting a new and

magnificent building for the school's inauguration and, two years later, an adjacent teaching hospital, with money allocated for that purpose by the Puerto Rican Legislature. The new building for the School included "well-equipped" laboratories in bacteriology, chemistry, mycology, pathology and parasitology. Thus, if the laboratories are considered a reasonable criterion for the intended scientific research to be carried out, these basic sciences provided the scientific foundations and research support for the School. As with the ITMH, experimental animals were actively used in research; therefore, living quarters for animals were contemplated from the start (95).

The other crucial location for both clinical teaching and research, a "teaching hospital," already had been built and in operation by the fourth year of the STM (with 40 beds and an outpatient clinic) (96). During previous years, clinical instruction was offered in several public and private hospitals (97). Since the School's inception, there were plenty of opportunities for fieldwork research (98). Research expeditions (i.e., fieldwork) were a long-standing tradition in international tropical medicine, and the STM's precursor institution, the ITMH, used it intensively (99). The June 1930 Dean's Report started by noting that the entire building facilities were in use and that new laboratories had to be provided with partitions not originally intended, due mainly to the addition of local investigators and new appointments of Columbia's permanent staff (100).

With respect to its location, it must be concluded that the Pappenheimer-Ashford affair, viewed as an exemplar of an asymmetrical colonial power relationship, became a great opportunity and achievement for the development of local medical science (e.g., construction of a "medical citadel"). However, as part of Puerto Rico's tropical obliviousness, the building has been physically and unwisely altered throughout the years, and unjustly appropriated for nonacademic or nonscientific uses. More enlightenment will be needed to understand the nature and history of this tropical forgetfulness: how a colonial medical modernity eludes the sense of being in a particular geographical place in this world (101).

Conclusions

In this ongoing historical series on the STM, the question that orients this and forthcoming papers revolves around the nature of the sciences that were qualified by the scientific representations and research practices revealed at the School. The directors' tenures and the analyses of publications paved the way to delineate a discrete periodization of the stories of those sciences.

Although the relationship between Columbia and the UPR was clearly asymmetrical (e.g., level of science, institutional hierarchy, political influences), the idea of a school of tropical medicine on an island was a desirable and useful opportunity for the prestigious metropolitan Columbia University, and local counterparts embraced the idea and the opportunity as well. The local government provided the major part of the monetary and physical resources for the School. From the start, the HD made available to the School its medical staff as instructors of public health, who also were part of the first class of graduate students. Many of them later became bona fide members of the School's cadre of medical scientists and faculty members. Columbia provided intellectual prestige, strategic resources, scientific networks, and organizational experience. Besides major funding, Puerto Rico offered significant public health resources and experience, well prepared clinical medical staff, and the modest but already well refined scientific culture of the ITMH. Thus, this idea of an academic tropical medicine center in the tropics had a shared colonial metropolis image.

The variety of medical scientists at the STM could be characterized, in a representational manner, as a group that shared a common interest in developing local medical science in a research graduate center in the tropics where common, but unequal, scientific citizens progressively would become a well-defined autonomous and integrated community geared to the production of knowledge. The institutional policies of visiting professors, academic incentives for assistants, technicians and graduate students, and special studies for faculty members, definitely must have enriched the personnel's aspirations and the academic environment of the STM.

An analysis of a set of networks and persuasive communities by their scientific and professional activities (i.e. conferences and clinics for the medical community and multidisciplinary expertise of visiting professors) revealed an epistemic profile in which the School played a significant role in advancing the general medical and scientific knowledge. The unceasingly rise in scientific productivity by the faculty at the School reflects a kind of general knowledge that transcended the local community. The quality of external journals preferred by the faculty for publishing their research results is an exemplar of these achievements.

The analysis of external publications demonstrated the following essential historical paradigms of exemplars of knowledge: a) the classical medical science of bacteriology informed the research work in the first period (1926-31); b) the tropical medical science of parasitology (mainly research on schistosomiasis) became hegemonic during the second period (1932-40), with a solid experimental and methodological research practice and with nutritional biochemistry marking its productive path; and c) parasitology, entomology, experimental medicine, methodology, and the correlated sciences of nutrition and biochemistry dominated the entire scientific scenario during the third and final period (1941-49). Therefore, an image of a mature science already was present at the School during the second historical stage, and a significant tropical medicine school flourished during the last historical period.

The process of trying to ascertain the significance of the institutional curriculum and the organizational aspects of the

School on the history of the sciences at the STM produced significant scientific representations. The most important aspect is the paramount value given to both research education and research practices in the basic and clinical sciences and in studies of public health problems during the School's life span. Experimental medicine and methodological studies were always important matters, as well as the educational and practical aspects of laboratory and field study courses. Tropical medicine was the theoretical core of the fundamental basic sciences and, as expected, played a significant role in clinical research. Although the educational aspect of public health training became central during the last epoch, the STM continued to be a basic tropical medicine research institution. The School's curriculum reflected a high degree of denominational flexibility, either for circumstantial or for pertinent reasons. The correlated disciplines with the highest conceptual fluidity were: a) medical zoology and parasitology; b) mycology and dermatology; c) tropical medicine and clinical medicine; and d) hygiene and public health. A conceptual exercise on these naming fluxes generates the following dialectical poles: general vs. applied, basic science vs. clinical science, and general science vs. medical science, which means that the internal debates were far more profound and visible than what were apparent (102).

Reflecting on the nature of the sciences at the STM, the foundational schemes envisioned so far are as follows. From the side of Columbia, the primordial basic sciences were chemistry and parasitology, with pathology providing administrative direction, research orientation, educational biological materials, and a nexus to the medical community. Locally, the following medical areas were represented for more pragmatic reasons: tropical medicine, mycology, clinical bacteriology, clinical medicine and surgery, and public health. In terms of the initial laboratories established in bacteriology, chemistry, mycology, parasitology and pathology, they represented the immediate base and prospect for research practices. Pathology, in general, could be seen as forging a kind of "conspicuous chain" among the other sciences (103).

This first paper on the history of the sciences at the STM, focused on persuasive communities, networks, foundational and academic representations, and publications in external journals. It provided a set of basic scientific representations and images as a prelude to the examination of the research conditions and practices that will elucidate the evolution of science at the School in different periods and paths traversed. In a sense, this initial inquiry offered a kind of historical scientific contextualization that will help to explain and understand the story of an exemplar of a neocolonial tropical medicine shared enterprise. The analysis of local and external publications established the historical periodization that will be used as distinct research epochs in upcoming articles. The next two articles of this serial collection of papers will present a narrative on the history of the sciences at the STM in three distinct eras (1926-31, 1932-40, and 1941-49). It delves into the story of scientific representations as manifested by an analysis of research reports and publications.

Resumen

Este ensayo indaga las representaciones científicas que surgen de la historia de la ciencia en la Escuela de Medicina Tropical (EMT) de la Universidad de Puerto Rico, bajo los auspicios de Columbia University (1926-1949). En la investigación se examinan las principales investigaciones realizadas por la facultad, el desarrollo de los programas de investigación, y la evolución de la producción científica. Los resultados del estudio se presentan en una colección serial de artículos: 1) las imágenes de la ciencia, 2) la evolución de la ciencia en las primeras dos etapas (1926-31, 1932-40), 3) el desarrollo en la tercera y última etapa (1941-49), y 4) estudios especiales. Este primer artículo de la colección se enfoca en las imágenes que se proyectan en torno a las interacciones de comunidades de interés, las redes de científicos e instituciones, y los discursos fundacionales. Las representaciones científicas surgen del examen de dos tipos de fuentes: informes académicos y de investigación, y publicaciones en revistas externas y locales. Las imágenes emergentes se analizan mediante las nociones de redes científicas, comunidades persuasivas, y los epistemes y saberes concomitantes. Los hallazgos más significativos de esta historia de representaciones e imágenes científicas son: la idea de un centro académico de medicina tropical en los trópicos es una imagen colonial-metrópolis compartida; la comunidad desigual de ciudadanos científicos devino en una comunidad epistemológica integrada; la cooperación interdisciplinaria constituyó una norma o principio de investigación en la Escuela; y la imagen emergente es la de una ciencia y escuela de medicina tropical madura.

