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Source: *The Journal of Parasitology*, Vol. 88, No. 2 (Apr., 2002), pp. 404-405
Published by: The American Society of Parasitologists
Stable URL: http://www.jstor.org/stable/3285598
Accessed: 25/03/2011 14:21

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to the SCSIE, University of Valencia. Institutional support was provided by Instituto Cavanilles de Biodiversidad y Biología Evolutiva (U. Valencia, Spain) and Centro Nacional Patagónico (CONICET, Argentina). The study was supported by projects ANPCYT (PICT98 N° 01-04025), Argentina, and DGES PB96-0801 (MEC), Spain. F. J. Aznar benefits from a postdoctoral contract from the MEC of Spain.

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J. Parasitol., 88(2), 2002, pp. 404–405

First Recovery of *Schistosoma mansoni* Eggs From a Latrine in Europe (15–16th Centuries)

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ABSTRACT: *Schistosoma mansoni* eggs were found in a latrine dated AD 1450–1550 in Montbéliard, France. This is the first record of intestinal schistosomiasis in archaeological material. Because the parasite has an African origin, its presence in Europe at that time may be due to African slaves. However, intestinal schistosomiasis has never been established in Europe.

Human and other animal intestinal parasite eggs have been recorded from a latrine dating AD 1450–1550 in Montbéliard, France (Bouchet and Paicheler, 1995). Reviewing the same material, helminth eggs with a typical *Schistosoma mansoni* lateral spine were also found.

The material studied was composed of coprolites and sediment collected from a latrine found in a house built during the second half of the 15th century. The latrine (2.35 × 2.30 × 1.65 m) is located in an inner courtyard, which was completely closed from the first half of the 16th century up to the recent archaeological excavations. Three stratigraphic units were identified, but only samples of the middle one (US544) were sent for paleoparasitological analysis. The sediment is macroscopically rich in organic remains, fecal material, and artifacts. Dishware and other cultural remains point to very rich dwellings (Cantrelle et al., 2000).

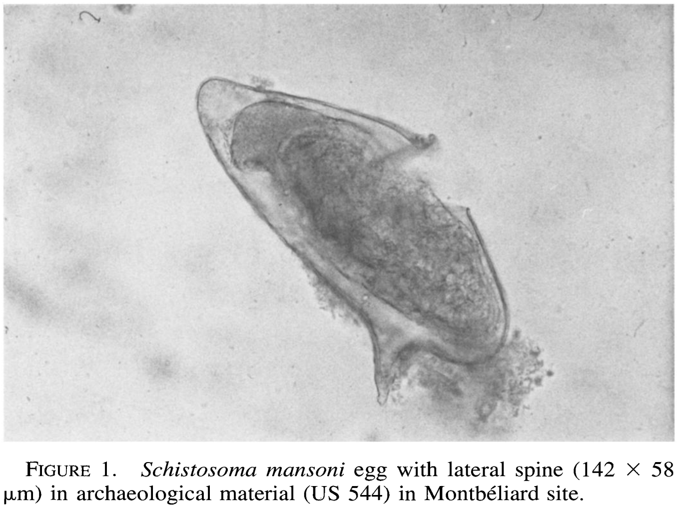

FIGURE 1. *Schistosoma mansoni* egg with lateral spine (142 × 58 μm) in archaeological material (US 544) in Montbéliard site.

The recovered parasite eggs were found to be very well preserved by the anaerobic and humidity conditions. Thus, the material was not rehydrated by current methods used in palaeoparasitology (Reinhard et al., 1988). Samples were directly submitted to ultrasound for 20 sec then run through graduated sieves (315, 160, 50, and 25 μm). The final sediment recovered from the last 2 sieves was observed under a microscope. Eggs and other organic remains found were measured and photographed.

The eggs presented here were identified by their morphology as *S. mansoni*, size (142 × 58 μm), and lateral spine (Fig. 1). All 4 species classified in the *S. mansoni* group have eggs with a lateral spine. Apart from *S. mansoni*, these species are found only in Africa. *Schistosoma rodhaini* is a parasite found in African rodents and carnivores; *Schistosoma edwardiense*, which have eggs with a rudimentary lateral spine, is a parasite of *Hippopotamus amphibius*; *Schistosoma hippopotami*, in the same host, might be a synonym of *S. mansoni* (Rollinson and Simpson, 1987).

