PRESENT-DAY KNOWLEDGE CONCERNING COCCIDIOIDES IMMITIS

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Of the fungi pathogenic to man, perhaps more is known about *Coccidioides immitis* than any other. This knowledge which has been accumulated within the past 50 years has brought the following facts to light.

C. immitis is a dimorphic organism, i.e., it exists in two separate and distinct phases, one in living tissue and the other in laboratory media. In animal tissue it occurs in the form of spherical bodies known as spherules or sporangia (figure 1). These structures at maturity are filled with a varying number of endospores that are released through rupture of the sporangial wall. The liberated spores may each, in turn, develop into new sporangia and by this method the fungus may continue to multiply within the animal body.

On artificial media, *C. immitis* develops in the form of a mold-like fungus not unlike that of many nonpathogenic fungi. The white cottony colonies, however, from numerous small, more or less rectangular thick-walled arthrospores that are of diagnostic importance (figure 2). When spores or mycelial fragments are inoculated onto suitable media, the mold-like colony again develops. On the other hand, sporangia appear when the same cultural elements are injected into animals. At the present time, the tissue phase of *C. immitis* cannot be obtained with any degree of regularity on artificial media.

The disease induced by *C. immitis* is known as coccidioidomycosis and was formerly believed to be rare and invariably fatal. Today it is known that millions of people have been infected in several of our western States; and although fatal manifestations are rare, the symptoms induced

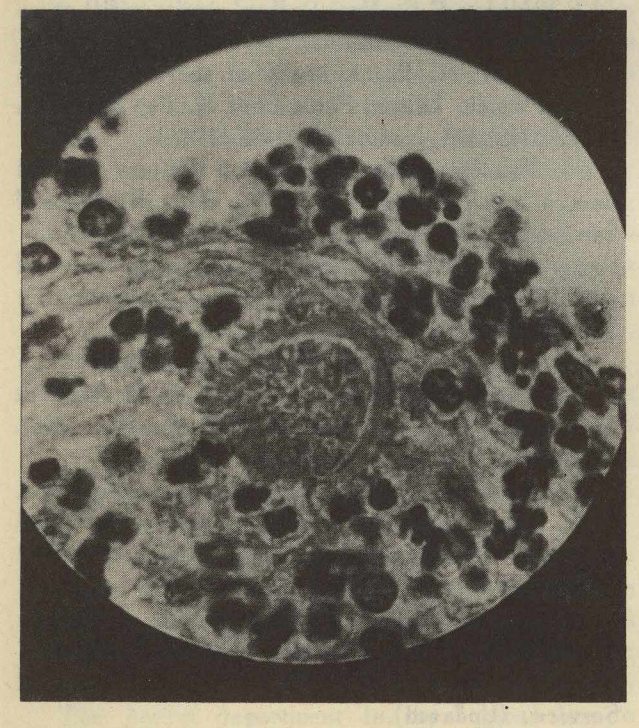

Figure 1. Mature sporangium of *C. immitis* in animal tissue.

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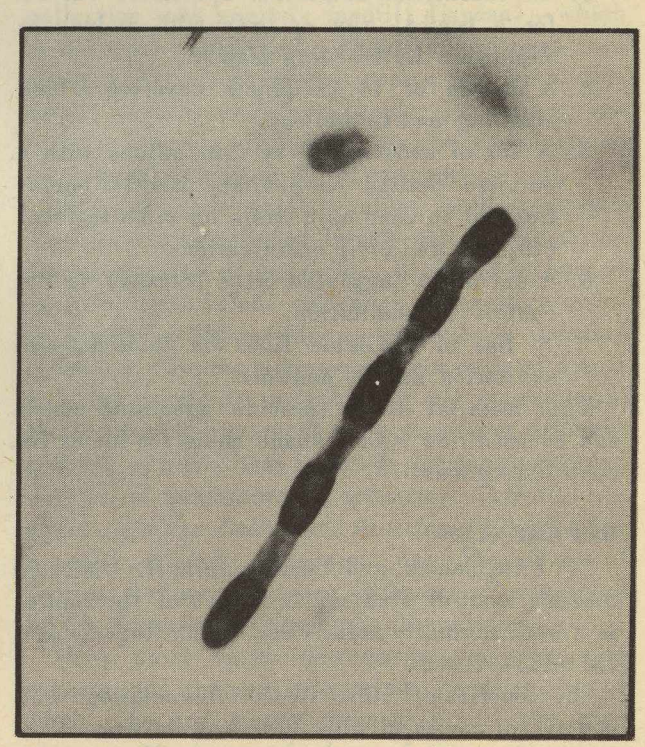

Figure 2. Chain of arthrospores from a culture of *C. immitis*.

may be quite severe.