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1. Mayo Santana R, Rabionet SE, Peña-Carro L, Serrano AE. Marvels and Shadows: Science and Education at the University of Puerto Rico School of Tropical Medicine under the Auspices of Columbia University: An Introduction. PR Health Sci J 2016;35:49-52. Mayo Santana R, Peña Carro L, Rabionet SE. The historical antecedents of the UPR School of Tropical Medicine. P R Health Sci J 2016;35:1-9. Rabionet SE. The educational legacy of the UPR School of Tropical Medicine: Curricula, faculty, students (1926-1949). P R Health Sci J 2016; 35:125-133. Mayo Santana R. The Puerto Rico Journal of Public Health and Tropical Medicine (1925-1950): From a Health Department Bulletin to a UPR School of Tropical Medicine Scientific Journal. P R Health Sci J 2016; 35:179-190.
2. First, as we mentioned in the text, an analysis of the incremental ratios in both local and external faculty publications by year suggested the use of the following historical periods: 1926-1931, 1932-1940 and 1941-1949. Second, the first of these periods (1926-31) coincides with the term of the first two directors of the School: Robert A. Lambert (MD, Pathology; 1926-28) and Earl B. McKinley (MD, Bacteriology; 1928-31), which was a period of institutionalization. Third, the second period of publications (1932-40), coincides with the longest term of Director George W. Bachman (PhD, Parasitologist; 1931-42), a period of institutional stability in which the discipline of parasitology established its predominance in the local science of tropical medicine. Fourth, the last period of publications (1941-49), covers the paradigmatic change in which a Puerto Rican physician was appointed, Director Pablo Morales Otero (MD, Bacteriology; 1942 April 1949), which marks a period of tension with Columbia, and of Interim Director Enrique Koppisch

(MD, Pathology; May June 1949), which covers the period of closure, both with Columbia and the STM.

3. Concerning the meaning of the notions of scientific representations and images, see also the methodological discussion in Note 3 in the forthcoming second paper, "School of Tropical Medicine Scientific Evolution First Eras." Representations and scientific images have been a central notion in historical inquiries and in science: Chartier R. El mundo como representación. Estudios sobre historia cultural (Ferrari C, transl.); Barcelona; Editorial Gedisa, 2005, 1992. Van Fraassen, BC. La imagen científica (Martínez S, Amara L, trad.); México; Paidós, 1966, 1980. The term 'persuasive communities' has been used to refer to the rhetorical aspects presumed to be involved in the references cited in particular 'corpus of scientific writing': Allen B, Qin J, Lancaster FW. Persuasive communities: A longitudinal analysis of references in the Philosophical Transactions of the Royal Society, 1665-1990. Social Studies of Science 1994; 24:279 310. Since the communities examined involved two corpus of experts (i.e. the faculty of the School and the cadre of visiting professors), addressing communities from a presumed distinct level and projecting different epistemic points of views from a rhetorical perspective, the concept of persuasive communities was modified or extended for our particular purposes.
4. There were three main crucial institutional moments in this history: the Puerto Rico Anemia Commissions (1904-1908), the Institute of Tropical Medicine and Hygiene (1912-1924), and the STM (1926-1949).
5. Scott HH. A History of Tropical Medicine, 2 vols.; London, England; Edward Arnold, 1939. Wright WH. 40 Years of Tropical Medicine Research: A History of the Gorgas Memorial Institute of Tropical and Preventive Medicine, Inc. and the Gorgas Memorial Laboratory; Baltimore, Maryland; Reese Press, 1970. MacLeod RM, Lewis M. Disease, Medicine, and Empire: Perspectives on Western Medicine and the Experience of European Expansion; London and New York; Routledge, 1988. Farley J. Bilharzia: A History of Imperial Tropical Medicine; Cambridge; Cambridge University Press, 1991. Cook GC. From the Greenwoch Hulks to Old St Pancras: A History of Tropical Disease in London; London; The Athlone Press, 1992. Watts S. Epidemics and History: Disease, Power and Imperialism; New Haven and London; Yale University Press, 1999. Haynes DM. Imperial Medicine: Patrick Manson and the Conquest of Tropical Medicine; Philadelphia, Pennsylvania; University of Pennsylvania Press, 2001. Caponi S. Trópicos, microbios y vectores. História, Ciências, Saúde. Manguinhos 2002;9 (Suppl):111-138. Arnold D, ed. Warm Climates and Western Medicine: The Emergence of Tropical Medicine, 1500-1900, 2nd Ed; Atlanta, GA; Rodopi, 2003. Perez Hatori A. Colonial Dis-ease: US Navy Health Policies and the Chamorros of Guam, 1898-1941; Honolulu; University of Hawai'i Press, 2004. Cook GC. Tropical Medicine: An Illustrated History of the Pioneers; London, England; Elsevier, 2007. Ngalamulume K. Colonial Pathologies, Environment, and Western Medicine in Saint-Louis-du-Senegal, 1867-1920; New York; Peter Lang, 2012. Cook GC. The Rise and Fall of a Medical Specialty: London's Clinical Tropical Medicine; London, England; Tropzam, 2014. Snowden, Frank. An appraisal of Tropical Medicine. In: Epidemics in Western Society Since 1600 (https://www.youtube.com/playlist?list=PL3AE7B3B6917DE8E6&feature=plcp). Rabionet, The educational legacy of the UPR School of Tropical Medicine: 126. Brazil is a special case in the history of tropical medicine since a group of 19th Century physicians independently established the Escola Tropicalista Bahiana: Peard JG. Race, Place, and Medicine: The Idea of the Tropics in Nineteenth-Century Brazilian Medicine; Durham and London; Duke University Press, 1999.
