TROPICAL MEDICINE

The Social Factors Affecting the Diffusion of Parasitology to Puerto Rico and Hong Kong

RODRIGO FERNÓS, MA*.

This study seeks to understand the role played by social factors in the diffusion of parasitology to Puerto Rico, in particular those affecting the work of Bailey K. Ashford between 1898-1934. Most studies of Ashford to date focus mainly on the intellectual framework per se, and rarely on the surrounding social environment. In order to achieve this aim, Ashford's experiences were contrasted to those of Patrick Manson in Hong Kong and China between 1866 and 1889. By undertaking this comparative approach, it became clear that social factors more significantly affected the advancement on their respective investigations than intellectual ones. Manson simply did not have the political and financial support needed to develop his work, hence greatly delaying the establishment of a research institute in Hong Kong, or China for that matter. By contrast, Ashford achieved a great deal of popular and congressional support, thereby enabling him to establish a research institution early in the century. Relevant social factors included: cultural differences, their history of colonial relations and the local economy.

Keywords: Tropical medicine, Parasitology, Filariasis, Uncinariasis, Patrick Manson, Bailey K. Ashford, United States, England, Puerto Rico, China, Hong Kong, Spain.

Two men, both equally wise, honest, and capable, may have diametrically opposite views on almost any subject.... Everything depends on the respective standpoints they view it from. As between European and Chinese, the principal difference affecting their respective judgements is antecedent education—using the word in its widest sense. Education in this sense is very much a matter of birth, a thing we cannot control.

Patrick Manson, 1887

The spread of parasitology outside the Western world did not occur in an even fashion. Although introduced into Hong Kong at a much earlier date than Puerto Rico, an institution dedicated to its practice was established in the Chinese island a quarter of a century later than in the "isla del encanto". In fact, Dr. Jose Oliver Gonzales at Puerto Rico's School of Tropical Medicine was already making contributions to the science as China's first Institute of Parasitic Diseases was being formed in 1950. (1) Even during the 1960's, while there was a strong resistance to Western Medicine in China during Mao Tse Tung's heavy reliance on local 'barefoot' doctors, an even larger institutional complex had already been established in Puerto Rico, housing a vast array of modern medical research. (2, 3) These examples stand in sharp contrast to the usual rates of scientific diffusion of Latin America and Asia, the second usually leading the first. (4, 5)

The difference in the rates of scientific diffusion between the two regions can be better understood by looking at the experiences of their first practitioners. Bailey K. Ashford and Patrick Manson were metropolitan physicians who had traveled to the colonies as a result of military exigencies, the first to Puerto Rico in 1898 and the second to Hong Kong in 1866. (6, 7) Yet, while Ashford chose to remain in the island until his death in 1934, Manson left in 1889, never to return. An examination of the two cases reveals that while cultural and political stimuli did much to boost Ashford's legitimacy in Puerto Rico, Manson received very little of that social support needed to continue his research. Manson's departure is hence both a cause and an effect of the slow growth of parasitology

* Independent Scholar.

Address for correspondence: Rodrigo Fernós, 165 Ave Hostos #226, Hato Rey, PR 00918 (787) 763-3781.

in China—inhibiting its development but also being affected by factors which would long continue to influence the Chinese intellectual landscape. Inversely, Ashford's continued presence in Puerto Rico not only stimulated the island's acquisition of modern science, but also demonstrated the existence of preexisting factors beneficial to its development.

Sir Patrick Manson

Patrick Manson has long been regarded as the 'father of tropical medicine' because he pinpointed that first link in the vector transmission of elephantiasis, although he was not able to discover the entire life cycle of the disease. (8, 9, 10, 11, 12) While working in Amoy, he noticed that the number of filarial eggs in the bloodstream exponentially increased at night, even after the person's sleeping pattern was altered. He then realized that the disease was transferred from the patient to night flying insects upon biting of the patient, and thus that the insect also 'suffered' from the illness. Manson, however, wrongly believed that the disease was then retransmitted to another human victim via the laying of eggs in stagnant water, which the victim then unknowingly acquired—an understandable idea given Chinese water practices. The last link in the cycle was finally identified in 1898 by Manson's independent protégé, Ronald Ross, while also doing work in China. (13) These studies resulted in the creation of Manson's textbook, *Manual of Tropical Diseases,* which Ashford used while analyzing a different tropical illness in Puerto Rico. (14)

Although Manson lived a life of relative prosperity in China, he did not have the cultural and political power necessary to establish a full-fledged research program in tropical medicine. Despite the fact that Hong Kong was under British control, the political regard for empire as a whole had been under wane during the second half of the nineteenth century. Perceived as costly and burdensome, there was much popular opposition to a consequent expansion as voiced in England by local politicians as Gladstone during the 1860's and Disraeli in the following decade. (15) China's share of trade with England was also minor visa vie other international relations, and that which existed (opium) constituted a source of conflict between the two nations. During Manson's stay, Hong Kong was ruled by an ineffective governor, John Hennesy, who favored Chinese counsel above that of his own national peers. To complicate matters further, Western science hadsometimes been tainted by overtones of cultural domination in previous centuries. (16, 17) The local medicine which did exist was so influenced by humoralism, that any attempts of its reform were gravely rejected. The Chinese would remain Chinese, regardless of how ineffective their practices might be; to do otherwise would be to submit to a form of cultural imperialism, according to the Chinese perspective.

