HISTORY OF MEDICINE

¡HAY BILHARZIA!, by Klock, Ildefonso, and Mateo-Serrano: Medical Images of Poverty and Development in Puerto Rico in the 1950s

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ABSTRACT. From 1940 to 1970 Puerto Rico underwent a dramatic change in its economic, social, political, and medical characteristics. Schistosomiasis (known locally as bilharzia) persisted troughout this period as a nearly intractable problem. In 1954, staff from the Puerto Rico Department of Health, and the Puerto Rico Field Station of the U.S. Communicable Disease Center (now San Juan Laboratories, Centers for Disease Control and Prevention) created a set of black and white 35 mm slides as a tool for community education. The presentation, titled "¡Hay Bilharzia!" ("There is schistosomiasis here!") is organized in four major sections (Introduction, Disease Cycle, Disease Prevention, Treatment). Each section consists of two to four sub-themes, with three to eight slides each. The slides were used extensively in public schools and community lectures. This set of slides is worthy of preservation as evidence of the bilharzia control efforts and the dismal living conditions widely prevalent in Puerto Rico in the 1950s. It is also an example of the educational programs that were produced at the time to stimulate community development and health.

From 1940 to 1970 Puerto Rico underwent a dramatic change in its economic, social, political and medical characteristics, due to windfall revenues from United States duties on rum during World War II, massive emigration to the mainland and industrialization at home, a constitutional charter (1952), and the elimination or great reduction of age-old infectious diseases (smallpox, uncinariasis, tuberculosis, malaria and others, 1921-1953). Schistosomiasis (known locally as bilharzia) persisted troughout this period as a nearly intractable problem, due to the parasite's association with sugarcane cultivation (Puerto Rico's main product), the insufficient rural coverage of potable and waste water distribution networks, and the lack of inexpensive, safe, and effective early treatment. In 1954, staff from the Puerto Rico Department of Health (PDRH), and the Puerto Rico Field Station of U.S. Communicable Disease Center (CDC, now San Juan Laboratories, Centers for Disease Control and Prevention) created a set of black and white 35 mm slides, titled "¡Hay Bilharzia!" ("There is Schistosomiasis here!"), as a tool for community education, to show the risk factors and diagnostic methods for bilharzia, and its clinical consequences. This article offers a context to understand the circumstances surrounding the production of this set of slides, but does not intend to summarize the large amount of information available on the prevalence and control of schistosomiasis on the island.

Bilharzia is an intestinal parasitosis produced by *Schistosoma mansoni*. The eggs of this worm exit the human body in feces, hatch in water, and its larvae (miracidia) lodge in a freshwater snail (*Biomphalaria glabrata)*. The infectious stage (cercaria) of the parasite swims from this intermidiate host and penetrates the skin of a person who comes in contact with the water. Cercarie migrate to the veins of the intestinal system, and after maturation and fertilization produce thousands of eggs. The eggs that remain lodged in liver tissue provoke fibrosis, and in some persons, eventually cirrhosis and death by hepatic failure (1).

At the beginning of the twentieth century, bilharzia was limited to a few low-incidence locations in Puerto Rico (Mayagüez, Utuado and Aibonito), and an area of high incidence, the island of Vieques. The change from coffee to sugarcane cultivation produced migrations of workers from the mountains to the coast, and the contruction of large irrigation system in the dry, southern plains. In consequence, bilharzia spread thoughout the island, with highest incidence in the eastern regions. The malaria eradication program of the federal government, undertaken during the Second World War, produced the

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drainage of large areas of wet lands, contributing to the elimination of *Schistosoma* habitats. In 1945, the Puerto Rico Aqueduct and Sewer Authority ("Autoridad de Acueductos y Alcantarillados de Puerto Rico") began a large-scale effort to provide potable water to the entire population, probably the most effective way to decrease the contact of persons with the cercariae (2). The PRDH identified the residents of areas without sanitary connections, and gave them the concrete platforms for latrines, so the owners would then build the facilities.

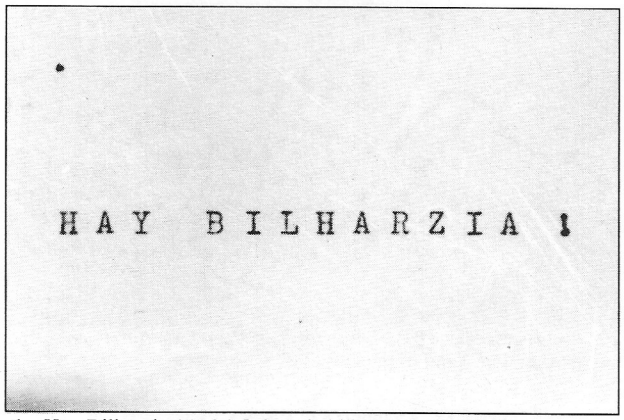
In 1953, the PRDH established a Bilharzia Control Program combining community education, provision of potable water, use of sanitary latrines, snail elimination, and treatment of infected persons. The Program had, from its beginnings, the support of the Puerto Rico Field Station of the CDC, then located in the Arsenal complex in the Puntilla sector of old San Juan. The program, maintained until the late 1970s, used a variety of medications and chemical agents trough the years. Infected persons identified in the pilot projects from 1954 to 1957 were treated with Stibphen ("Fuadin"), a relatively toxic antimony-based compound. Initially (and up to 1958), sodium pentachlorophenate was used to eliminate the snail from creeks and canals, applied at 6 mg/l for 24 hours to flowing water, and at 10 mg/l to standing water (3,4). The crews would set up camp (see slide number 34), and a large canvas tent was used to house the program staff overnight while a segment of creek or irrigation canal was being treated. Water flow would be controlled with a temporary earthen dam and a wood board with a V-shaped opening (slide number 36). The design of this "Sutro" type of weir meant that the volume of water flowing through the dam could be estimated by the height of the water in the V-shaped opening. The solution of sodium pentachlorophenate was dispensed from a box held on top of the weir, and the amount of chemical dripping from the faucet was manually controlled, in proportion to the flow of water in the creek. After a segment of creek or canal was treated, the staff would move downstream, to repeat the procedure. This process was very labor-intensive, did not permit accurate dispensing of the chemical compound, and required about a week of work for every stream. John W. Klock, a sanitary engineer at the CDC Field Station, later developed an automated dispensing mechanism (slide 47), using inexpensive used materials, such as an old car carburator and a float valve. With the automatic dispensers, the work was faster and more efficient. Field crews were able to simultaneously treat all tributaries of a creek, so that the chemical was carried for longer distances without dilution. The devices (slides 34,47) were built at the CDC Field Station by Tomás Ocasio, following Klock's specifications.