6. Leonard Reyes HE. El impacto de la campaña contra la uncinariasis y la política de salud pública norteamericana en Puerto Rico; Departamento de Historia, Facultad de Humanidades, UPR, Recinto de Río Piedras, 1991 (Tesis M.A. 89). Trigo B. Anemia and vampires: Figures to govern the colony, Puerto Rico, 1880 to 1904. Society for Comparative Study of Society and History 1999; 104-123; 0010-4175/99/1510-1303. Fernós R. Medicine and International Relations in the Caribbean: Some Historical Variants; New York; iUniverse, 2006. Peña Carro LI. Las Comisiones contra la Anemia de Puerto Rico (1904 1908): ¿Medicina o justicia social?; Departamento de Historia, Facultad de Humanidades, UPR, Recinto de Río Piedras, 2007 (Tesis M.A. 92). Scarano FA. Doctors and peasants at the intersection of empires: The early hookworm campaigns in Puerto Rico. Paper presented at the Annual Meeting of the American Studies Association; San Juan, PR, (15-18 November), 2012. Amador J. Medicine and Nation Building in the Americas, 1890-1940; Nashville, Tennessee; Vanderbilt University Press, 2015. Trujillo-Pagán N. Modern Colonization by Medical Intervention. U.S. Medicine in Puerto Rico; Chicago, IL; Haymarket Books, 2013, 2014. Trujillo-Pagán NE. Worms as a hook for colonising Puerto Rico. Social History of Medicine 2013;26:611-632.
7. On the notion of the STM as an institutional "outpost" of Columbia, see: a) Report of the Joint Commission for the Establishment of the School of Tropical Medicine of the University of Puerto Rico under the Auspices of Columbia University (Archives and Special Collections, A.C. Long Health Science Library, Columbia University); c. 1923-24: 7. b) Ramírez de Arellano AB. The Politics of Medical Education in Puerto Rico; School of Public Health, Columbia University; Doctoral Diss.; 1985: Ch. 1. A Research Outpost: 1-33.
8. On science at Columbia, see: a) Baatz S. Imperial science and metropolitan ambition: The scientific survey of Puerto Rico, 1913-1943. In: JC Figueroa Colón. The Scientific Survey of Puerto Rico and the Virgin Islands. An Eighty-Year reassessment of the Island's Natural History; New York, NY; The New York Academy of Sciences, 1996:1-16: i) "Before 1900 ... the major centers of science within the United States were located primarily in those northeastern cities that possessed both well endowed universities and scientific societies with a tradition stretching back at least to the early decades of the nineteenth century... Among this small group it was New York City that could claim preeminence: it boasted a variety of scientific institutions that in their own spheres were unrivaled on the continent": 2; and ii) "At Columbia University science had been a central part of the curriculum since the appointment of Frederick Barnard as president in 1864. A leading member of the American Association for the Advancement of Science, Barnard, with the assistance of Charles Chandler, dean of the Columbia School of Mines, transformed Columbia into the principal academic center of science in the United States... Columbia possessed the largest faculty and the greatest number of graduate students and it spent more on education for each student than any other American university": 3; and b) McCaughey RA. Stand, Columbia. A History of Columbia University in the City of New York, 1754 2004. New York, Columbia University Press, 2003: i) "By 1915 Columbia by several measures had become the biggest university in the country... The Columbia's Summer School and Extension Program were also the largest in the country, enrolling some twelve thousand students in 1915": 230-231; ii) "It was in the Faculty of Pure Science where prewar Columbia was most impressive... if not the best American university on the eve of World War I, Columbia had little cause to cede that distinction to any competitor... the smart money was on Columbia.": 232 233; and iii) In October 12, 1928, Columbia established the Columbia-Presbyterian Medical Center, "the world's first comprehensive medical center": 303.
9. The contextual situation of the UPR already has been described in one of our serial articles: Rabionet, The educational legacy of the UPR School of Tropical Medicine. Two things should be kept in mind: a) early in the 20th Century the foundations of the University were specifically related to teacher training and agricultural science, and b) at the onset of the twenties the University did not "come close to the standards of an institution of higher learning" (See Ref. No. 18 in Rabionet). In 1924, Thomas E. Benner, the first Chancellor of the University, "was charged with the implementation of the Pan-Americanization project within the University and to raise the University's standard and prestige" (Rabionet: 127). It is interesting to note that eight years after the inauguration of the UPR-STM in 1926, Theodore Roosevelt (Jr.), which was U.S. Governor in Puerto Rico (1929-32) and U.S. General Governor of Philippines (1932-1933), promoted a kind of Pan American political policy towards Latin America based on two scientific experiences on the island: tropical medicine and tropical agriculture. Roosevelt T (Jr.). Puerto Rico: Our link with Latin America. Foreign Affairs1934;12:271-280: "Through the School of Tropical Medicine we will be discovering the cures of the diseases which have devastated

