

*Discussion.* None of the series of animals in which some members showed an apparent tendency to recover, was sufficiently prolonged to demonstrate undoubted spontaneous recovery. Such a tendency seemed to be present in house rats, white rats and to a less extent in white mice but the numbers of these rodents killed at each interval were too few to make the findings unequivocal. All the field rodents studied, as well as the house mice remained heavily infected throughout the period of observation

*Conclusions.* 1. The giant hamster (*Cricetulus triton*), a vole (*Microtus* sp.) and the Chinese house mouse (*Mus wagneri*) are markedly susceptible to infection with *Leishmania donovani*. These showed no tendency toward spontaneous recovery during the periods covered by the present studies.

2. The house rat (*Mus rattus*) white rat (*Mus novegicus* (vel *decumanus*) *albinus*) and white mouse (*Mus musculus albinus*) show infections of only moderate intensity and seem to exhibit a tendency to recover spontaneously. However none of the series was long enough to show undoubted and complete recovery.

## 2989

### A search for field and house rodents naturally infected with kala-azar.

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The striped hamster (*Cricetulus griseus*) has been shown to be very susceptible to infection with kala-azar.<sup>1</sup> Its southern range corresponds, so far as it has been studied, with the distribution of kala-azar in China. These two facts together with other obser-

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<sup>1</sup> Smyly, H. J., and Young, C. W., PROC. SOC. EXP. BIOL. AND MED., 1923-24, xxi, 357.

<sup>2</sup> Young, C. W., Smyly, H. J., and Brown, C., PROC. SOC. EXP. BIOL. AND MED., 1923-24, xxi, 357.

vations on the epidemiology of the disease, suggested the possibility that this hamster or some other field rodent may be a reservoir of *Leishmania donovani*. Assuming such a source, man might be infected in his dwelling directly from the animal or indirectly by means of some domestic rodent (rat or mouse) which had in turn become infected from an invading field rodent. In either case the probable vector or intermediate host would be some rodent ectoparasite. With this rodent-ectoparasite hypothesis in mind we have: (1) searched for hamsters and other field and house rodents naturally infected with kala-azar; (2) tested for susceptibility to infection with *Leishmania donovani* the common field and house rodents from an endemic area; and (3) studied the natural ectoparasites of these rodents and their capabilities as transmitters of the disease. The present paper is a brief statement of the results of the first of these investigations. The animals recorded comprise (1) those killed and examined primarily for the purpose of searching for naturally infected animals; (2) those that died in the laboratory before they had been submitted to any experimental procedure and (3) such stock rodents as were accidentally killed by liver puncture. From this study were excluded (1) all rodents that had received any injection or had been submitted to any manipulation other than liver puncture; (2) all carcasses that showed decomposition of the organs; and (3) all animals regarding whose exact origin and subsequent history there was any doubt. Examination consisted in making smears of at least the spleen and liver, staining with Wilson's stain and studying microscopically.

*Field Rodents.* More than 3500 striped hamsters were sacrificed in the direct search for natural infections. In less than fifty of these, smears were not examined but the spleen and liver were injected intraperitoneally into tested negative hamsters. Later these inoculated animals were killed and smears for their organs were examined microscopically. Enlargement of the spleen resembling more or less that found in early or moderately advanced kala-azar, was occasionally encountered. The cause of this enlargement was not determined. Trypanosomes were seen in some of the rats but in none of the other rodents here recorded.

Of the 4480 striped hamsters included in this study only one was found to be infected with *Leishmania donovani*.

H-8056 was brought to the Kala-Azar Field Studies Laboratory from Lo T'o Shan between October 1st and 15th, 1924. It

was placed with nine others of the same lot in a cage. On November 29th the ten hamsters were killed with ether and autopsied. The smears from this hamster showed *Leishmania donovani* in large numbers (spleen +++, liver +++, marrow +++++, heart blood +). The spleen was ground and suspended in sterile Locke's solution and injected intraperitoneally into a tested hamster (No. H-7798). The liver was similarly inoculated into ten tested negative hamsters (Nos. H-7799-7808). Of these eleven inoculated animals, eight were found to be infected when autopsied later and three were negative.

More than 3500 of the striped hamsters examined were captured during the months of October and November, 1924. The dates of taking the others were scattered throughout the rest of the year.

Four hundred giant hamsters (*Cricetulus triton*) and 134 voles (*Microtus* sp.) were examined. All were negative.

*House Rodents.* The house rodents studied were the black rat (*Mus rattus*) and the Chinese house mouse (*Mus wagneri*). These were divided into those caught in "clean" houses, *i. e.*, buildings not occupied by kala-azar patients; and those taken in "kala-azar" houses, *i. e.*, buildings that were the homes of persons suffering from that disease. All the 400 rats from "clean" houses and the 210 from "kala-azar" houses were negative, as were the 114 mice from "clean" and 57 from "kala-azar" houses.

*Discussion.* Of the 5819 rodents examined, one, a striped hamster, was found to be infected with kala-azar. There is no reason to doubt that this is an authentic instance of natural infection. On the other hand it should be pointed out that infected hamsters were kept in the same building though in a separate room. Moreover, the animal was killed six to eight weeks after it was brought from the field. The fact that only 0.02 per cent of the striped hamsters were positive while about 5 per cent of the inhabitants of the nearby villages of Camel Mountain (Lo T'o Shan) and Lion Mountain (Shih Tzu Shan) have the disease indicates that these rodents are not the source of human kala-azar. Even if this animal was naturally infected, it does not follow that *Cricetulus griseus* is the reservoir of kala-azar. During the winter's trapping no field rodents were caught in village houses though a few house mice were taken in the fields throughout the year.

The number of house rodents examined was not large enough to form a basis for definite conclusions, but the evidence so far as it goes is against domestic rodents being concerned with the spread of kala-azar.

2990

**Attempts to transmit kala azar by means of rodent lice,  
haematopinus sp.**

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On account of the susceptibility of the Chinese hamster to infection with kala-azar we have considered in another paper<sup>1</sup> the possibility of these and other rodents being reservoirs of the disease, the transmission in such case being effected by means of their ectoparasites from the rodents to other rodents and man. In this connection a number of rodent ectoparasites have been studied with regard to their capabilities as transmitters of kala-azar. The rodents examined have been chiefly the striped hamster (*Cricetulus griseus*), the giant hamster (*Cricetulus triton*), a vole (*Microtus* sp.), the Asiatic house mouse (*Mus wagneri*) and the house rat (*Mus rattus*). Their ectoparasites have been limited chiefly to fleas, bloodsucking mites (*Gamasidae*), ticks, non-bloodsucking mites (*Myobia*) and lice (Pediculidae, *Haematopinus* spp.). The fleas, Gamasid mites and ticks have been found only on the house rodents, while the lice have been found on both field and house rodents, each having its own species of louse. The present paper is a summary of the studies made on the respective species of *Haematopinus* of the two hamsters.

In addition to the possible rôle of lice in connection with the rodent-ectoparasite hypothesis, a further reason for studying these insects lay in the fact that our stock animals tended to more

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<sup>1</sup> Young, C. W., and Hertig, M., *PROC. SOC. EXP. BIOL. AND MED.*, 1925-6, xxiii, 395.