In the first years of the Bilharzia Control Program, the only audiovisual material available was a 16mm black and white sound movie, produced by CDC. Staff from CDC and the PRDH then produced a set of slides to be used in educational talks in schools and communities. John W. Klock and Víctor Ildefonso (biologist) with the U.S. Public Health Service, and Julio Mateo-Serrano (public health inspector) with the PRDH, produced the set. An outline of the series was established and several PRDH staff were involved in selecting the best locations throughout the island. Klock took the pictures, in conjuction with other field studies, in 1954. His camera was a Zeiss (Jena) Pentacon, with an *f*/2.0, 58mm Biotar lens. There was, at a time, no inexpensive film for taking slides, so the images were taken in regular black and white film. With the negatives, Klock made contact prints onto a special "reverse film" sold by Kodak, to produce the slide. It was then mounted on a hand-made cardboard frame. Five sets of slides were prepared: three for the PRDH, one for the CDC, and one for Klock.

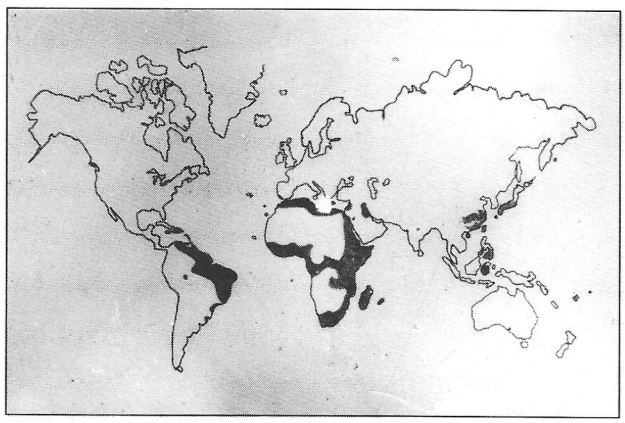
The slide set preserved at CDC is kept in a hand-made wooden case measuring 13.2 cm. long x 7.1 cm. wide x 6.5 cm. tall. A descriptive list of the 49 slides is included, as a carbon copy, in two pages of "onion skin" paper folded at the bottom of the box. Three slides were missing from this set, and two of them were copied from Klock's set. Both sets were missing slide number 19 (microphotograph of the "adult parasite in the human body"), and a slide was produced using the negative found in the CDC files. A comparison of the slides in the CDC and Klock's set showed that some images presented slight variants in the position of the subjects, which indicated that the slides in different sets were not all copies of a single original, but (at least for some slides) different originals for the different slides sets. The presentation is organized in four major sections (Introduction, Disease Cycle, Disease Prevention, Treatment). Each section consists of two to four subthemes, with three to eight slides each. The following list is transcribed from the desciptive list found with the CDC slide set. We have added a translation into English, and comments provided by John W. Klock, and retired and current PRDH and CDC staff interviewed recently* (Alfredo Casta-Vélez, Frederick F. Ferguson, Rafael Hernández-Colón, Ezequiel Mateo-Serrano, Henry Negrón-Aponte, Tomás Ocasio, Juan R. Palmer; Víctor Ildefonso and Julio Mateo-Serrano are now deceased.)

* **Editor's note:** For the convenience of the reader the items transcribed from the original list, as well as the translations, have been printed here as captions of their corresponding slides, with comments following in italics.

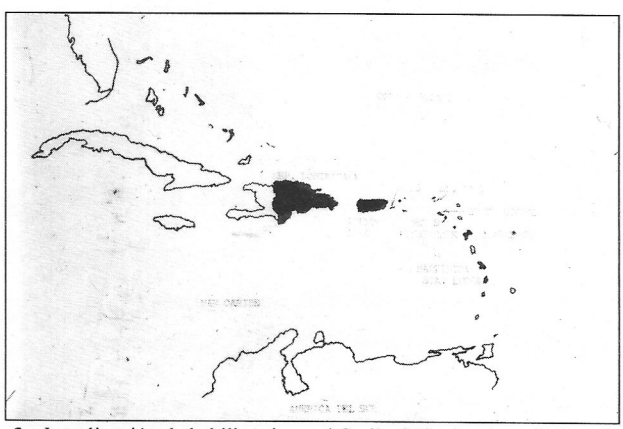
Introducción [Introduction]