tropical peoples"; and "The same holds true in agriculture. The experimental work... the Puerto Rican Experimental Station": 279.

10. Gutierrez Igaravidez P. Copy of typed letter addressed to Dr. Nicholas Murray Butler, President of Columbia University, April 21, 1927. Institutional Archives, Río Piedras Campus, University of Puerto Rico, 4 p.: "You very well know that the minds which conceived and planned this Institution... expected to use as a nucleus for their project a modest scientific Insular organization, known as the Institute of Tropical Medicine": 1. On the history of the Institute see: Santos Corrada CM. El desarrollo de la idea de medicina tropical y el Instituto de Medicina Tropical e Higiene de Puerto Rico, 1912-1924; Departamento de Historia, Facultad de Humanidades, UPR Recinto de Río Piedras, 2012 (Tesis M.A. 208).
11. Gutierrez Igaravidez, Copy of a typed letter addressed to Dr. Nicholas Murray Butler: "Under these circumstances, the School of Tropical Medicine was inaugurated, and this country and the whole world knows that the soul of the People who raised the building and pays its running expenses is absent from the said School": 2.
12. Gutierrez Igaravidez, Copy of a typed letter addressed to Dr. Nicholas Murray Butler: "A law of our Legislature, inspired by and approved through the efforts of persons not natives of this Island, eliminated the members of the Institute…" Different nationalistic concerns (e.g., ITMH, local political issues, identity of the STM Director, the 'voices' of local physicians), were present at different critical moments in the STM story and in different scenarios (e.g., Legislature, Board of Trustees, Puerto Rico Medical Association).
13. As mentioned previously, "this institutional rupture produced a schism among the leadership of the medical scientists on the Island that had been collaborating since the times of the Puerto Rico Anemia Commissions". Mayo Santana, Rabionet, Peña-Carro, Serrano, Marvels and Shadows: 50. However, the rupture also had previous stories of conflict. In the Institute of Tropical Medicine and Hygiene, Ashford tried to force the resignation of Dr. Isaac González Martínez and unauthorized him on several occasions because of an issue related to the production of vaccines. Santos-Corrada, El desarrollo de la idea: 89.
14. Ashford BK. A Soldier in Science: The Autobiography of Bailey K. Ashford; London, England; George Routledge, 1934: 358 359. Mayo Santana R, Rabionet S. "They could not accept a master"-Bailey K. Ashford. Conflictos en la fundación de la Escuela de Medicina tropical. Conference held under the auspices of AAAS-Caribbean Division, MSC, UPR. San Juan, PR; 5 April 2005. A.B. Ramírez de Arellano has summarized Alwin M. Pappenheimer visit and impressions, as follows: "Unlike the previous emissaries, who had found conditions on the island favorable to the project, Pappenheimer inspected the existing Institute of tropical Medicine and found it unfitted to undertake the proposed training. The 'research' was largely routine laboratory work, the physicians were primarily interested in their private practice, and the milieu was not conducive to investigation. For Columbia to proceed with the development of the school was therefore most unwise 'unless radical changes were made in the organization and the staff of the Institute'. Ramírez de Arellano, The Politics of Medical Education in Puerto Rico: 22; source on p. 32: Alwin M. Pappenheimer, "Memorandum Relating to the Proposed School of Tropical Medicine", [n.d., c. July 1924], Columbia University Central Files.
15. Ashford, A Soldier in Science: 363-364.
16. On the Health Department's (HD) academic collaboration with the STM, initially it was mainly through the offering of public health teaching (an important secondary type of academic support) and the opportunity for the HD staff to take graduate studies in tropical medicine in order to become basic scientists at the School (a primary scientific activity). Later, it took the form of a federal grantee department for training health officers and personnel, which in a sense partially transformed the original principal educational mission of the institution, from tropical medicine to public health. See also: Rabionet, The educational legacy of the UPR School of Tropical Medicine: 129-130.
17. For the inferences, descriptions, and summaries included in this paragraph, see our series of articles on the School of Tropical Medicine (Reference 1).
18. The community of patients, as reflected more directly in case studies, research investigations, community surveys, and autopsies, and ultimately the majority of the population that were more affected by economic, social and health risks, as shown in statistical health indexes and measures, will be the subject of another investigation.
19. Since part of the faculty and administration were American professors from the U.S. and some of the Puerto Rican faculty studied or were studying at U.S. universities, the author decided to use the term 'local' to signify professors and other persons living and working on the island, regardless of national origin, unless otherwise specified. This is not meant to suggest that these differences were not important; however, instead of emphasizing national identities and solving the ensuing issues as definitive, we chose to leave the issue open for further consideration and not conclude it by mere definition or prejudice.
20. Visiting professors did not participate in the Weekly Public Conferences and Clinics, but some of the activities of the visiting professors also were open to the local community.
21. Based on STM Director's Annual Reports ("Memorias"), between 1934-35 and 1948-49.
22. Based on descriptions included in different types of official documents (i.e. Announcements, Sessions, Dean's Reports, Memorias) covering all the sessions of the School, from 1926-27 to 1948-49; it does not include local resident lecturers.
23. The analysis excluded the category of 'other' (i.e. administrative) in the case of visiting professors (98 visits of a total of 308). There were three specific types of patterns: first, differences are moderately distinct with respect to the categories of Clinical Medicine (49.9% vs. 44.3%; a difference of 5.6%) and Science (28.9 vs. 24.3%; a difference of 4.6%), in favor of public conferences and clinics; second, proportions are almost similar in Tropical Diseases (11.2% vs. 12.4%; a difference of 1.2%) in both kinds of activities; and third, differences are larger and distinct in the area of Public Health (10.0% vs. 19.0%; a difference of 9%), in favor of the visiting professors.
24. These epochal contrasts between public health visiting professors and those visitors that focused on tropical medicine could reflect a historical change in the School's instructional environment toward a greater emphasis in public health training instead of the early academic prevalence of medical formation in tropical medicine. The question arises as to whether analogous changes occurred in the area of tropical medicine research.
25. Local publications in the STM-Journal were described in a previous article in the series: Mayo Santana, The Puerto Rico Journal of Public Health and Tropical Medicine. In the analysis of local publications for the present article, local journals were mainly the STM Journal and the Boletín de la Asociación Médica de Puerto Rico.
26. Several assumptions were made: a) publications in external journals reflect a kind of science more competitive or at a higher level of competence/aspirations-however, this assumption (a kind of universal supposition) could be sustained more properly in relation to the basic sciences or in tropical and clinical medical sciences rather than in other types of important academic practices within the School where the local scenario (a kind of particular situation) is more pertinent (e.g. public health); and b) the ratio between external/local publications will help to elucidate the historical nature of knowledge production among the epistemological practices of the School.
27. Collected Papers of the School of Tropical Medicine (1926-1938), Biblioteca General de Puerto Rico, Instituto de Cultura Puertorriqueña; Report of the Dean of the School of Medicine/Memoria Anual del Director de la Escuela de Medicina Tropical (1939 1949), Columbia University Archives and Special Collections. (Note: From now on, the Report of the Director in Spanish (i.e."Memoria") will be referenced as follows: Director's name. STM Memoria del Director, Año Académico, Date.) In terms of the analysis of publications, information from 1926 to 1938 was compiled using the Collected Papers published by the School, where all publications of the faculty were included, and the data from 1939 to 1949 were obtained from the Director's Reports ("Memorias").
28. In general, these stages correspond roughly with the Stages of the STM Journal (local): the 1926-31 period corresponds with the first two stages