The intellectual and cultural conflict with the predominant Chinese population of Hong Kong were also prominent—a problem greatly affected by the deeply rooted humoral medicine of China. (18, 19, 20, 21) Manson's biography is full of references of such conflicts. Believing that the body should remain intact, the Chinese did not allow postmortems and violently objected to them. While Manson was performing one, "a mob gathered outside, curious to know what the 'foreign devils' [Manson and assistants] were doing, and the outcome was that the 'foreign devils' had to run for their lives." To do medical research, Manson was forced to either work with animals or illegally in cemeteries (7). So great was the distrust, even from patients who had purposefully sought his help, that Manson had to move his practice to the house's bottom floor near the street for all to observe and thus ease his doctor-patient relations.

In order to gain local patients, many Western practitioners were forced to bring along with them a cured Chinese patient who would testify as to the doctor's merits. Breaking Chinese norms of proper etiquette could also be a source of mistrust. "Correct behavior, whether at court, in the market-place, or in the seclusion of private life, is regarded...of such extreme importance....breaches of impropriety in this sense area always severely frowned upon." (22, 23, 24)

In a lecture made at the founding of the Hong Kong College of Medicine, Manson said,

> Those who have been even but a short time in the country know what a wretched thing native medical science is....The notions on Anatomy and Physiology are absurd; there is no Surgery worthy of the name...Hygiene is unknown....We find in them the same spirit of artificial classification, the same love of a 'system' that characterized the pre-scientific era in European medicine....every article of food, of drink, and every medicine is classified according as it is considered a heating or a cooling thing... (7)

Although humoralism was also pervasive in Europe—a factor which led to the initial rejection of Manson's ideas in England—its Oriental version was much more deeply tied into Chinese society and social structure. In the latter, the distinction between science and politics was blurred, thereby enabling the ruling elite to publicly equate challenges to intellectual authority as challenges to their political power. Physicians became physicians not by studying medicine, but rather by studying philosophical texts outlining the social and natural world order; those

who excelled became government leaders, those who did not became doctors. It was a situation compounded by the low rates of education; as late as 1949, only 23% went to primary school, and of these only 2% to secondary school. (2, 18)

These social dynamics are also revealed in the troubles which native intellectuals had in reforming their society, as demonstrated by the case of a Chinese student of Manson's, Sun Yat Sen. (25) Since persistent critiques of political authority would have led to unduly harsh punishments, the most plausible manner in which to reform society was by directly attaining political power—personal outcomes which stood in sharp contrast to Ashford's students. Although forced into exile in England in fear of his life, Sen persisted to eventually become China's president in 1911.

As he explained, neither the public nor much of the ruling elite, understood the role played by science in the establishment of national sovereignty. "The so called modern-living, as well as powerful armies and navies, comes from the development of science...What we should learn from the West is not political philosophy but science." (26, 27) It was not then commonly understood that attaining scientific knowledge of the natural world was difficult, and hence an enterprise needing state and popular support. The public philosophy was perhaps best epitomized by the saying, "knowledge is easy while action is hard." As Sen wrote,

> The modern Chinese, or shall we say the majority, treat the foundations of knowledge with contempt and value action highly. This is not quite justifiable....In our age of science we must know how to value knowledge as well as performance.... Consequently, there is no public opinion [in China] leading civilization along the path to progress. (25)

It is unlikely that a foreigner as Manson, with less time available, would have been able to establish reform more quickly.

While it might be pointed out that the island where Manson practiced and did research was not ruled by the Chinese but rather by the British, the Chinese constituted the majority of the population, and its British rulers were none too effective. John Pope Hennesy had been appointed governor of Hong Kong between 1877 and 1898 only as a political favor. His leadership was so poor, that his previous posts in Africa and the Caribbean had left, "[a trail of] unhappy civil servants..and disgruntled colonists." One commentator noted that Hennesy, "had grossly mismanaged every government he has been entrusted with." In the medical realm, he had opposed the installation of sewage facilities in the city, and the water-closets in the hospital, as well as the inspection for venereal disease. Since Hennesy preferred to heed the advice of Chinese counselors, Manson's opportunities for political influence could best be described as pessimistic. (28)