1. Hay Bilharzia (título) [There is bilharzia here (title)].

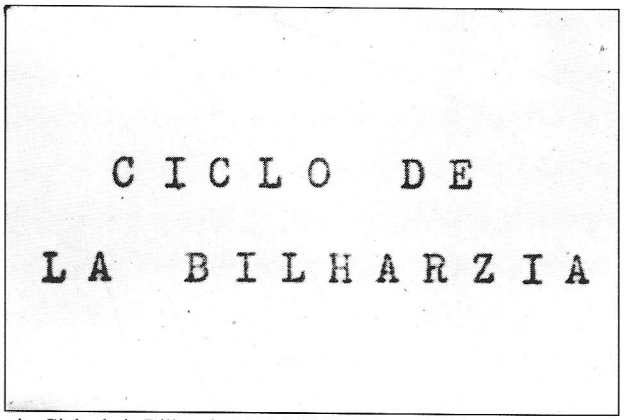


2. Localización mundial de la bilharzia [World distribution of bilharzia].

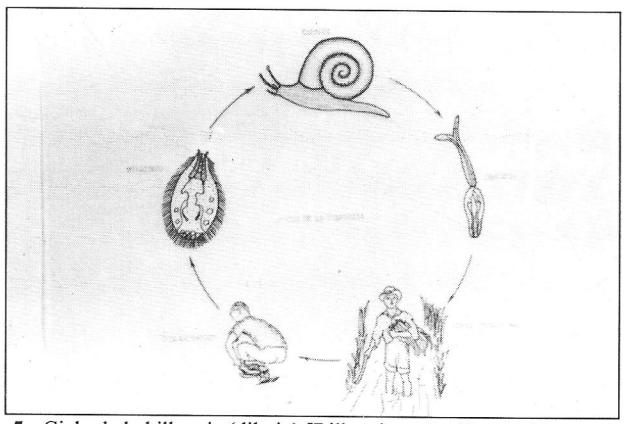


3. Localización de la bilharzia en el Caribe [Distribution of bilharzia in the Caribbean].

Ciclo de la Enfermedad [Disease cycle]

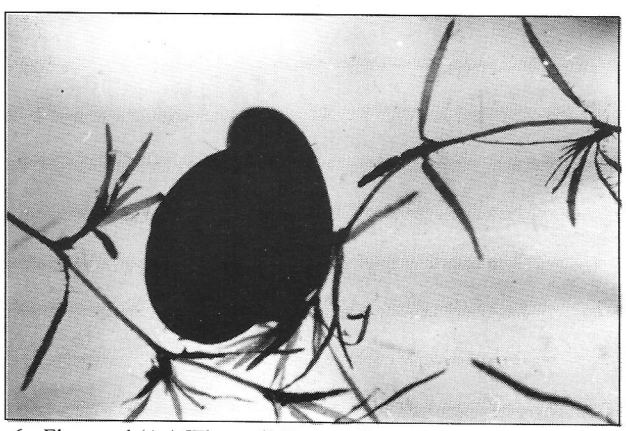


4. Ciclo de la Bilharzia (título) [Bilharzia cycle (title)].



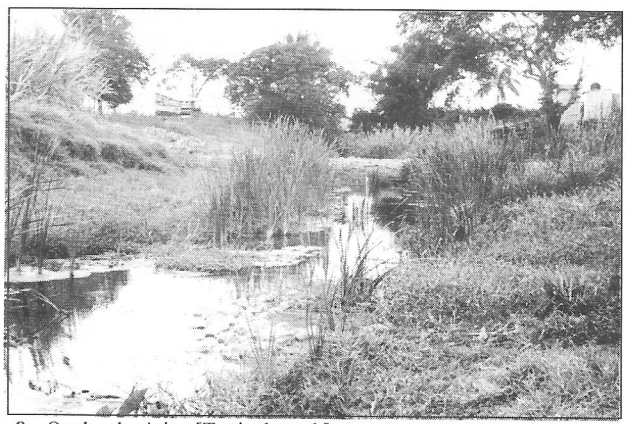
5. Ciclo de la bilharzia (dibujo) [Bilharzia cycle (drawing)].

El hospedero intermediario y su localización [The intermediate host and its location]

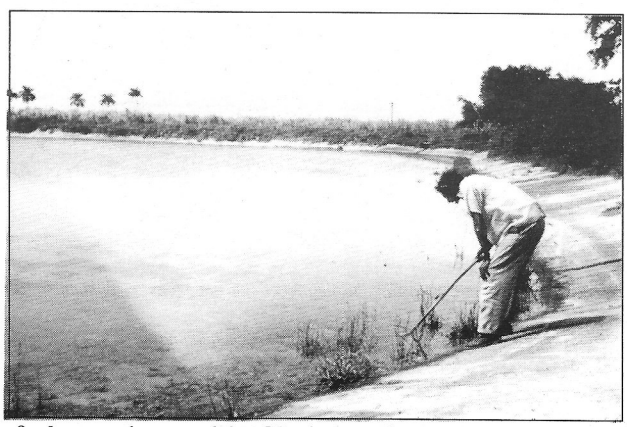


6. El caracol (Ag) [The snail (Ag - sic)].

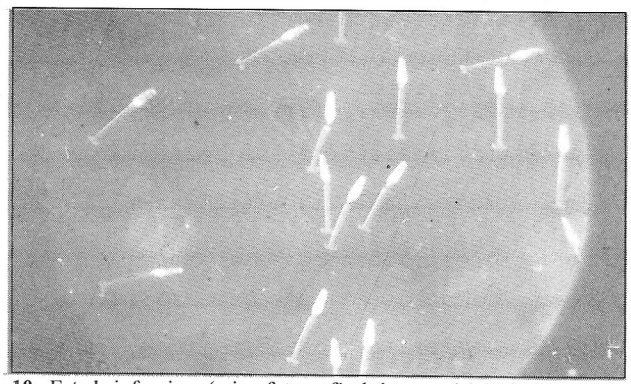
7. Caracoles en el agua [Snails in the water]. — *This is a typical, highly infested stream, with snails visible in the bed of the creek.*



8. Quebrada típica [Typical creek].



9. Laguna de agua dulce [Fresh water lagoon]. — *Located near Patillas (south coast). The person in the photo is Julio Mateo-Serrano.*



10. Estado infeccioso (microfotografía de la cercaria) [Infectious stage (photomicrograph of the cercaria)].

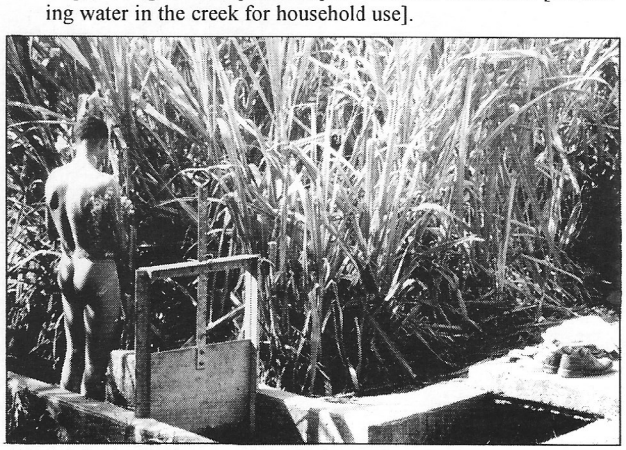
CÓMO SE CONTRAE LA ENFERMEDAD [HOW THE DISEASE IS ADQUIRED]