of the STM-Journal (from the Health Department Bulletin to a Transitional stage); the 1932-40 period corresponds with the third and fourth stages of the STM Journal (from the conversion into a Science journal to the transformation into a bilingual journal published solely by Columbia); and the 1941-49 last ratio period corresponds with the last stage of the STM Journal, characterized by the STM Local Editorship. Mayo Santana, The Puerto Rico Journal of Public Health and Tropical Medicine.

29. In this aspect, the term 'external' refers to publications in U.S. journals, and 'foreign' signifies other countries.
30. Mayo Santana, The Puerto Rico Journal of Public Health and Tropical Medicine.
31. Sedgwick WT. The origin, scope and significance of bacteriology. Science 1901; 13: 121. Bulloch W. The History of Bacteriology, New York; Dover Publications, 1938: Ch. VII-X. See also the interesting historical view of the sciences between the end of the 19th Century and the beginning of the 20th Century by: Hobsbawm E. The Age of Empire, 1875-1914; 1st Vintage Books ed.; New York; Vintage Books, 1989: 251. Ch. 10. Certainties undermined: The sciences: 243-261.
32. The list of Journals with lesser frequencies were: J Am Med Assoc (JAMA) (2 in second period and 4 in last period); J Am Pharm Ass (5 in last period); Am J Hyg (4 in 2nd period); J Nutr (4 in last period); Am Heart J (3 in last period); J Lab Clin Med (1 in 2nd period and 2 in last period); J Am Chem Soc (3 in last period); J Immunol Virus Res Exp Chemotherapy (3 in last period). The following journals had 2 publications each: Am J Med Sci, Arch Pathol, J Prev Med, Proc Helminthol Soc, Ann Entomol Soc Am, Oil & Soap, Arch Biochem, J Food Res, Am J Vet Med, Hospitals. Thirty nine external journals only had one article published by the faculty.
33. Proceedings of the Society for Experimental Biology and Medicine, the journal is described in Internet as: "the official journal of the Society since 1903, has continuously been among the leading peer-reviewed journals publishing interdisciplinary research. It publishes original research articles in all fields of biomedical research, with traditional emphasis on: nutrition; biochemistry; endocrinology; immunology". (https://www.researchgate.net/journal; 06/27/2017)
34. During the first period (1926-31), all six articles published were in the discipline of virology ("filterable viruses") by the STM director's, E.B. McKinley. In a sense, he opened this venue to the rest of the faculty. In the second era (1932-40) it mainly attracted the interest of bacteriology (P. Morales Otero, A. Pomales-Lebrón), with minor interest in parasitology (G.W. Bachman, J. Oliver-González, W.A. Hoffman), zoology (W.A. Hoffman) and nutrition (C. Krakower, J.H. Axtmayer). In the last period (1941-49), this journal received the highest preference from the faculty in all periods with 15 articles maintaining mainly the interest in bacteriology (including methodological articles) (A. Pomales-Lebrón, P. Morales Otero, L.M. González) and parasitology (J. Oliver-González) with a minor presence of zoology (I. Fox).
35. See the following specific summary of the data of articles published in the Proc Soc Exp Biol Med (34 articles). a) First period (6): Bacteriophage, E.B. McKinley & J. Cámara-2; E.B. McKinley & M. Douglas; Encephalitis, E.B. McKinley & M. Douglas; Aedes aegypti, E.B. McKinley & M. Douglas; Ultraviolet light, E.L. Scott, E.B. McKinley. b) Second period (13): Bacteriology (9): lymphangitis, P. Morales Otero & A. Pomales-Lebrón-3;lymphangitis, J.A. Pons; Brucella, P. Morales Otero & A. Pomales-Lebrón-3; Hemolytic s., P. Morales Otero & A. Pomales-Lebrón; Clostridium welchii infection, P. Morales Otero & A. Pomales-Lebrón. Parasitology (2): Trichinella spiralis experimental host, G.W. Bachman & J. Oliver-González-2.Chemistry/Nutrition (1): Vit. A, C. Krakower & J.H. Axtmayer. Methodology (1): Jacobson method, A. Rodríguez Olleros & R. Rodríguez Molina. c) Third period (15): Bacteriology/Methodology (4): Shigella, L.M. González & P. Morales Otero; Weil-Felix Rx, A. Pomales-Lebrón & P. Morales Otero; Brucella, P. Morales Otero & A. Pomales-Lebrón; Soluble BBP, L.M. González. Bacteriology (4): Hemolytic s., A. Pomales-Lebrón, P. Morales Otero & J. Baralt 3; Streptococcus, A. Pomales-Lebrón & P. Morales Otero. Parasitology (6): Ascaris, J. Oliver-González & E. Montilla; Schistosomiasis experimental, J.L. Brandt; Schistosomiasis tx., F. Hernández Morales & J. Oliver-González; Trichinella spiralis, J. Oliver-González & E. Bueding; (Malaria, Trichinosis experimental), J. Oliver-González 2. Zoology (1): I. Fox.
36. The official internet description is as follows: "'The American Journal of Tropical Medicine and Hygiene' is a peer reviewed journal published monthly by the American Society of Tropical Medicine and Hygiene (ASTMH). The Society is a nonprofit, professional organization whose mission is to promote world health by the prevention and control of tropical disease through research and education. It is among the top ranked tropical medicine journals in the world publishing original scientific articles and the latest science covering new research with an emphasis on population, clinical and laboratory science and the application of technology in the fields of tropical medicine, parasitology, immunology, infectious diseases, epidemiology, basic and molecular biology, virology and international medicine." (http://www.ajtmh.org/journal-facts; 06/27/2017)
37. See the following specific summary of the data of articles published in the Am J Trop Med Hyg (14). a) First period (2): Sprue, Ashford; Sprue, C. Weiss & F. Landrón. b) Second period (6): Leprosy experimental (1): M.H. Soule & E.B. McKinley. Chemistry/Nutrition (4): Vit. B, J.H. Axtmayer; Vit. A, J.H. Axtmayer & D.H. Cook; Nutrition in anemia, D.H. Cook & T. Rivera; Nutritional studies IV, D.H. Cook & J.H. Axtmayer. Parasitology (1): Hookworm, G.H. Bachman & R. Rodríguez Molina. c) Third period (6): Parasitology (6): antigen Filariasis, J. Oliver-González & Z.T. Bercovitz; chemotherapy Filariasis: I & II, J.T. Culbertson, H.M. Rose & J. Oliver-González 2; Schistosomiasis, F. Hernández Morales & J.F. Maldonado-2; Schistosomiasis, J.F. Maldonado & J. Acosta Matienzo.
38. An Internet description of the journal is: "Science, also widely referred to as Science Magazine, is the peer-reviewed academic journal of the American Association for the Advancement of Science (AAAS) and one of the world's top academic journals. It was first published in 1880, is currently circulated weekly and has a print subscriber base of around 130,000. Because institutional subscriptions and online access serve a larger audience, its estimated readership is 570,400 people. The major focus of the journal is publishing important original scientific research and research reviews, but Science also publishes science-related news, opinions on science policy and other matters of interest to scientists and others who are concerned with the wide implications of science and technology. Unlike most scientific journals, which focus on a specific field, Science and its rival Nature cover the full range of scientific disciplines." (https://en.wikipedia.org/wiki/Science_(journal); 06/27/2017)
39. See the following specific summary of the data of articles published in Science (13). a) First period (0). b) Second period (4): Climatology (1): Tropical storm, D.H. Cook & C. Cintrón. Leprosy experimental (1): C. Krakower & L.M. González. Parasitology (1): Parasitic anemia in PR, R. Rodríguez Molina & J.A. Pons. Primatology (1): Rhesus monkeys, C.R. Carpenter. c) Third period (9): Zoology (2): ants & Schigella, S.D. Grifitz; Lebistes reticulatus, J. Oliver-González; Chemistry (2): Bromelia, C.F. Asenjo & M. del C. Fernández; Ascorbic acid, W.I. Cherry, C.F. Asenjo & A.R. Freire de Guzmán; STM (2): present activities in collaboration Health Department, P. Morales Otero; Caribbean Research Council, P. Morales Otero. Sprue folic acid (1), T.D. Spies, R.M. Suárez Jr & F. Hernández Morales. Parasitology (2): operative Schistosomiasis, J.L. Brandt; Insect bites, W.A. Hoffman.
40. An Internet description of The Journal of Infectious Diseases is: "a peer reviewed biweekly medical journal published by Oxford University Press on behalf of the Infectious Diseases Society of America. It covers research on the pathogenesis, diagnosis, and treatment of infectious diseases, on the microbes that cause them, and on immune system disorders. The journal was established in 1904 and was a quarterly until 1969 when it became a monthly, then in 2001 it began biweekly publication. From 1904 to 2011, the journal was published by the University of Chicago Press". (https://en.wikipedia.org/wiki/The_Journal_of_Infectious; 06/27/2017)
41. See the following specific summary of the data of articles published in the J Infec Dis (12). a) First period (0). b) Second period (2): Veterinary (1): Brucella abortus, P. Morales Otero. Parasitology (1): Trichinella, J. Oliver-González. c) Third period (10): Leprosy experimental (1): C. Krakower, P.M.O. & J.H. Axtmayer. Parasitology (9): Dual antibody, J.