The social conditions in which Manson lived also seem to have been none too pleasant. The legal and political circumstances created by the British colony in Hong Kong stimulated the exodus of the criminal underclass to the island. Although the island was barren rock when the British first established a colony, the population quickly grew from 4,350 in 1841 to 248,498 by 1895, of whom only 4.3% were of European descent. (29, 28) Because the Chinese law was so harsh in its punishment, including such cruelties as amputation and flogging, the British tradition of incarceration was a tremendous respite by comparison. The opium trade between England and China, which as early as 1835 had generated $18M for England, also encouraged the migration of this underclass. (30, 31) Living conditions were commented on by James Cantlie, Manson's close colleague both at the Alice Memorial Hospital and the medical college in Hong Kong. "When the Chinese began to swarm into the colony, the Europeans were gradually driven to the higher levels of the city; but as the years passed, the encroachment of these undesirable neighbours became so acute, that other places of the colony were sought after as suitable residences for Europeans." Others observed that the "shelter and protection afforded by the presence of our fleet soon made our shores the resort of outlaws, opium smugglers, and indeed, of all persons who had made themselves obnoxious to Chinese laws." (29)

Surprisingly, the colonial value of Hong Kong, or China for that matter, was relatively low, further inhibiting the political climate which Manson operated under. Although Britain controlled 75% of Chinese trade in 1895, and the latter had a vast potential economic market of 400 million people, China never became its significant trading partner in the nineteenth century. (30,31) Belgium, for example, had a larger share of British trade than China. In contrast to other colonial regions, only 7.5 million pounds were traded with China while 29 million was exchanged with India. Sir Robert Hall aptly commented that "the Chinese have the best food in the world, rice; the best drink, tea; and the best clothing, cotton, silk, and fur....they do not need to buy a pence's worth elsewhere." China's widespread proverty, however, also played a significant role. The British were affected by a complex number of concerns: overextending their empire outside of India, China's self-sufficiency, European competitors, and the country's size and instability, which hindered proper control. (32, 29)

As Robinson and Gallager wrote in their studies of imperialism, "The type of political lien between the

expanding economy and its formal or formal dependencies, as might be expected, has been flexible. In practice it has tended to vary with the economic value of the territory, the strength of its political structure, the readiness of its rulers to collaborate with British commercial or economic purposes..." (33) Hence China's economic insignificance and political animosity would render informality and minimalism to England's colonial policy in the region for most of the century—to the detriment of its colonials as Manson residing on the periphery.

Bailey K. Ashford

The intellectual and political climate in which Bailey K. Ashford lived could not have been more different. Although there was a strong and persistent strain of humoralism in Puerto Rico, it showed a sign of weakening and did not have the same political overtures as that which the *Huang Ti Nei Ching (Yellow Emperor's Manual of Corporeal Medicine)* of China possessed. Despite the fact that both societies were at the time predominantly agricultural, the high predominance of hookworm in Puerto Rico meant that its cure would have tremendous social repercussions in the Hispanic society—in contrast to the relatively low presence of filariasis in China. If the problems afflicting modern science in China would continue long after Manson's departure, Ashford's success would have the opposite effect in helping to cut Puerto Rico from its intellectual past. The cumulative effect of these and other factors was to create a state that would much more strongly support the scientific enterprise—even after its colonial relations to the United States were redefined in 1952. (34, 35, 36, 37, 38) The torch of science would be passed down; Ashford's native students would become scientists rather than political revolutionaries. This dynamic, in turn, would also continue to build on the island's historical pattern of social stability, necessary for the continued progress of science in the island.

Ashford's story is well known. (39, 40, 41, 42, 43, 44, 45, 46) Traveling to the island in 1898 as a result of the Hispanic-American War, Ashford discovered that the cause of the malignant anemia was not the local diet but rather a local worm. The vector cycle had been fairly easy to establish. Making stool analyses, he discovered that field laborers spread and maintained the disease in an endemic state by excreting under the shade of the same coffee trees they worked under. Ashford then began treating his patients with thymol in a campaign that quickly mushroomed from 15 patients a day to 600. After the Porto Rico Anemia Commission was established in 1904, field hospitals virtually eliminated uncinariasis, which had affected nearly 75% of the working population. (47, 48, 49, 50, 51) After this successful campaign, Ashford soon thereafter became a local hero, married a local woman, and eventually received funds by the local government for his own research institution in 1926: The School of Tropical Medicine. Sought after throughout the world, he took part in the Rockefeller Institution's study of tropical diseases in Latin America. Ashford had become a valiant "soldier in science"—despite the fact that he made few genuine scientific discoveries per se.

Yet the keys to Ashford's victory, which ultimately amounted to the successful diffusion of modern medicine to Puerto Rico, are to be found in the political and intellectual environment he operated under. This environment proved highly amenable to the successful completion of his work; had it been otherwise, it is unlikely his name would likely not have been as prominently recorded in the history books.