Skin testing surveys and clinical records show that more than 99 percent of all infections are mild and self-limited. In fact, about 60 percent of all infections are either completely asymptomatic or are accompanied by vague, insignificant symptoms. The remaining nonfatal infections are characterized either by respiratory disturbances resembling those of influenza and pneumonia or by the development of a variety of more or less severe symptoms.

In white persons, progressive disease develops in only 0.2 percent or less of all infections, but in these disseminated cases mortality averages 50 percent. The incidence of severe infections appears to be higher in other racial groups, but not enough data has been accumulated to substantiate this impression. Although these statistics, gathered principally from California, would indicate that coccidioidomycosis is not the invariably fatal disease it was once considered to be, we lack morbidity and mortality data from all the endemic areas.

From an epidemiological point of view, *C. immitis* is a highly interesting organism. It has a markedly limited geographic distribution for reasons that are not yet understood. At the present time, *C. immitis* is known to exist solely in several arid regions of North and South America with a possible small endemic focus in Italy. In the United States, it has been found in portions of California, Arizona, New Mexico, Nevada, Utah, and Texas.

Until recently, Argentina was the only South American country where cases of coccidioidomycosis were known to occur. Recent findings, however, show that the organism exists in Paraguay, Bolivia, Venezuela, and Mexico. It is not unreasonable to expect that, in time, *C. immitis* will be found to be distributed in suitable environments elsewhere.

C. immitis probably exists as a saprophyte in nature. In fact, it has been isolated from soil by several workers. All evidence indicates that coccidioidomycosis is essentially an air-borne disease. Incidence of infection is highest during dry, dusty periods and lowest during rainy seasons. Recent studies have shown that dust control measures significantly reduce the incidence of infection of humans by *C. immitis*. There are no records of person-to-person transmission.

SUMMARY

This presentation has summarized briefly some of the knowledge of *Coccidioides immitis* that has been accumulated since Posadas, of Argentina, described the first case of coccidioidomycosis in 1892 and Ophuls (1900) showed, by successful isolation, that the etiologic agent was a fungus and not a protozoan.

To medical and public health workers, *C. immitis* still presents many problems. Because coccidioidomycosis is a protean disease which simulates syphilis, pneumonia, measles, tuberculosis, and other diseases, differential diagnosis in this infection is an important problem for the physician. Competent mycological laboratory work is necessary to guide the physician in his diagnosis.

It is unfortunate that, at the present time, once a correct diagnosis of coccidioidomycosis has been made there is available little besides supportive measures to aid the patient. No immunological or chemotherapeutic tools are yet available to control the disease. In the prevention and therapy of this and most other mycoses, the microbiologist, chemist, and immunologist have an unlimited field for investigation.

REFERENCES

1. Smith, C. E.: Epidemiology of acute coccidioidomycosis with erythema nodosum. Am. J. Pub. Health 30:600-611 (1940).

2. Smith, C. E.: Coccidioidomycosis. Med. Clin. of N. Am. 27:790-807 (1943).

3. Emmons, C. W.: Coccidioidomycosis in wild rodents: a method of determining the extent of endemic areas. Pub. Health Rep. 58:1-5 (1943).

4. Smith, C. E., Beard, R. R., Rosenberger, H. G., and Whiting, E. G.: Effect of season and dust control on coccidioidomycosis. J.A.M.A. 132:833-838 (1945).

5. Smith, C. E.: Recent progress in pulmonary mycotic infections. California Med. 67:179-185 (1947).

6. Campins, H., Scharyj, M., and Gluck, V.: Coccidioidomicose. Su combrobacion en Venezuela. Arch. Venez. Patol. Trop. Y. Parasit. Med. 1:215-234 (1949).

7. Posada, A.: Un nueva caso de micosis fungoidea con porospermias. An. Circulo Med. Argentino 15:585-597 (1892).

8. Ophuls, W.: A new pathogenic mold (formerly described as a protozoan *Coccidioides immitis* pyogenes) Philadelphia Med. Jour. 5:1471-1472 (1900).