Oliver-González; Trichinosis, J. Oliver-González; antigen Ascaris, J. Oliver González; Trichinella, G. Wright & J. Oliver-González; Schistosomiasis experimental, C. Krakower, W.A. Hoffman & J.H. Axtmayer; Ascaris, J. Oliver-González; Animal parasites, J. Oliver-González; antigen Filariasis, J. Oliver-González & F. Hernández Morales; functional antigens, J. Oliver-González.

42. Esch G, Desser SS, Nickol B. A history of The Journal of Parasitology. J Parasitology 2013; 100 [DOI: 10.1645/13-326.1 Pub Med] Abstract: "The present issue is Number 1 of Volume 100, The Journal of Parasitology. All 6 numbers of this, our Centennial Volume, are dedicated to those in the past who have contributed in any manner to the Journal's success as a national and international broker for parasitology. Our essay on the history of the Journal is divided into three parts. The first extends from 1914 to 1932, i.e. 'the beginning', when Henry Baldwin Ward was Editor and owned the Journal. The 'middle years' continue from 1933, when Ward gave the Journal to the American Society of Parasitologists, to 1961. The 'current period' carries on from 1961 to the present, our Centennial year. Obviously, we cannot provide many more specific details for each era, but we have made an effort to identify some of the events/issues/people that have played a significant role in our Journal's history."
43. See the following specific summary of the data of articles published in the J Parasitol (10). a) First period (0). b) Second period (2): Parasitology (2): Schistosoma, A. Giovannola; parasites PR cattle, J.S. Andrews. c) Third period (8): Parasitology (6): Tamerlania bragai, J.F. Maldonado-2; Animal parasites, J.O.G.; Schistosoma, F. Hernández Morales & J.F. Maldonado; Schistosoma, J.L. Janer; a parasite of pigeons, J.F. Maldonado & W.A. Hoffman. Entomology (2): Borinquo laelaps, I. Fox; a new tick rats PR, I. Fox-2.
44. See also: Rabionet, The educational legacy of the UPR School of Tropical Medicine.
45. School of Tropical Medicine of the University of Porto Rico under the auspices of Columbia University. San Juan, Porto Rico, Published by University of Porto Rico and Columbia University, June 1926. Archives & Special Collections A.C. Long Health Sci. Library, Columbia University. Announcement 1926-27: 19-21. The 'tropical medicine and surgery' area consisted of four courses: tropical medicine clinic, surgery, bedside instruction and dispensary service. (Note: From now on, the Announcements will be referenced to as: 'STM Announcement', plus the Academic Session.)
46. STM Announcement, 1927-28: 20-23.
47. STM Announcement, 1929-30: 18-24.
48. STM Announcement, 1931-32: 3-32.
49. STM Announcement, 1934-35: 17.
50. Rappleye W.C. STM Report of the Dean for the period ending June 1934: 37.
51. Bachman G.W. STM Reports of the Dean for the periods ending June 1938: 31-33. First, the unit of Ultraviolet Solar Radiation was created with the death (in an automobile accident) of O.L. Fassig (1926-27 STM resident lecturer, U.S. Weather Bureau; 1934 and 1935 STM visiting professor, and research associate Blue Hill Meteorological Observatory, Harvard University. See: Rappleye W.C. STM Report of the Dean for the period ending June 1935: 55). Fassig's studies on solar radiation were continued by G.W. Kenrick of the Department of Physics, UPR Río Piedras Campus, and from now on they were reported separately under a unit named "Studies of Ultraviolet Solar Radiation." Second, 1938 was the effective initiation of the program of the "Santiago Primate Colonies," under the leadership of C.R. Carpenter of Columbia and M.I. Tomlin of the Philadelphia Zoological Society. That year, 409 Rhesus monkeys were released on Cayo Santiago island and 14 gibbons were added to the first group of nine brought in 1937.
52. See: a) Bachman G.W. STM Reports of the Dean for the periods ending June 1938, June 1939 and June 1941. b) Bachman G.W. STM Report of the Dean for the period ending June 1936: 20-21. In 1936, the project of Ultraviolet Solar Radiation was described separately, not as a unit, under the label, "Preliminary Studies in Tropical Physiology, Climate and Health," under the name of O.L. Fassig. c) Bachman G.W. STM Report of the Dean for the period ending June 1940: The project changed its name in 1940 to, "Division of Biophysics and Radiation Studies" under the 'directorship' of Kenrick. d) Bachman G.W. STM Report of the Dean for the period ending June 1941: In 1941 it dropped the division label, under the 'head'of Kenrick. In: Morales Otero P. STM Memoria del Director, Año Académico, 1943-44, the project no longer appeared. e) Kenrick GW, Del Toro G Jr. Studies in solar radiation and their relationship to biophysics and the general problem of climate and health. PR J Public Health Trop Med 1940;15:389-419. In this paper, the authors present a 'historical development of programs' at the STM that includes the following stages: 'Climatological Solar Radiation Studies initiated by Fassig,' 'Continuation and Extension of Studies' by Kenrick, and 'Some Related Publications,' which also mentions a paper by, Kenrick GW, Ortiz H. Measurements of ultraviolet solar radiation in Puerto Rico. Transactions of the A.G.U. (American Geophysical Union) (Section of Meteorology) April 1938; 38:134-140. On Fassig, they mention that "on retirement from active service in the San Juan office of the U.S. Weather Bureau in 1935, Dr. Oliver Fassig was appointed Visiting Professor of the School of Tropical Medicine and Research Associate of Blue Hill Observatory of Harvard University": 390.
53. Bachman G.W. STM Report of the Dean for the period ending June 1938: 33. Bachman G.W. STM Reports of the Dean for the periods ending June 1939: 33-35; this 1939 reports presents the story of the early plans and developments on the Cayo Santiago Primate Colonies.
54. The history of the Cayo "Santiago Primate Colonies" is an extraordinary narrative and has been very well documented, in particular by M.J. Kessler and R.G. Rawlins. See for example: Rawlins RG, Kessler MJ (eds.). The Cayo Santiago Macaques: History, Behavior, and Biology; Albany, N.Y.; State University of New York Press, 1986. Kessler MJ. Establishment of the Cayo Santiago Colony. PR Health Sci J 1989; 8:15-17. Kessler MJ, Rawlins RG. A 75-year pictorial history of the Cayo Santiago Rhesus Monkey Colony. Am J Primatol 2016; 78:6-43 (HHS Public Access).
55. Bachman G.W. STM Report of the Dean for the period ending June 1939: 5. The physiological clinical aspects of medicine presumably assumed at the STM by the internal medicine faculty of the Department of Clinical Medicine and the Hospital staff. In the fields of tropical nature and medicine, the general topic of human physiology appeared earlier in history associated with the controversial and highly ideological (e.g., climatic and racially tropical imageries) concept of 'tropical acclimatization.' In manuals of tropical medicine, the mention of environmental influences and human physiological effects usually occur in relation to both 'acclimatization' and 'hot climates' themes; see for example: Manson-Bahr PH (ed.). Manson's Tropical Diseases, 11th Ed.; Baltimore, Maryland; The Williams & Wilkins Company, 1943:10 19: a) on acclimatization it concludes: "... the general consensus of opinion is to the effect that the white man cannot long survive or multiply in a pure state in most tropical countries": 12; and b) on hot climates it says: "Observations have been made on the effects of tropical climates on body temperature, skin reaction, respiratory exchange, urinary excretion and the blood, with conclusions on the influence upon digestion, circulation, nervous system, generative organs and growth": 14. In the 1940 paper by Kenrick, Del Toro, Studies in solar radiation, the authors address the study of the influences of the physical world on health and disease at the STM as follows: "Cognizant of the importance of physical data for applications in the fields... and as a preliminary to the development of a biological program to study the effects of all the factors enumerated [i.e. solar radiation, temperature, precipitation, humidity, wind circulation, vegetation, ethnological characteristics, social development, etc.] the School of Tropical Medicine in 1935 engaged in the development of a Division of Biophysics to initiate work...": 389-390. An examination of publications by the STM faculty on physiology or biophysics revealed that few articles appeared in the STM Journal: Hanger FM. Diseases of the liver and spleen from the medical aspects. PR J Public Health Trop Med 1933; 8:255-268-a lecture delivered at the STM on 23 Nov 1932. Martínez Álvarez A. Apparent points of contact between the daily course of the magnetic components of the earth with certain solar elements, and the diastolic pressure of human beings and the total amount of leucocytes. PR J Public Health Trop Med 1935; 10:388-395. Coblentz WW. The evaluation of ultraviolet radiation for use in medicine. PR J Public Health Trop Med 1935;

11:1-25-a lecture delivered at the STM on 7 Feb 1935. Kenrick, Del Toro, Studies in solar radiation. And very few in external periodicals (e.g. from 1926-1940): Scott EL, McKinley EB. Effect of ultraviolet light upon genus Trichophyton. Proc Soc Exp Biol Med 1930;27:598-599-effect on fungi infection. Cook DH, Cintrón C. An odd occurrence following a tropical storm. Science 1932: 76:541-mostly physical effects. Kenrick, Ortiz, Measurements of ultraviolet solar radiation in Puerto Rico.