Humoralism has long been present in Latin America, and would continue to be so throughout the 20th century. (52, 53, 54, 55, 56, 57) Yet its presence in Puerto Rico appears to have been weakened by a certain distrust of local physicians. The same distrust which Manson had experienced with his Chinese patients to some degree existed between Puerto Rico's 'jibaro' population and its Spanish-trained physicians referred to as 'leidos'. Local physicians neither had complete organizational control over medical institutions, nor did they have a monopoly on medical practices as many patients turned to African curanderos for treatment. More importantly, there existed a certain empiricism in the ignorant agricultural community which helped it question the erroneous claims of Spanish physicians. The untutored judgement of the jibaro suffered less bias and was hence more "scientific" than that of many local physicians who attributed the illness to a thinning of the blood and consequently ordered their patients to tortuous 'cures.' As Ashford observed, the pedal dentritis first associated with hookworm was noted by jibaros themselves who appropriately called it 'culebras' (snakes). "The sharper ones accuse their annual dermatitis of being the cause of their infirmity [anemia, as opposed to explaining it on the basis of]...improper and insufficient food." (48) Although much of the population was ignorant as the Chinese—in 1899 only 16.6% of the population could read, and less than 2% had any training above primary school—this ignorance took on a different form in Puerto Rico. (58) It promoted the questioning of cultural biases rather than their reinforcement, as had been the case in Hong Kong.

This is not to say that all jibaros were entirely free from the taint of humoralism. As Ashford also noted, "The jibaro is equally superstitious and very quickly impressed by a supernatural explanation of any phenomena he can not

understand. The more outlandish the explanation of a disease the better he likes it..." Anthropological studies done in the island in the 1950's, and of Puerto Ricans living in New York City in the 1970's revealed strong humoral outlooks. (59, 60) Nonetheless, we may note that, in contrast to Hong Kong's cultural outlook, humoralism had been greatly weakened, possibly affected by the particular character of its economy. Since coffee made up 41% of all agricultural production in 1899, it may have also played a role in the development of this outlook. It has been argued that the coffee economy, like tobacco, engenders a much stronger 'independent' outlook than that of the slavish sugar economy. (61, 62, 63)

Another aspect to the decay of humoralism was that of the advancement of Spanish medicine at the turn of the century. Although Spain would remain scientifically backward throughout much of the century, the small funds necessary for scientific work in areas as bacteriology and histology meant that persistent men could make new contributions as Santiago Ramon y Cajal and Jaime Ferran (64). Ramon y Cajal had been awarded the Nobel in 1906 for his work in neurology, while Ferran was distinguished for his 1889 studies on rabies, which gained favorable recognition by Pasteur and won the Le Prix Breant in 1907. Both men, curiously, worked in Barcelona. Cajal was Chair of the Histology Section of the University Medical School until 1892, and Ferran had led the "Laboratorio Microbiologico Municipal" of Barcelona most of his life. (65, 66, 67, 68)

This unusual scientific advancement in certain sectors of Spanish medicine is important because many Puerto Ricans obtained their medical education there, as had traditionally been done during the Spanish colonial period. Two central Puerto Rican figures who worked with Ashford, Pedro Gutierrez Igaravidez and Isaac Gonzalez Martinez, had both studied at the University of Barcelona in the 1890's. Gonzalez had also worked for Ferran between 1895 and 1897. (69, 70, 71) Consequently, it may be noted that the cultural divide between metropolitan and colonial scientists was not as great as that which had existed in Hong Kong. Puerto Ricans had already been actively acquiring aspects of modern medicine on their own.

Yet Ashford also had a great deal of political favor in Puerto Rico after the Spanish-American war because of experiences the U.S. had with tropical diseases. During this period, political power in P.R. rested mainly in the hands of presidential appointed governors rather than in locally appointed politicians. These generally recognized the importance of tropical medicine as a result of recent successes in Panama, Cuba, and the southern U.S. (72) Under the leadership of military governor Leonard Wood, who was also a physician, U.S. physicians in Cuba discovered the insect vector responsible for yellow fever: aedes aegypti. (73, 74) Although this disease and malaria had prevented the French effort at a Panama Canal under Ferdinand de Lesseps, under the care of William Gorgas the disease was kept under control during the North Americana effort in the first decade of the 20th century. (75, 76) The medical profession in the United States was also undergoing a rapid stage of advancement and institutional consolidation, lending greater social legitimacy than that which it previously held. (77)

The cumulative effects of these experiences was to create a political leadership aware of the necessity of awarding the legal authority needed by physicians to accomplish their mission—in contrast to the low priority placed on medicine by the British leadership in Hong Kong, and even that of England. Initially, Gorgas had been unable to succeed in his battle with tropical diseases precisely because the first man in charge of the project did not recognize the importance of his work. Theodore Roosevelt eventually became aware of these problems, and appointed John Stevens as new director in 1905 while also gaving more powers to Gorgas. Similarly, Wood was again appointed military governor of the Philippines in the 1920's. (78, 79) This favorable political climate in which medicine found itself during the first third of the century would also beneficially affect Ashford's relation with local U.S. appointed military governors in "Porto Rico."