11. Mujer lavando ropa en la quebrada [Woman washing clothes in a creek].

12. Obrero trabajando en sistemas de regadío [Laborer working in irrigation systems].

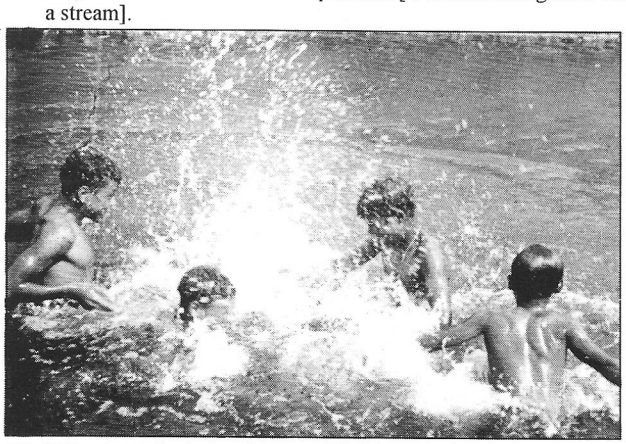
13. Persona cruzando quebradas [Person crossing streams].

14. Cogiendo agua en la quebrada para consumo doméstico [Collecting water in the creek for household use].



15. Adulto bañándose en el río [Adult bathing in the river].

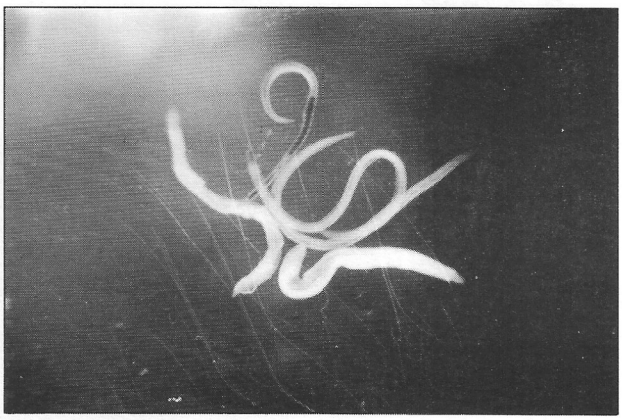
16. Mujer bañando un niño en una quebrada [Woman bathing child on a stream].



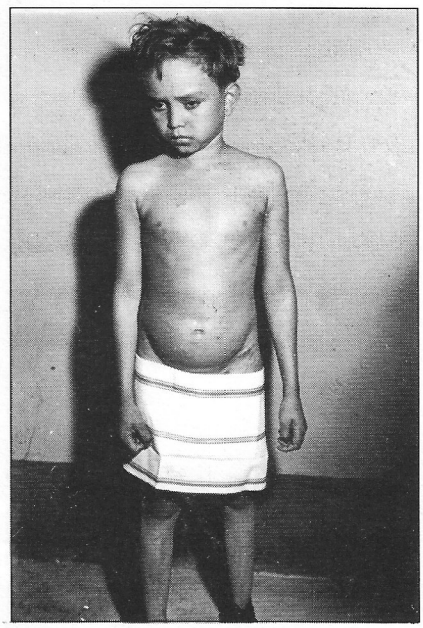
17. Niños jugando dentro del agua [Children playing in the water].

18. Lavando carros en el río [Washing cars in the river].

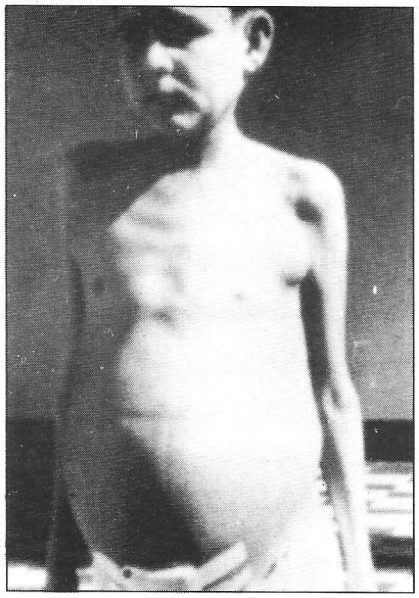
INFECCIÓN EN LOS HUMANOS [INFECTION IN THE HUMANS]



19. Parásito adulto en el cuerpo humano (microfotografía) [Adult parasite in the human body (photomicrograph)].



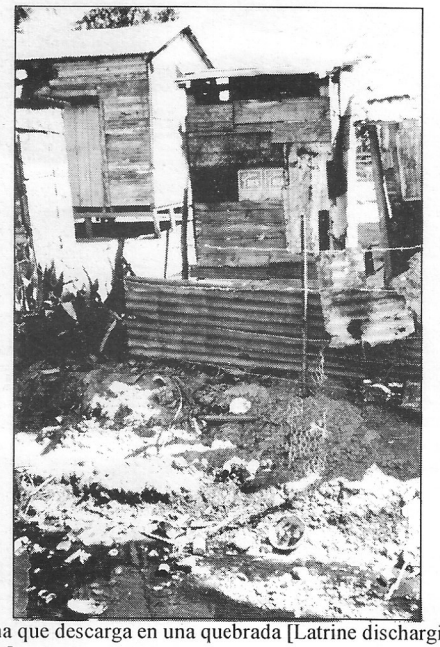
20. Infección en un niño [Infection in a child]. — *Taken at a public health clinic in the San Germán (southwest) area. That region of the south coast had several very good public health nurses with whom CDC worked extensively.*



21. Infección en otro ser humano [Infection in another human being]. — *Copied from an earlier CDC 16 mm sound movie filmed in Puerto Rico.*

