

have been no prospective, randomized controlled trials illustrating the effectiveness of FFP treatment, as well as no standardized dosing for FFP treatment in acute attacks. Nevertheless, until C1-INH concentrate is made more widely available, FFP currently is one of the most effective alternatives for AE patients in the United States.

Sincerely,
Joann H. Lin, M.D.

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FLAGELLATED PROTOZOA IN COCKROACHES AND SPUTUM: THE UNHYGIENIC CONNECTION?

To the Editor:

Cockroach allergy is a major problem in inner-city areas. Furthermore, cockroaches are considered potential vectors of human pathogenic protozoa (*Entamoeba*, *Toxoplasma*, *Cryptosporidium*, etc.) because they can contribute to the spread of food-borne protozoan diseases. The existence of several species of protozoa (*Nyctotherus*, *Endolimax*, *Gregarina*, etc.) in the hindgut of certain types of cockroaches such as *Blattella germanica* and *Periplaneta americana*, and their role in the metabolism of these arthropods, is a well-known fact, *Lophomonas blattarum* being one of the most representative and frequently found multiflagellated protozoa.

A recent study has reported on the presence of *L. blattarum* in bronchoalveolar samples of patients with kidney allograft transplantation who developed pulmonary infection, with a positive response to metronidazole therapy.¹ We have studied intestinal extracts of the German cockroach *B. germanica* under the micro-

scope and have observed different flagellated protozoa, one of which is shown in Fig. 1 A. Because of its morphological features, this microorganism was catalogued as *L. blattarum*.

Figure 1 B shows a flagellated protozoon similar to the one seen in the cockroach, but this time found in a fresh sputum sample from a 21-year-old asthmatic patient. The asynchronous beating of the flagella, their orientation in various directions and irregular insertion in the cytoplasm, and the absence of the typical terminal bar of ciliate epithelial cells are three characteristics that indicate that this structure is very different from human detached ciliate epithelial cells.

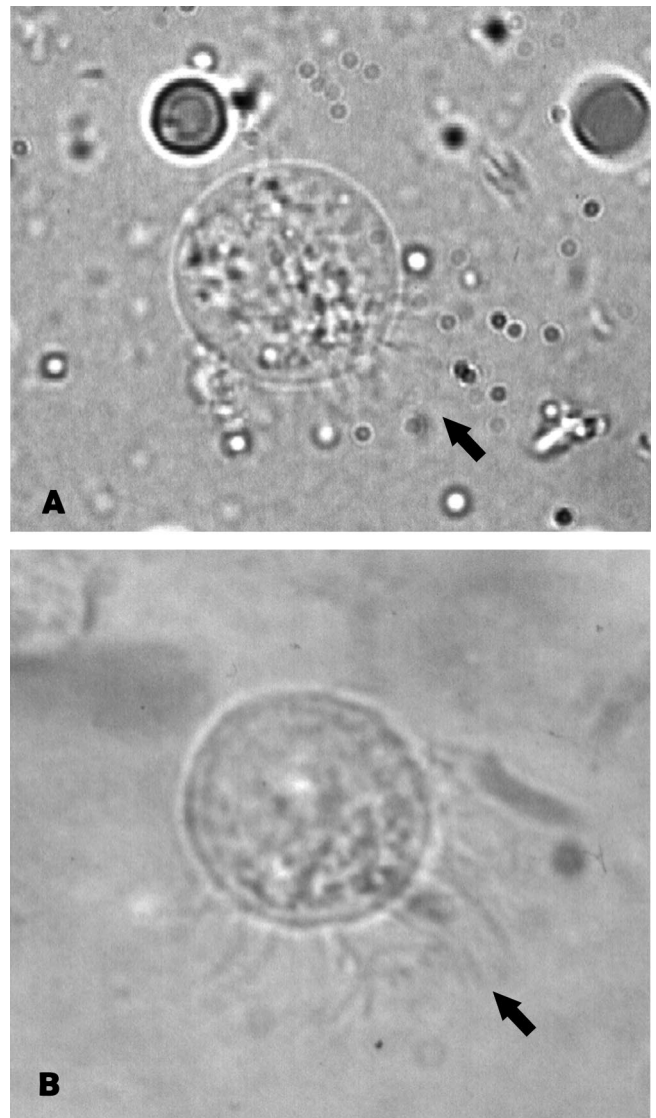


Figure 1. A: Flagellated protozoa (round shape, 20–25 microns in size, and numerous flagella inserted in one of the ends) observed in hindgut extract of German cockroach (phase-contrast microscopy, $\times 1000$). B: Flagellated protozoa observed in a fresh sputum sample (phase-contrast microscopy, $\times 1000$). The insertion of the flagella is indicated (arrows).

Our wide experience in the observation of sputum smears from patients with chronic respiratory pathway disease, especially asthmatic patients, has made us aware of a significant increase in detached ciliate epithelial cells in the cytological extrusions of these patients, which would favor the presence of erosions in the mucous membrane of the respiratory system, a fact already documented. In addition, we have noticed that in these samples, when flagellated protozoa are observed there also exists a marked increase in the presence of monocytes when compared with other types of leukocytes. This peculiar inflammatory response has already been reported by us.²

Protease-activated receptors (PARs) in the epithelia of the human airways are likely to play an important role in airway inflammation, especially in asthmatic patients. Exogenous proteases from well-known allergens such as mites, molds, and microbes react with cell-surface PARs in the airways, especially PAR-2, to produce an increase of the vascular permeability, leukocyte infiltration, and airway hyperreactivity.³

A mechanism by which German cockroach proteases react with PAR-2 regulating interleukin-8 expression *via* nuclear factor for interleukin-6 in human bronchial epithelial cells has been described.⁴ In other species of human pathogenic flagellated protozoa, it has been shown that certain secreted cysteine proteases cause epithelial cell detachment followed by extensive cell destruction, constituting some of the molecules involved in the pathogenesis of these protozoa.⁵

In our opinion, the existence of flagellated protozoa in the respiratory pathways has an important meaning. It is

necessary to establish the pathogenesis of these protozoa. We suggest two possible mechanisms for this. One, by direct damage to the respiratory epithelium, provoking desquamation and denudation of the mucous membrane, suppressing its function as a protective barrier of the epithelium, and making this much more susceptible to the action of allergens and other inhaled particles. Two, the synthesis of proteases may activate the PARs, with the consequent inflammatory response through mediators such as interleukins-6 and -8, among others.

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