When Ashford and his co-researcher, W.W. King, criticized the delay of the local government's expansion of their work in 1903, there was an immediate response. Governor William Hunt and Regis Post, the president of the Executive Council, bypassed normal funding routes to give Ashford's group the needed money for his first 'campaign' of 1904. Gov. Hunt also was able to get the U.S. Army temporarily released Ashford to partake in the Commission. A similar problem occurred upon Ashford's nomination as Commissioner of Public Health in 1911. Possibly loosing his military position, an 'enabling act' was passed at the behest of the local congress, allowing Ashford to participate in both civilian and military roles. Ashford's clout was so great that at times his actions bordered on the excessive. When he insisted on appointing those in the commission, then governor George Colton, who held this power, initially acceded to Ashford's request but backtracked shortly thereafter. Even after Henry Stimson, then U.S. Secretary of War, objected to Ashford's extra-legal demands, Ashford still made his acceptance contingent on his control of appointees. Although Ashford would 'loose' this particular power struggle, his actions suggest the kind of influence and clout he held over local politics. When Colton complained that Ashford was trying to usurp his power, Ashford

responded that he too had been offered the position of governor—indicating some sort of equality between the two. (6) It is inconceivable that Manson would have ever had this kind of influence over Hennessy.

Yet Ashford also had a great deal of clout with the native political leadership, most likely due to the wide-spread success of his work. By riding the nation of a pervasive illness, he obtained a degree of popular trust and respect which Manson never received while living in Hong Kong. This aggregate respect amounted to political power, and even when U.S. authorities were hesitant to fund Ashford's work, the P.R. legislature rapidly granted these sums. Local politicians, as Antonio R. Barceló actively promoted Ashford's work. (80) When the success of the Porto Rico Anemia Commission became immediately evident, the legislature passed a bill giving $50,000 in 1905 when only $15,000 had been requested.

Funding for his programs continued to rise alongside his successes; as the number of deaths declined from 11,875 in 1900 to 1,758 by 1907, his funding increased. (6) By 1911, the Legislative Assembly funded the first "Servicio Insular de Sanidad." In 1912 the Institute of Tropical Medicine and Hygiene, Ashford's first research institute, was similarly established. A 1924 joint resolution by the local Congress created in paper the School of Tropical Medicine. Ashford's School was paid for primarily by the Puerto Rican legislature, despite the fact that control was held by Columbia University and its purpose was not initially for training local physicians. The school had and a small hospital with 56 beds as well as laboratories of bacteriology, immunology, medical zoology, and pathological anatomy amongst many others. While the Columbia University paid for the director and three professors, the local legislature covered its annual expenses of $30,000 and awarded $100,000 for the design and construction of its building. (81, 82) By 1954, two years after the island acquired greater political autonomy, local leaders again turned Ashford's School of Tropical Medicine into a formal School of Medicine—a medical center of a more ambitious scale and larger fiscal demands.

Conclusion

The progress of science cannot be understood solely by analyzing the discovery of new ideas and facts. (83, 84, 85, 86) Scientists operate in social spheres which serve to either advance or retard their work. The cases of Patrick Manson and Bailey K. Ashford are particularly illustrative of this divide between the social and intellectual realms. The social recognition of their work did not necessarily coincide with its scientific merit. Had it been so, we would expect to have seen Manson receiving public fame and renown in China, and Ashford to have become a common medical practitioner known for unusual, but not exceptional, talents. Although the summa scientifica seeks eternal answers, the social recognition of its findings is a slow process tainted by regional conflicts, short-term self-interests, and circumstantial historical background. Here the individual is not entirely coequal to the social, and the acceptance of a scientific idea, for however true it might be, is not immediate and certain. The differences between discovery and public renown are similar to the differences between invention and innovation in the history of technology. In the latter, the creation of a new mechanism is not a guarantee of the inventor's financial prosperity by his formal rendering of that new mechanism into the social realm.

The father of tropical medicine, Patrick Manson, was rejected by the local society he practiced in despite the fact he was inventing a new science. Curiously, the recognition of his work was also initially unclear upon his return to England. The nation's lack of institutionalized research and development meant that luck would greatly affect his program's final outcome. (87, 88) In China, however, the social divide was too great for Manson to ever have obtained public recognition. Culture, political forces, and even demographics were factors too overwhelming to battle against. His observations about other scientists he had seen while in China perhaps best describes his own circumstances,

I have known in my time one, or two, or perhaps three...medical Sir Galahads...men who have buried themselves in some wretched inland town....away from all the comforts...[of] companionship, human sympathy and encouragement.....[But] my thought was 'The pity of it!'... to see energy, knowledge, talent...wasted or at most half utilized, frittered away in individual and unorganized effort. (7)

Certainly, it could be argued that, had the demography of filariasis been more widespread, Manson's political outcome might have been more like Ashford's. Yet the circumstances, again, dictated against this unlikely fate. Despite the fact that Hong Kong stood independently of China, the extension of a miracle cure to the mainland was inhibited by its sheer size. Manson could not have carried a cure to a region with so much epidemiological diversity, which otherwise would have widely demonstrated the validity of Western science. In contrast, Puerto Rico's small size and its physical and climatological distance from Spain created a natural medical experiment in island biogeography. Since the predominant disease was mainly circumscribed by its local economy, its cure would hence be defined locally. Its discoverer would be turned into a national hero, be he of foreign origin or not. With the

elimination of unciniariasis from the island, it became very clear to the local populace and all political factions that science was socially useful.