CONTAMINACIÓN DE AGUAS NATURALES [CONTAMINATION OF NATURAL WATERS]

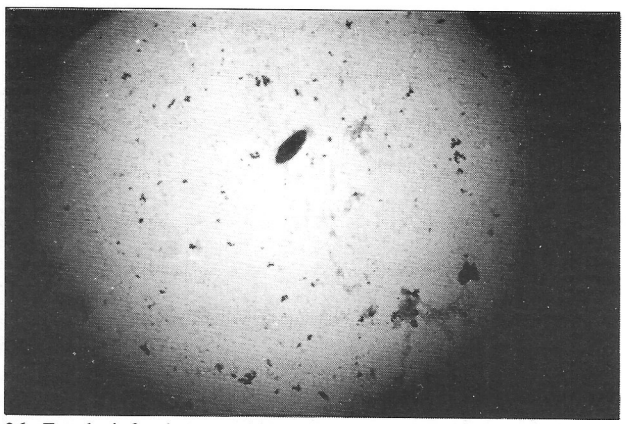
22. Adulto defecando a orillas de un arroyuelo [Adult defecating by the side of a stream]. - *One of the public health field workers posed for the picture.*



23. Letrina que descarga en una quebrada [Latrine discharging onto a stream].

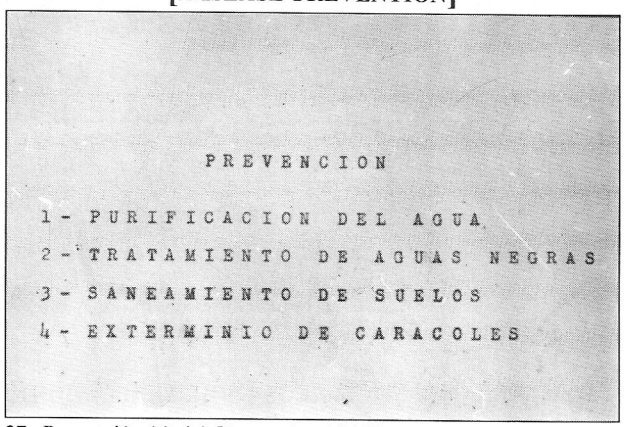
24. Mujer tirando heces fecales a una quebrada [Woman discarding feces onto a stream].

25. Cloaca al descubierto [Uncovered sewer]. - *Taken in one of the communities at higher elevations in the central part of the island. Conditions were particularly bad.*



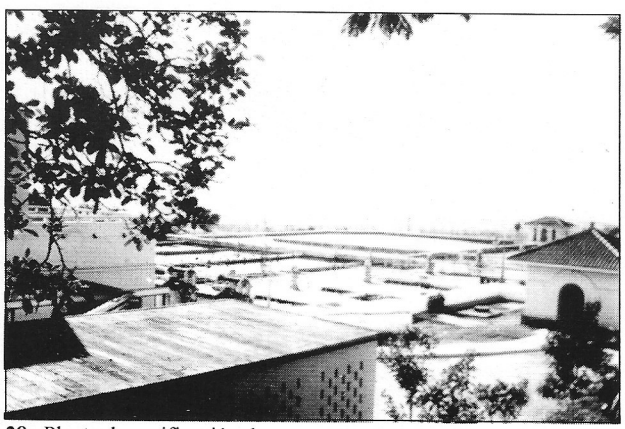
26. Estado infeccioso en el caracol (Microfotografía del miracidio) [Infectious stage in the snail (photomicrograph of miracidium].

Prevención de la enfermedad [Disease prevention]



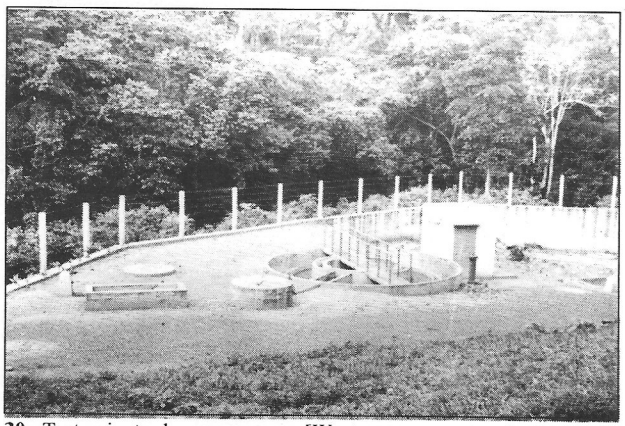
27. Prevención (título) [Prevention (title)].

Tratamiento de las aguas [Water treatment]



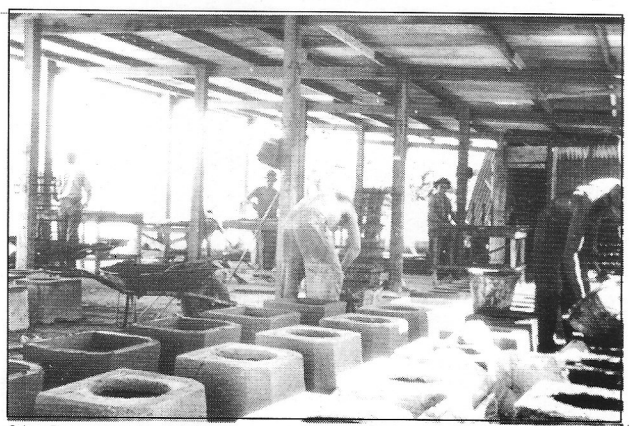
28. Planta de purificación de agua para uso general [Water treatment plant for general use]. - *Main water treatment plant for the city of San Juan ("Sergio Cuevas").*