56. Bachman G.W. STM Report of the Dean for the period ending June 1939: 23-25.
57. STM Announcement, 1945-46: 46-48. The departmental course retained its original label of Tropical Medicine and Surgery in the curriculum until the last available announcement (1945-46).
58. Bachman G.W. STM Report of the Dean for the period ending June 1940: 5-6; the report states that the source of the funds for maintaining the Department of Public Heath was an appropriation granted to Puerto Rico under the National Social Security Act. Also, it mentions that: "the establishment of this new division of studies is the culmination of years of careful planning." Bachman G.W. STM Report of the Dean for the period ending June 1941: 27 29; this 1941 report also mentions that the new Department of Public Health was headed by A.V. Hardy, an Associate Professor from DeLamar Institute of Public Health of Columbia University, who was "assigned to the School." In addition to these official reports' statements concerning the establishment of the Department of Public Health in 1940, some further historical clarifications are needed on the nature of the Public Health academic program at the STM: a) the discipline and the academic program (i.e., curriculum, faculty, and students) were present at the School since its foundation, as announcements, lists of staff, academic reports, and period photographs showed; b) in a sense, the HD and its leadership functioned during the first two scientific eras as the actual organizational unit of the discipline; and c) the STM Collected Papers (1926-38) display the oblique or cryptic departmental presence not only of public health but also of a medical discipline such as physiology that never had a formal department at the School but that at least it had a temporary division of biophysics during this period of time. Volume I (1926-1927-1928) of the Collected Papers sets of publications, which was organized by departments, included a nominal Department of Public Health, but the authors of the only two listed publications were in fact not faculty members of the STM-one came from Columbia University and the other was from the HD. Volume II (1929) was not departmentally ordered. In Volume III (1930), the names of a Department of Tropical Physiology appeared with publications from members of the biophysics division (on climatology and solar radiation studies) and of a Department of Public Health with only one publication by a HD staff. In Volumes IV (1931), V (1932), and VI (1933) which were organized by departments (i.e., Bacteriology, Chemistry, Mycology/Dermatology, Medical Zoology, Pathology, and Clinical Medicine), the departmental name of Tropical Physiology was included but not that of Public Health. In Volume VII (1934) neither public health nor tropical physiology, or even mycology/dermatology, did come into view. The name of public health will not appear again as a department. Tropical Physiology became again visible in Volume VIII (1935) and Volume XI (1938). Volumes IX (1936) and X (1937) did mention a Department of Administration. Interestingly, in the last two volumes of the collection, Vol. X (1937) and XI (1938), there is a heading with the label of 'Department of Bacteriology and Hygiene' but with only one publication in 1937 that included as authors a School's bacteriologist and members of the P.R. Reconstruction Administration Health Division. It seems that in the Collected Papers the disciplinary authorship of publications was the basic criterion for the inclusion of a public health cryptic departmental presence.
59. STM Announcement, 1941-42: 20-24. STM Announcement, 1944-45: 30-41. STM Announcement, 1945-46: 28-42. Rabionet, STM The educational legacy: 129.
60. Bachman G.W. STM Report of the Dean for the period ending June 1940: 24-26.
61. Morales Otero P. STM Report of the Dean for the period ending June 1943: 32-37. The Clinical Medicine department also appointed a research associate in chemistry assigned to it, which mainly supported clinical research.
62. STM Announcement, 1929-30: 7.
63. STM Announcement, 1944-45: 3-7. This variety seems to be forced by both the educational expansion of public health training at the School and the development of the services at the University Hospital. Included in the 1944-45 lists: a) Officers of Instruction (STM faculty); b) Honorary Appointments of the Special Board of Trustees in the Department of Public Health of the STM (Public Health Nursing, staff n=3; Public Health Practice, n=19; Sanitary Science, n=9); c) Administrative Staff of the STM and of the University Hospital (n=9); and d) under the heading of the STM, University Hospital, Medical Staff (Resident, n=6; Attending, n=28; Consulting, n=14; Courtesy, n=21; and Medical Board, n=9).
64. Bachman G.W. STM Report of the Dean for the period ending June 1938: 24.
65. Morales Otero P. STM Report of the Dean for the period ending June 1942: 25.
66. Morales Otero P. STM Report of the Dean for the period ending June 1946: 32.
67. Morales Otero P. STM Report of the Dean for the period ending June 1948: 27.
68. STM Announcement, 1945-46: 26.
69. STM Announcement, 1941-42: 17-19.
70. Morales Otero P. STM Report of the Dean for the period ending June 1943: 39-41. Besides its services of plasma production for the Armed Forces (from their own donors) and blood transfusions for the hospitals on the Island (during difficult hours), the unit engaged in research of an 'experimental nature,' such as "preparation of immune plasma from cases of Weil's disease used therapeutically at the University Hospital."On the Blood bank, in: Morales Otero P. STM Report of the Dean for the period ending June 1942: 6, there is mention that it "functions under an advisory board appointed by the Director of Civilian Defense," and the board is composed of 7 members representing: Civilian Defense, U.S. Armed Forces in P.R., U.S. Public Health Services, P.R. Medical Association, P.R. Hospital Council, Insular HD, and STM. For a related history, see also: Rigau Pérez JG. Caridad, nacionalismo y colonialismo: Los orígenes de la Cruz Roja en Puerto Rico, 1893-1917. Historia y Sociedad 1993; 6:55-80.
71. Morales Otero P. STM Report of the Dean for the period ending June 1948: 24 26.
72. STM Announcement, 1946-46: 26.
73. Bachman G.W. STM Report of the Dean for the period ending June 1941: 27 29.
74. Morales Otero P. STM Report of the Dean for the period ending June 1944: 45 47.
75. Morales Otero P. STM Report of the Dean for the period ending June 1945: 37. This report stated: "After consulting the Columbia members of the Special Board of Trustees, the name of the department... was changed to that of 'Department of Hygiene' and, as such, will be known from now henceforth." In a 1964 article on 'public health progress in Puerto Rico', Arbona mentioned the following: "In 1940 a department of public health was created in the School of Tropical Medicine, and training of public health personnel was started. More consideration was then given to the best way to face the public health problems of Puerto Rico" (pp. 41 42): Arbona G. Public Health progress in Puerto Rico. Public Health Reports (1896 1970) 1964; 79:41 44. Hygiene is an ancient and broader notion, and it always has included both personal/home and environmental/occupational aspects of health. The public health notion historically is more related to community public services (e.g. state) and, using Rosen's words, to an "endeavor to project hygiene from a personal to a public plane" (p. 119): Rosen G. A History of Public Health, Expanded Ed.; Baltimore and London; The Johns Hopkins University Press, 1958; 1993: 6 25; 119. The modern tradition of hygiene includes improved public services infrastructures and sanitary measures, as well as improved social conditions, health services and advances in medicine: Stanwell Smith R. The infection potential in the home and the role of hygiene: historical and current perspectives. Int J Environ Health Res 2003; 13:S9-S17.
76. Arbona, Public Health progress in Puerto Rico: 41 42. According to Arbona (1964), since the creation of the department of public health in 1940

and the start of public health training at the School, "more consideration was then given to the best way to face the public health problems of Puerto Rico" (p. 42). In terms of conceptual history, at least, it signifies that hygiene was considered a fundamental concept (the whole) and public health a subsumed one (a part): Koselleck R. The Practice of Conceptual History. Timing History, Spacing Concepts (Presner TS and others, transl.); Stanford, CA; Stanford University Press, 2002: 20-37. See also: Rosen, History of Public Health. Duffy J. The Sanitarians: A History of American Public Health; Urban and Chicago; University of Illinois Press, 1990; 1992: 175-192. Bashford A. Imperial Hygiene: A Critical History of Colonialism, Nationalism and Public Health; New York; Palgrave Macmillan, 2004. Dawson A (ed). The Philosophy of Public Health; Surrey, England; Ashgate Publishing, 2009. However, regardless of general philosophical and historical meanings (Dawson, Duffy, Rosen), it is interesting to note that the departmental hygiene re-conceptualization implicates going backwards semantically to a time when the STM'sprecursor, the ITMH, included in its name the dual notions of tropical medicine and hygiene.