Favorable circumstances were hence predisposing elements to Ashford's professional success, and, ultimately, to the diffusion of his science to the island. North American political control, an independent jibaro culture, and a local legislature willing to recognize and fund useful science played key roles in the early comparative establishment of tropical medicine in Puerto Rico. It cannot be denied that Ashford's scientific discovery served as the foundation for his rise to fame. Anomalies in the treatment of the disease quickly suggested to Ashford that it was not anemia as identified by Creole and local Spanish doctors; had the illness been due to food deficiency, hurricane relief efforts would have quickly eradicated it. Yet Ashford's political success rested on the laurels of what were relatively poor scientific foundations, ultimately creating a mythic image of the man. Ironically, by serving as a base for the establishment of local institutions in the island, this myth of science had also helped turn it into a living fact.

Resumen

¿Como fue que el colonialismo afectó la creación y el desarrollo de la medicina tropical? Este ensayo trata de contestar la pregunta por medio de una comparación entre dos científicos a luz de sus diferentes experiencias, uno proveniente de los Estados Unidos y el otro de Inglaterra. El primero, Bailey K. Ashford, fue a Puerto Rico durante la Guerra Hispano-Ameriana, y el otro, Patrick Manson, vivió en la China durante la segunda mitad del siglo diecinueve. Aunque ambos trataron de desarrollar la misma ciencia (la parasitología) y también habían vivido en las colonias de sus respectivas metrópolis, el fruto y esfuerzo de sus labores variaron significantemente. Se argumentara en el ensayo que las diferencias entre sus mundos sociales, asi como domestico (gubernamental) e internacional (cultural), afectaron significantemente las oportunidades que cada científico tuvo, y en tal manera el proceso interno de sus decisiones. El origen y la localización de las escuelas de investigación que cada uno formó últimamente es una consecuencia directa de el ambiente social en que estos se encontraban.

Acknowledgement

I would like to acknowledge the help of Prof. John Eyler at the Department of the History of Science, Technology, and Medicine of the University of Minnesota for his advice and support.

References

1. Bowers JZ. Western Medicine in a Chinese Palace: Peking Union Medical College, 1917-1951. Philadelphia: Josiah Macy Jr. Foundation; 1972.
2. Warren KS. Farwell to the Plague Spirit: Chairman Mao's crusade against Schistosomiasis. In: Bowers JZ, Hess W, Sivin, editors. Science and Medicine in Twentieth Century China— Research and Education Ann Arbor (MI): Center for Chinese Studies, University of Michigan; 1988: p. 123-140.
3. Lampton D. The Politics of Medicine in China: The Policy Process, 1949-1977. Boulder (CO) Westview Press; 1977.
4. Freeman C, Soete L. The Economics of Industrial Innovation. 3rd. ed. Cambridge (MA): MIT Press; 1999.
5. Low MF. Beyond Joseph Needham: Science, Technology, and Medicine in East and South East Asia. Osiris 1998; 13: 1-162.
6. Ashford BK. A Soldier in Science: The Autobiography of Bailey K. Ashford. New York: William Morrow; 1934.
7. Manson-Bahr PH, Alcock A. The Life and Work of Sir Patrick Manson. New York: William Wood; 1927.
8. Arnold D, editor. Warm Climates and Western Medicine- The Emergence of Tropical Medicine, 1500-1900. Amsterdam: Rodopi; 1996.
9. Delaporte F. The History of Yellow Fever: An Essay on the Birth of Tropical Medicine. Cambridge (MA): MIT Press; 1991.
10. Willis C. Yellow Fever, Black Goddess: The Coevolution of People and Plagues. Reading (MA): Addison-Wesley; 1996.
11. Scott HH. A History of Tropical Medicine. Baltimore (MD): Williams & Wilkins Co., 1939.
12. Worboys M. Tropical Diseases. Bynum WF, Porter P. Companion Encyclopedia of the History of Medicine. vol 1. London: Routledge; 1993: p. 624-650.
13. Harrison G. Mosquitoes, Malaria and Man: A History of the Hostilities Since 1880. New York: E.P. Dutton; 1978.
14. Manson P. Tropical diseases: a manual of the diseases of warm climates. Rev. edition. London : Cassell; 1900.
15. Eldrige CC. England's Mission: The Imperial Idea in the Age of Gladstone and Disraeli, 1868-1880, New York: MacMillan; 1973.
16. Boorstin DJ. The Discoverers: A History of Man's Search to Know his World and Himself. New York: Vintage Books; 1985.
17. Adas M. Machines as the Measure of Men- Science, Technology, and Ideologies of Western Dominance. Ithaca (NY): Cornell University Press; 1989.
18. Risse GB, editor. Modern China and Traditional Chinese Medicine. Springfield (Ill): Charles C Thomas; 1973.
19. Bowers JC, Purcell E, editors. Medicine and Society in China. New York: Josiah May Jr. Foundation, 1974.
20. Said HM. Medicine in China. Karachi: Hamdard Academy; 1981.
21. Levenson JL. The Problem of Intellectual Continuity: Confucian China and its Modern Fate. Berkeley: University of California Press; 1958.
22. Giles HA. The Civilization of China. New York: Henry Holt & Co.; 1911.
23. Roberts, JA. China Through Western Eyes: The Nineteenth Century, A Reader in History. Glouchestersire (UK): Alan Sutton Publishers Inc.; 1991.
24. Bowers JC, Purcell E, editors. Medicine and Society in China. New York: Josiah May Jr. Foundation; 1974.
25. Cantlie J. Sun Yat Sen and the Awakening of China. London: Fleming H Revell Co.; 1912.
26. Yat Sen S. Memoirs of a Chinese Revolutionary: A Programme of National Reconstruction of China. London: Hutchinson & Co.; 1918.