29. Cogiendo agua de la pluma pública para uso doméstico [Obtaining water for home use from the public faucet].

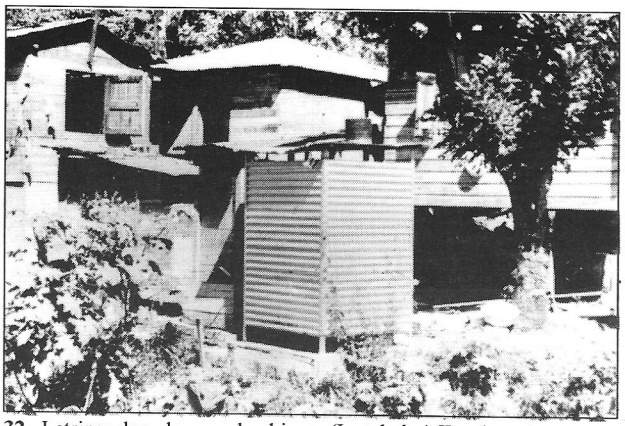


30. Tratamiento de aguas negras [Waste water treatment].

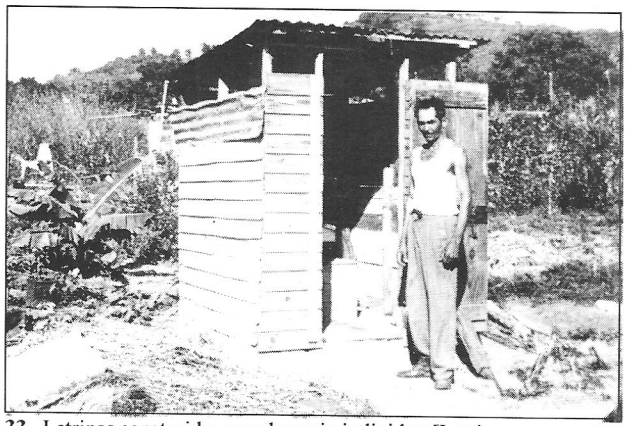
Saneamiento de Suelos [Soil sanitation]



31. Construcción de letrinas por el gobierno [Latrine construction by the government]. - *PRDH pit privy manufacturing plant, located on the grounds of what had previously been the cow barn for the Insular Tuberculosis Ayslum, and is now the Forensic Phychiatry Hospital, Centro Médico, Río Piedras.*



32. Letrinas donadas por el gobierno (Instaladas) [Latrines donated by the government (installed)].

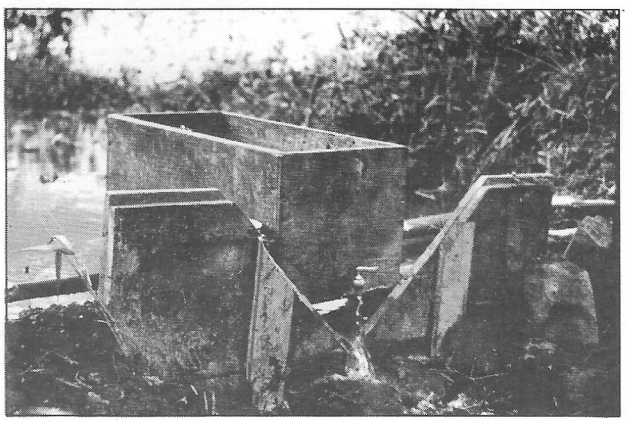


33. Letrinas construidas por el propio individuo [Latrines constructed by the private individual].

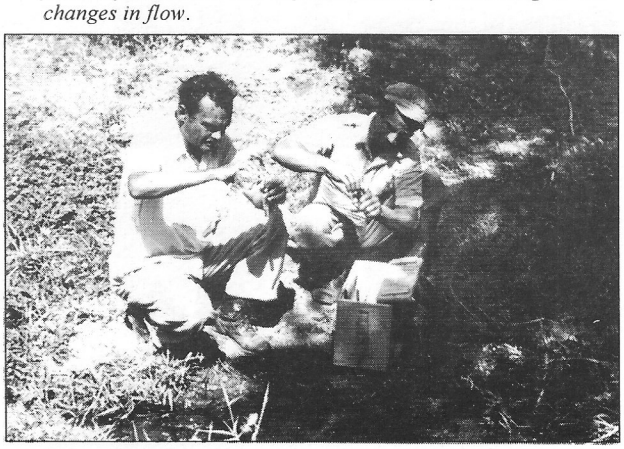
Exterminio del huesped intermediario [Eradication of the intermediate host]

34. Operando el equipo de aplicar el componente químico [Operating the equipment to apply the chemical component]. - *Field staff preparing for the experimental application of sodium pentachlorophenate. In the foreground, the second man from the left (writing) is Higinio Elías, from the Guayama-Arroyo area.*

35. Mezclando el componente químico [Mixing the chemical component].

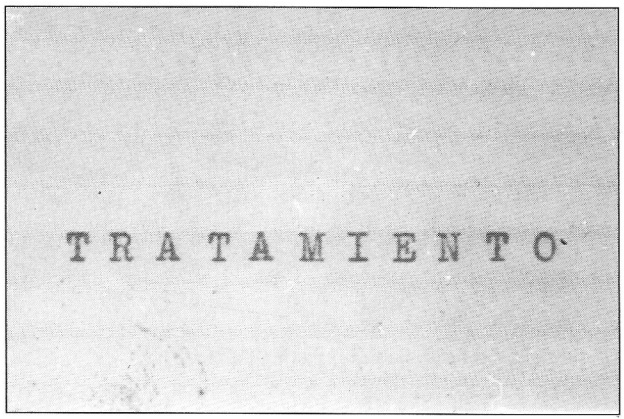


36. Aplicando el componente químico al agua [Applying the chemical component to water]. - *Sutro proportional flow weir, with V-notched wood board to measure water flow. A solution of sodium pentachlorophenate, in the wooden box, drpped on the water from a faucet that was adjusted manually according to the changes in flow.*