77. Darrach W. The object and outlook of the School of Tropical Medicine. Porto Rico Health Rev 1926; 2:3 6. Quotations: a) "What is the object of the School of Tropical Medicine? It can briefly be stated as the study and teaching of the physical and mental ills of mankind as they occur in the tropics." b) "...the School of Tropical Medicine is essentially a place for study..."c) "This spirit of research, this desire for the truth is the great, overwhelming, essential quality for the staff of a modern school": 4.
78. Lambert RA. Preliminary Report of the Director of the School of Tropical Medicine of the University of Porto Rico, 1926-27. Porto Rico Health Rev 1927;2:3 8.
79. Lambert, Preliminary Report of the Director, 1926 27: "Research requires not only laboratory equipment, but most important of all, trained men with time for work and contemplation. Little… can be expected from busy clinicians or public health workers, fully occupied with routine duties...": 7.
80. STM Announcement, 1926-27: 5. Robert A. Lambert (MD 1907 Tulane, Pathology 1908 John Hopkins). Lambert was an international expert coming from the University of Sao Paulo, Brazil, where he was sponsored by the Rockefeller Foundation; he had previous ties with Columbia, 1909-1918. STM Announcement 1926-1927, Historical Note: 11.
81. STM Announcement, 1926 27: 5, Historical Note: 12. D.H. Cook (PhD 1923 Columbia) who was Assistant Professor of Chemistry at the University of Montana received the same appointment at the School; a short time later, William A. Hoffman (DSc 1924 Johns Hopkins) was appointed Assistant Professor of Parasitology.
82. STM Announcement, 1926-27: 5-6. The areas of medical science represented by Ashford, tropical medicine and mycology, were not merely an accidental personal attribution; both proved to be productive for medical research and education. Symbolically, they were examples of the types of the research work carried out at the ITMH. The academic presence of the Health Commissioner could be considered merely convenient and instrumental, but hygiene and public health would prove to be durable and indispensable assets. Instructors represented either local expertise in disease prevention and control (plague, uncinariasis, and malaria), or in public health engineering and rural sanitation, or in medical basic and clinical sciences (clinical pathology, tropical medicine, transmissible diseases, hygiene, chemistry, and epidemiology)-all were MDs, 12 were U.S. trained, and there were two exceptions, from Havana and Seville.
83. A Biological Laboratory for public use was not established because it was already a service well provided by the Health Department, but bacteriological laboratory analysis was an essential research tool within the School. Lambert, Preliminary Report of the Director, 1926 27: 5.
84. STM Announcement, 1926-27: 6-7. First resident lecturers were: (U.S.) Tropical Food Plants (O.W. Barrett, Agricultural Advisor), Tropical Botany and Plant Pathology (Melville T. Cook, Experiment Station), Tropical Climatology (O.L. Fassig, U.S. Weather Bureau). (Local) Diseases of Domestic Animals of P.R. (Jaime Bagué, Assistant Commissioner of Agriculture), Tropical Surgery (Rafael López Nussa, St. Luke's Hospital, Ponce), History of Medicine in P.R. (Manuel Quevedo Báez).
85. Mayo Santana, Rabionet, Peña Carro, Serrano, Marvels and Shadows.
86. Sepúlveda Rivera A. San Juan: Historia Ilustrada de su Desarrollo Urbano, 1508-1898. San Juan; CARIMAR, 1989: "San Juan es una de las capitales caribeñas mejor representadas en la cartografía e iconografía de todo el continente americano": 1.
87. Ramírez de Arellano, AB. From Document to Monument: The School of Tropical Medicine of the University of Puerto Rico. PRHSJ 2009; 28:140-142: "... like a precious stone set with minimal support, the new School's unique site exposed its presence to all who passed": 141.
88. According to B.K. Ashford, it seems that he was the scientific mind behind the design of the building: Ashford, A Soldier in Science: 35. However, for an ample history of the UPR architecture and the controversy generated at the time on the "Spanish Mission Style", see: Moreno ML. La Arquitectura de la Universidad de Puerto Rico; San Juan, P.R.; Editorial de la Universidad de Puerto Rico, 2000: 26-65.
89. O'Connor F.W. Diary of a Porto Rican Trip. In: Mayo Santana R, Ramírez de Arellano A.B., Rigau-Pérez J. (eds.). A Sojourn in Tropical Medicine: Francis W. O'Connor's Diary of a Porto Rican Trip, 1927; San Juan, Puerto Rico; La Editorial, Universidad de Puerto Rico, 2008: 19. See also the following singular description: "The three-story building... is delightfully situated on the main boulevard which connects the old city proper of San Juan with the new city. It stands on one side of the small park which surrounds the new capitol, and the rear of the building overlooks the sea, which is less than three hundred feet away": 7; In: The Second Session of the School of Tropical Medicine of the University of Porto Rico. Porto Rico Rev Public Health Trop Med 1927; 3:6-12.
90. Ashford, A Soldier in Science: 362.
91. Ramírez de Arellano, From Document to Monument: 141.
92. Ramírez de Arellano, From Document to Monument: "And its continuing aura will be as memorable as the classrooms that resemble dovecots, and the site which 'combined the beautiful and the practical' [Francis W. O'Connor] in a unique medical citadel": 142.
93. As already mentioned, the original ITMH facilities were deemed unsatisfactory for the needs and standards of a main metropolitan university center. It was not that ITMH did not have the basic facilities of a modern medical scientific enterprise; in particular: good library resources, several biological laboratories, and the use of animals for experimental research, as well as the intensive use of field expeditions which was at the time an indispensable strategy in the field of tropical medicine. As we mentioned before, "their work focused on three core aspects: research expeditions in rural areas, experimental trials of various laboratory tests, and strategies aimed at training health professionals, particularly health officers and inspectors. They dedicated three months to perform field studies, three to educate health personnel, and four to do research analysis and laboratory studies."Mayo Santana, Peña-Carro, Rabionet, The historical antecedents: 56 57.
94. See: Mayo Santana, Rabionet, "They could not accept a master"-Bailey K. Ashford. Conflictos en la fundación de la Escuela de Medicina Tropical. Mayo Santana, Rabionet, Peña Carro, Serrano. Marvels and Shadows. Rabionet, The educational legacy.
95. STM Announcement, 1926-27: These laboratories could accommodate from 10 to 15 students, providing "ample opportunity for extensive laboratory work". Also, "quarters for animals are provided in a one-story structure to the rear of the laboratory building": 13.
96. The Second Session of the School of Tropical Medicine: 7. Darrach W. Columbia University. Bulletin of Information. Thirty- first Series, No. 12, 20 Dec 1930. Report of the Dean of the School of Medicine for 1930. New York; Morningside Heights: 84-92: 84. (Note: From now on the Reports of the Dean from different years will be referenced as: "Dean's name. STM Report of the Dean for..." plus the year.
97. The Second Session of the School of Tropical Medicine. Initially, clinical instruction was offered in the Quarantine Hospital (40 beds, 5 minutes distant), Presbyterian Hospital (80 beds, 10 minutes), and "Leper Hospitals" (50 beds, 30 minutes); other hospitals available were the San Juan Municipal Hospital (150 beds) and the Insular Anti-tuberculosis Sanatorium at Río Piedras (200 beds). The Díaz García Clinic and the Auxilio Mutuo ("Spanish Hospital") offered to cooperate in providing clinical and pathological material. The Hospital de Asilo de Damas of Ponce was the first institution outside of San Juan that was invited to be affiliated: 7- 8.

98. The Second Session of the School of Tropical Medicine: 8. "Field work may be carried on in any part of the Island at any time with the assured cooperation of the Department of Health." Interestingly, this cooperation included health officers with experience in the control of uncinariasis and malaria that served as instructors at the School.
99. Mayo Santana, Peña Carro, Rabionet, The historical antecedents. Santos Corrada, El desarrollo de la idea.
100. a) Darrach W. Report of the Dean of the School of Medicine for 1930: 85. Two new professors from Columbia: parasitologist George W. Bachman, a future director, from Johns Hopkins, and pathologist Hans Smetana from the University of Vienna. Three local physicians became staff members, two of them future directors: pathologist E. Koppisch, who spent a year in Columbia; medical bacteriologist P. Morales Otero, who spent the next year at Columbia with the support of the Rockefeller Foundation; and A.L. Carrión, who joined the School as an instructor in bacteriology but spent some time in Columbia training in dermatology, also with the support of the Rockefeller Foundation. b) Darrach W. Report of the Dean of the School of Medicine for 1930: 84. The opening of the 'San Juan District Hospital' adjacent to the School, administered initially in collaboration with the HD, was considered one of the "outstanding events"; but the report also noted that the hospital was transferred to the UPR in 1930 and became the 'University Hospital of the STM.'
101. Mayo Santana, School of Tropical Medicine Journal: 185.
102. For this conceptual exercise, the verbatim definitions (in parenthesis below) from the Dorland's Pocket Medical Dictionary, 23rd Ed; Philadelphia; W.B. Saunders Co., 1982, were used. The correlated disciplines with the highest conceptual fluidity were: a) medical zoology (biology of animals) and parasitology (the scientific study of parasites and parasitism); b) mycology (the science and study of fungi) and dermatology (the medical specialty concerned with the diagnosis and treatment of skin diseases); c) tropical medicine (medical science as applied to diseases occurring primarily in the tropics and subtropics) and clinical medicine (the study of disease by direct examination of the living patient); and d) hygiene (science of health and its preservation) and public health (the field of medicine concerned with safeguarding and improving the health of the community as a whole).
103. Long ER. A History of Pathology, 2nd Ed; New York; Dover Publications, 1965: 187.