The palaeoparasitology of human schistosomiasis has been discussed by several authors. Wei (1973) described a *Schistosoma japonicum* infection in a mummified body of the Han Dynasty. *Schistosoma japonicum* eggs were found in China in a 2,100-yr-old male corpse (Liangbiao and Hung, 1981). *Schistosoma haematobium* was the first parasite found in an Egyptian mummy dated 5,200-yr-old (Ruffer, 1910). Later, as Egyptian mummy necropsies were performed more frequently, this parasite was found at different periods (Jonckheere, 1942; Reyman, 1973; Cockburn et al., 1975; Lewin, 1977; Capron, 1993; Contis and David, 1996). The advent of new techniques allowed the diagnosis of other cases (Deelder et al., 1990; David, 1997), and a paleoepidemiology of schistosome infection was tentatively drawn (Miller et al., 1992; Araújo and Ferreira, 1997).

There are no records of human schistosomiasis infection outside Asian or African prehistoric populations (Araújo and Ferreira, 1997). *Schistosoma haematobium* infection was reported in Europe in the 19th century but vanished in a short period of time (Brumpt, 1936). *Schistosoma haematobium* eggs dated to the 15th century also were found in France (Bouchet and Paicheler, 1995).

Schistosoma mansoni infection can only have originated from Africa because there are no intermediate hosts in Europe. A returning infected European voyager or a foreigner are 2 possibilities to be examined. Archaeological evidence showed that the house was occupied by a very rich family, which could have afforded a voyage to an epidemic region. However, there is no archaeological evidence that such a voyage was made. No souvenirs or exotic artifacts have been found. On the other hand, a slave could have introduced it. Since 1441, African slaves were taken to Portugal, and a few years after, they could be found in many European countries (Zurara, 1937). In France, there are records of African slaves by the middle of the 16th century (d'Avenel, 1910).

Together with the finding of *S. haematobium* (Bouchet and Paicheler, 1995) and *S. mansoni* eggs from the same archaeological material, evidence supports the presence of an infected human host, probably of African origin at this 15th–16th century European site. Nevertheless, wherever it came from and whichever host it came in, schistosomiasis was never established in Europe as an endemic disease.

The authors thank C. Goy (AFAN) for allowing us to study the archeological material. Supported by CNRS, AFAN, CAPES/COFECUB, and CNPq/PRONEX.

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Dexamethasone Inhibition of the Cellular Immune Response of *Drosophila melanogaster* Against a Parasitoid

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ABSTRACT: Host larvae of *Drosophila melanogaster* injected with the eicosanoid biosynthesis inhibitor, dexamethasone, prior to parasitization by the wasp *Leptopilina boulardi*, exhibited significantly reduced rates of melanotic encapsulation in comparison with control and saline-injected larvae. The results of this investigation suggest that prostaglandins and other eicosanoids are involved as cell-signaling molecules in the hemocytic encapsulation reaction of *D. melanogaster* larvae.

Insects express 2 broad categories of innate immunity, humoral and cellular (Strand and Pech, 1995; Gillespie et al., 1997). Humoral defense reactions include the biosynthesis of various antimicrobial peptides (Meister et al., 1997, 2000). Cellular reactions involve blood cells or hemocytes, which form melanotic, multilayered capsules around parasites that are too large for individual cells to internalize (Carton and Nappi, 1997; Vass and Nappi, 2000). Although insect immune cell effector responses have been well documented (Nappi and Ottaviani, 2000), little is known of the signaling mechanisms mediating insect cellular defense reactions.

In the larvae of *Drosophila melanogaster*, the innate cellular immune response that results in the formation of melanotic capsules around intrahemocoelic wasps (parasitoids) is accompanied by elevated levels of nitric oxide, superoxide anion, and hydrogen peroxide, molecules implicated along with certain reactive quinonoid intermediates of melanin in the killing process (Nappi et al., 1995; Nappi and Vass, 1998; Carton and Nappi, 2001). Collectively, these host responses not only destroy the parasitoids, but also confine the cytotoxic activity within pigmented capsules, thereby protecting endogenous tissues from the biochemically hostile reactions that are directed against nonself entities. Of interest is the fact that some of the reactive intermediates of oxygen (ROIs) and reactive intermediates of nitrogen (RNIs) generated during encapsulation are known to be cell messengers (Nappi et al., 2000), and may thus serve a dual role in insect immunity, functioning as both cytotoxic and signaling molecules (Fig. 1). Other known signaling molecules that may be involved in insect cell–mediated innate immunity include eicosanoids. Eicosanoids are derived from arachidonic acid (20:4n − 6), which is hydrolyzed from cellular phospholipids via the activation of phospholipase A_2 (PLA_2) (Fig. 1). Whereas there is substantial evidence that eicosanoids are involved in the defense reactions of insects against