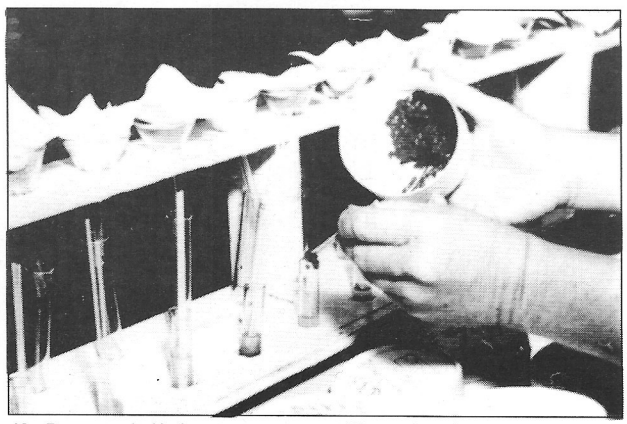
37. Determinando la concentración de componente químico en el agua (Uso del colorímetro) [Determining the concentration of chemical component in the water (use of the colorimeter)]. — *Haskins colorimetric field test for sodium pentachlorophenate. Mateo on the left.*

Tratamiento de la Enfermedad [Disease treatment]

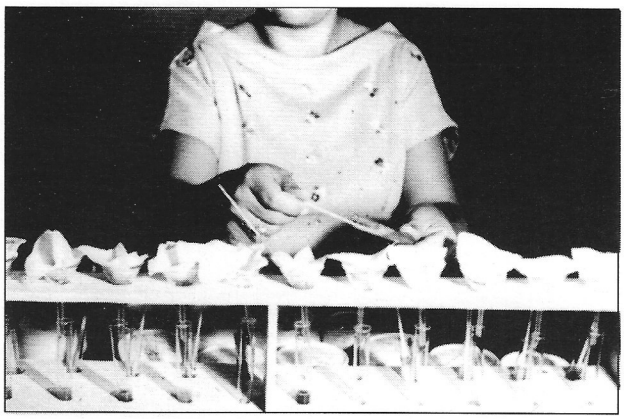


38. Tratamiento (título) [Treatment (title)].

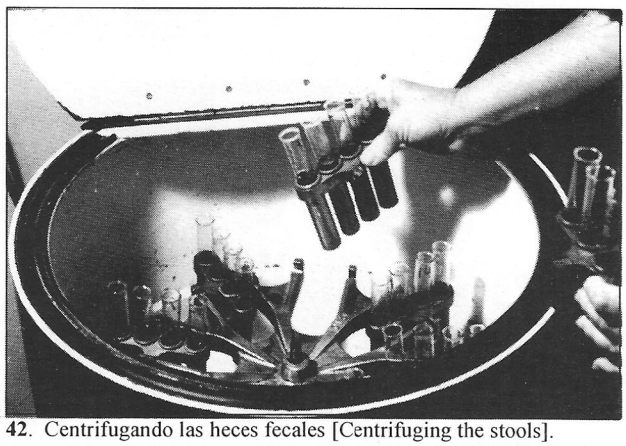
39. Recolectando las heces fecales para examen [Collecting stool samples for examination].



40. Preparando las heces para examen [Preparing the stools for examination].

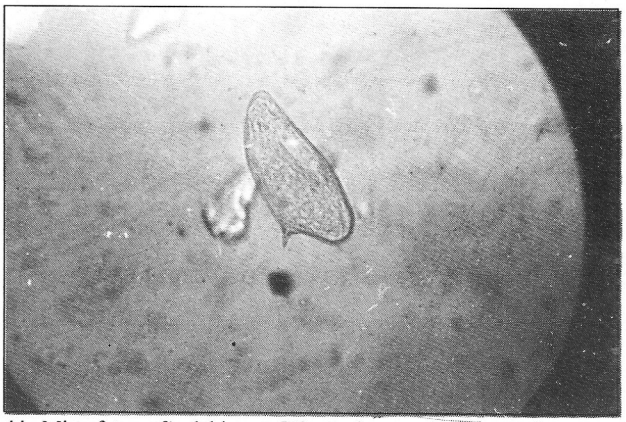


41. Filtrando las heces fecales [Filtering the stools].



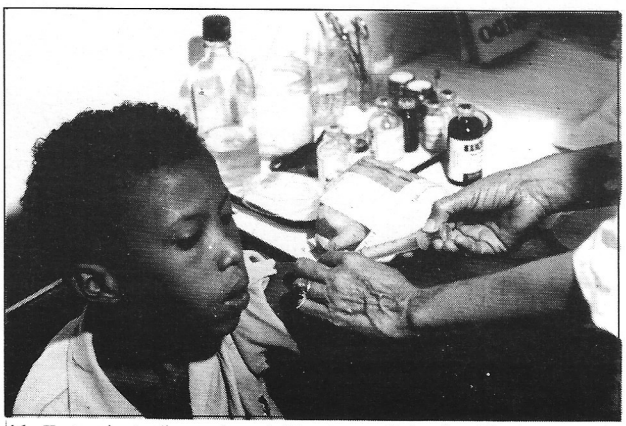
42. Centrifugando las heces fecales [Centrifuging the stools].

43. Examinando las heces a través del microscopio [Examining the stools on the microscope]. — *Ms. María Vicenta Zayas, PRDH employee assigned to CDC for program support and training.*



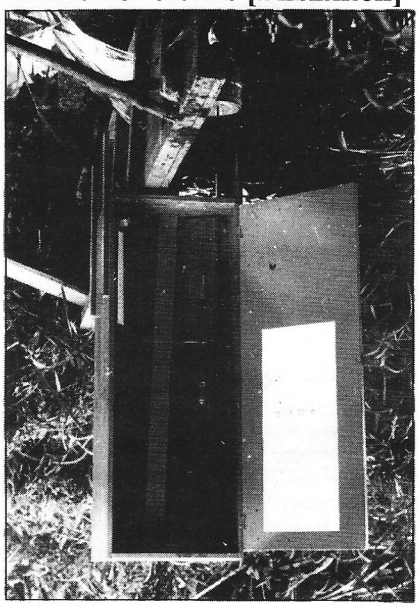
44. Microfotografía del huevo [Photomicrograph of the egg].