27. Shihlien HL, editor. Sun Yat Sen: His Political and Social Ideals. Los Angeles: University of Souther California Press; 1933.
28. Welsh F. A History of Hong Kong. New York: Harper Collins; 1993.
29. Cantlie J. Hong Kong. In: India, Ceylon, Straights Settlements, British North Borneo, Hong Kong. New York: Funk and Wangalis Co.; 1899: p. 500-535.
30. Langer WL. The Diplomacy of Imperialism, 1890-1902, New York: Alfred A Knopf; 1951.
31. Cameron N. An Illustrated History of Hong Kong. Oxford: Oxford University Press; 1991.
32. Hyam R. Britain's Imperial Century, 1815-1914: A Study of Empire and Expansion, London: B. T. Batsford; 1976.
33. Gallager J, Robinson R. The Imperialism of Free Trade. In: Louis R, editor. Imperialism: The Robinson and Gallager Controversy. New York: New Viewpoints; 1976.
34. Perkins WT. Denial of Empire: The United States and Its Dependencies. Leyden: A. W. Sythoff; 1962.
35. Carr R. Puerto Rico: A Colonial Experiment. New York: New York University Press; 1984.
36. Pratt, JW. America's Colonial Experiment: How the United States Gained, Goverened, and In Part Gave Away a Colonial Empire. New York: Prentice Hall; 1951.
37. Beisner R. Twelve Against Empire: The Anti-Imperialists, 1898-1900. Chicago: University of Chicago Press; 1985.
38. Healy D. U.S. Expansionism: The Imperialist Urge in the 1890's: Madison (WI): University of Wisconsin Press; 1970.
39. Ashford BK. A Soldier in Science: The Autobiography of Bailey K. Ashford. New York: William Morrow; 1934.
40. Homes LT. A Prophet in Medicine in Puerto Rico: Bailey K. Ashford. Washington D.C: Armed Forces Medical Library; 1950.
41. Rodriguez-Molina R. Del Esprue en Puerto Rico: Ayer y Hoy. Boletin de la Asociacion Medica de Puerto Rico Feb 1964; 56 (2): 31-50.
42. Amster LJ. Bailey Ashford: 'Prophet of Tropical Medicine'. Hospital Practices April 15, 1985; 20 (4): 183-206.
43. Crosby WH. The Hematology of Hookworm Disease: Contribution of Bailey K. Ashford. PRHSJ Dec 1985; 4 (3): 113-9.
44. Maldonado AE. Hookworm Disease: Puerto Rico's Secret Killer. PRHSJ; 12 (3):191-196.
45. Edelson E. Healers in Uniform. Garden City (NY): Doubleday & Co., Inc.; 1971.
46. Bachman GW. Bailey Kelly Ashford. Science Dec. 7, 1934; 80 (2084): 516-518.
47. Ashford BK. Payne GD, Payne FK. Acute Uncinariasis from Massive Infestation and Its Implications. JAMA Sept. 9, 1933; 101 (11): 843-7.
48. Ashford BK, Gutierrez Igaravidez P, Unciniariasis (Hookworm Disease) in Port Rico: A Medical and Economic Problem. Washington D.C.: GPO; 1911.
49. Ashford BK, King WW. A Study of Uncinariasis in Porto Rico" American Medicine Sept. 5, 1903: 391-6
50. Ashford BK, King W W, Gutierrez Igaravidez, P. Informe Prelimiar de la Comision para la supresion de la anemia en Puerto Rico. San Juan (PR): Bureau of Printing and Supplies; 1906.
51. Ashord BK. Ankylostomiasis in Porto Rico. New York Medical Journal 1900: 522-6.
52. Foster GM. Hippocrates' Latin American Legacy: Humoral Medicine in the New World. Amsterdam: Gordon and Breach Science Publishers; 1994.
53. Wells H. The Modernization of Puerto Rico: A political study of changing values and institutions. Cambridge (MA): Harvard University Press; 1969.
54. Moll AA. Aesculapius in Latin America. Philadelphia: W. B. Saunders Co; 1944.
55. Moll AA. Half a Century of Medical and Public Health Progress, 1890-1940. Washington D.C.: Pan American Union, 1940.
56 Fajardo Ortiz G. Los caminos de la medicina colonial en iberoAmerica y la Filipinas. Mexico, DF: Universidad Nacional Autonoma de Mexico; 1996.
57. Bowers JZ, Purcell E, editors. Aspects of the History of Medicine in Latin America, Report of a Conference. New York: Josiah Macy Jr. Foundation; 1979.
58. Carrion MA. Puerto Rico: A Political and Cultural History. New York: W.W. Norton & Co.; 1983.
59. Steward JH, editor. The People of Puerto Rico, A Study in Social Anthropology. Urbana: University of Illinois Press; 1956.
60. Harwood A. The Hot-Cold Theory of Disease, Implications for Treatment of Puerto Rican Patients. JAMA 1971; 216 (7): 1154-1154.
61. Dietz JL. Economic History of Puerto Rico: Institutional Change and Capitalist Development. Princeton: Princeton University Press; 1986.
62. Gonzalez JL. Puerto Rico, The Four Storeyed Country and Other Essays. New York: Markus Wiener Publishing, Inc.; 1993.
63. Ortiz F. Cuban Counterpoint: Tobacco and Sugar. Durham (NC): Duke University Press, 1995.
64. Burke ME. The Royal College of San Carlos- Surgery and Spanish Medical Reform in the Late Eighteenth Century. Durham (NC): Duke University Press; 1977.
65. Bornside GH. Jaime Ferran and Preventive Inoculation against Cholera. Bulletin of the History of Medicine 1981; 55 (4): 516-532.
66. Bornside GH. Waldemar Haffkine's Cholera Vaccines and the Ferran-Haffkine Priority Dispute. Journal of the History of Medicine and the Allied Sciences 1982; 37 (4): 399-422.
67. Matilla V. Jaime Ferran y su Obra. Madrid: Insittuto de Espana; 1977.
68. Cannon DF. Explorer of the Human Brain: The Life of Santiago Ramon y Cajal, 1852-1934. New York: Henry Schuman; 1949.
69. Baez V, editor. La Gran Enciclopedia de Puerto Rico. Madrid: C. Corrdera; 1977.
70. Pacheco PA. Isaac Gonzalez Martinez: Su Vida y su Obra. San Juan: Editora Montalvo; 1954.
71. Diccionario Historico Bibliograpfico Coventado de Puerto Rico. San Juan: Instituto de Cultura Puertorriquena; 1976.
72. Ettling J. The Germ of Laziness: Rockefeller Philanthropy and Public Healthin the New South. Cambridge: Harvard University Press; 1981.
73. Stepan N. The interplay of socio-economic factors and medical science: Yellow Fever research, Cuba, and the United States. Social Studies of Science 1978; 8: 397-423.
74. Kelly HA. Walter Reed and Yellow Fever. Baltimore: Norman Remignton Co.; 1923.
75. Gibson JM. Physician to the World: The Life of General William C. Gorgas. Durham (NC): Duke University Press; 1950.
76. McCullough D. The Path Between the Seas: The Creation of the Panama Canal, 1870-1914. New York: Simon & Schuster; 1977.
77. Starr P. The Social Transformation of American Medicine. New York: Basic Books; 1982.
78. Gilett MC. The Army Medical Department, 1865-1917. Washington D.C.: Center of Military History; 1995.
79. Chapman F. Leonard Wood and Leprosy in the Philipines: The Culion Leper Colony, 1921-1927. Washington D.C.: University Press of America; 1982.