45. Centro de Salud Pública [Public Health Clinic].

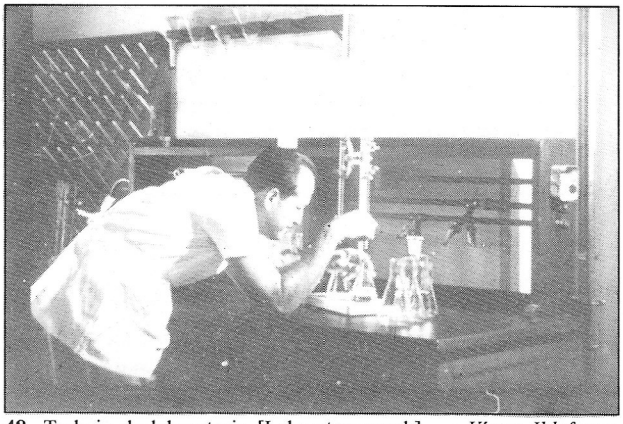


46. Tratamiento (inyecciones) [Treatment (injections)].

INVESTIGACIONES [RESEARCH]



47. Trabajo de campo (Dosificador automático) [Field work (automatic dispenser)]. — *Designed by John W. Klock, built by Tomás Ocasio at CDC.*



48. Trabajo de laboratorio [Laboratory work]. — *Víctor Ildefonso, titrating a solution, possibly sodium pentachlorophenate.*

49. Niño que padece la infección (resumen) [Child suffering from the infection (summarization)]. — *Terminal case of bilharzia; photo from the CDC 16 mm movie. We can only suppose that the last image served to impress the public with the terrible consequences of neglecting to take the recommended precautions.*

The slides were used extensively in public schools and community lectures, and years later, in lectures at the University of Minnesota. The use of slides and movies for community education in Puerto Rico was not a singular approach for bilharzia. The Puerto Rico Department of Instruction's Community Education Division ("División de Educación en la Comunidad"), created in 1949, gathered an extraordinary group of literary and graphic artists. They produced movies and posters of extraordinary quality on medical, social, and educational issues (5). In 1960 they produced a movie on bilharzia, titled "Sucedió en Piedras Blancas" (It happened in Piedras Blancas) (6). The CDC produced a 16 mm sound movie in color in 1968, "La biología y control de la schistosomiasis en Puerto Rico" (Biology and control of schitosomiasis in Puerto Rico).

It is curious to note the coincidence of image #48, and the logo of the island's Industrial Development ("Fomento") Office; a muscular worker moving a cogwheel (#50). Placed in a large sign outside each of the many new factories built in the 1950s, the signs publicized the success of the government's industrialization program (Operation Bootstrap). In simultaneous contrast and unintended allusion, the penultimate slide on the set depicts not just the muscle but also the mind of a scientifically trained Puerto Rican applied to achieving progress. The difference in the routines of material life between rural Puerto Rico in 1954 and our own time can be gauged by one simple realization: one can not find a single object made of plastic in any of the slides in the series.

50. Logo of the island's Industrial Development ("Fomento") Office.

From 1954 to 1976 the Bilharzia Control Program introduced other modalities for disease treatment and snail elimination or biological control (such as another snail, *Marisa*, as predator of *Biomphalaria*) and was very successful (3 - N&J). In the 1980s the PRDH closed its

bilharzia clinics. At present, in spite of the persistence of *Biomphalaria* in some locations, acute cases of schistosomiasis are extremely rare. On November 2, 1994, the PRDH established a Bilharzia Commission, to evaluate the current status of schistosomiasis in all regions of Puerto Rico, as a first step towards the implementation of a program for the erradication of the infection from the island.

This set of slides is worthy of preservation as photographic evidence of the bilharzia control efforts and the dismal living conditions widely prevalent in Puerto Rico in the 1950s, vividly described in books such as Sidney W. Mintz's *Worker in the Cane*, and Carmen Luisa Justiniano's *Con valor y a como dé lugar* (7,8). It is also an example of the education programs that were produced to stimulate community development and health.

Resumen

De 1940 a 1970, Puerto Rico vivió cambios dramáticos en sus características económicas, sociales, políticas y médicas. La bilharzia persistió durante este período como problema casi insoluble. En 1954, El Departamento de Salud de Puerto Rico y la "Puerto Rico Field Station" de "U.S. Communicable Disease Center" (Ahora "San Juan Laboratories, Centers for Disease Control and Prevention") produjeron unas diapositivas de 35 mm en blanco y negro como instrumento para educación de la comunidad. La presentación titulada "¡Hay Bilharzia!" está organizada en cuatro secciones principales (Introducción, Ciclo de la Enfermedad, Prevención y Tratamiento). Cada sección consiste de dos a cuatro subtemas, con tres a ocho diapositivas cada uno. Las diapositivas fueron usadas extensamente en charlas en escuelas públicas y comunidades. Esta serie de diapositivas merece conservarse como evidencia de los esfuerzos para el control de bilharzia y las terribles condiciones higiénicas prevalentes en Puerto Rico hacia los años cincuenta, y como ejemplo de los programas educativos producidos en esa época para estimular el desarrollo y la salud comunitaria.

References

1. Farley J. Bilharzia: a history of imperial tropical medicine. New York, N Y: Cambridge University Press, 1991: 5-10.
2. Jobin WR. Sugar and Snails: the ecology of bilharziasis related to agriculture in Puerto Rico. Am J Trop Med Hyg 1980; 29:86-94.
3. Negrón-Aponte H, Jobin WR. Schistosomiasis control in Puerto Rico: twenty five years of operational experience. Am J Trop Med Hyg 1979; 28:515-525.
4. Farley J., op. Cit., 99-100.
5. Anon. Irene y Jack Delano en Puerto Rico. San Juan: Imprenta Ramallo [1978]:28.
6. García J. Breve historia del cine puertorriqueño, 2nd. ed., Bayamón: Taller de Cine La Red, 1989:60.
7. Mintz SW. Taso, trabajador de la caña. Río Piedras, P R: Ed. Huracán, 1992.
8. Justiniano CL. Con valor y a como dé lugar: memorias de una jíbara puertorriqueña. Río Piedras, P.R.: Editorial de la Universidad de Puerto Rico, 1994.