80. Morales P. Ensaladilla de Recuerdo. San Juan: Biblioteca de Autores Puertorriquenos; 1966.
81. Ramirez de Arellano AB. Columbia's Overseas Venture- The School of Tropical Medicine at the University of Puerto Rico. Medicine's Geographic Heritage 1989; 5: 25-40.
82. Negron de Montilla A. Americanization in Puerto Rico and the Public-School System, 1900-1930. Rio Piedras (PR): Editorial Edil Inc.; 1970.
83. Bijker WE, Hughes TP, Pinch TJ, editors. The Social Construction of Technological Systems. Cambridge, MA: MIT Press; 1987.
84. Pinch T. Technological Change: Methods and Themes in the History of Technology. Amsterdam: Harwood Press; 1996.
85. Good BJ. Medicine, Rationality, and Experience: An Anthropological Perspective. Cambridge (MA): Cambridge Unviersity Press; 1994.
86. Kleinman A. Patients and Healers in the Context of Culture: An Exploration of the Borderland between Anthropology, Medicine, and Psychiatry. Berkeley: University of California Press; 1980.
87. Manson-Bahr P. History of the School of Tropical Medicine in London, 1899-1949. London: H. K. Lewis & Co. Ltd.; 1956.
88. Kubicek RV. The Administration of Imperialism: Joseph Chamberlain at the Colonial Office. Durham, NC: Duke University Press; 1969.