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Studies on the immunology and serology of leishmaniasis

III. On the cross-immunity between panamanian cutaneous leishmaniasis and *Leishmania mexicana* infection in man

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Workers on leishmaniasis have for long been interested in the antigenic relationships of the different species or strains of *Leishmania*, in particular those of the New World (ADLER, 1964). ADLER and GUNDERS (1964) showed that patients recovered from oriental sore were immune to subsequent challenge with *Leishmania mexicana*, but they did not study the capacity of *L. mexicana* to immunize against *L. tropica*. In this connexion it may be recalled that russian workers have shown that recovery from rural strains of *L. tropica* would immunize against urban strains, but that the reverse did not usually hold (SOKOLOVA, 1940; KOZEVNIKOV, 1945, 1963; RODYAKIN, 1957). Recently, work on the cross immunities between forms of american cutaneous leishmaniasis in monkeys (LAINSON and BRAY, 1966) has supported Adler’s suggestion (1964) that prior infection with and recovery from *L. mexicana* infection might confer immunity to other forms of american cutaneous leishmaniasis in man.

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Two volunteers were available, having experienced \textit{L. mexicana} infection and panamanian cutaneous leishmaniasis respectively. We felt this to be a good opportunity for cross immunity experiments with these two parasites.

**MATERIALS AND METHODS**

**Strains of \textit{Leishmania} used**

- **H1.** \textit{L. mexicana} from British Honduras. Isolated from a patient with chiclero’s ulcer in July, 1960.
- **L11.** \textit{L. mexicana}. Rodent strain M379, from British Honduras (LAINSON and STRANGWAYS-DIXON, 1964) and as used by LAINSON and BRAY (1966)
- **L7.** \textit{Leishmania} sp. Human strain SH24, from the Achiote area, Panama (SHAW, 1964, and in press)

Strain L7 (SH24) has been maintained by the inoculation of Leishman-Donovan (LD) bodies or leptomonads into the nose skin of hamsters, in which it generally produces a small, slow-growing lesion. Dermal lesions can also be produced on the noses of Rhesus monkeys.

**Inoculation of volunteers**

The volunteers were inoculated with leptomonads derived from primary NNN isolates from hamster lesions. The flagellates were washed once in sterile Hank's solution and resuspended in this fluid. Leptomonad density was established by using a Neubauer counting chamber, and 0.05ml amounts were inoculated intradermally into the volunteer’s arm.

**Volunteer 1**

Approx. September, 1962. Acquired cutaneous leishmaniasis while working in forest in the Achiote area of Panama.

February 9, 1963. Two ulcerative lesions developed on the neck, and strain L7 (SH24) \textit{Leishmania} sp. was isolated in NNN culture. Infection was terminated by treatment with pentostam (sodium stibogluconate, B. P.)
January 20, 1965. Challenged with approx. 50,000 leptomonads of the panamanian *Leishmania* sp. L7 (SH24) into the left arm. Strong Montenegro reaction but no infection. Hamsters inoculated with the same number of leptomonads developed typical infections.

February 25, 1965. Challenged with 50,000 leptomonads of strain *L. mexicana* L11 (M379) into the other arm. Strong Montenegro reaction, but no infection. One Rhesus monkey and two hamsters, inoculated with the same number of leptomonads from the same suspension, developed characteristic *L. mexicana* infections.

**Volunteer 2**

October 12, 1960. Received syringe-induced infection with strain H1 *L. mexicana* by inoculation of leptomonads into subcutaneous tissue of left thigh. Fibrous nodule palpable three months later and abundant LD bodies in aspirated material up to 11 months.

July 15, 1961. Challenged with leptomonads of same strain H1 *L. mexicana* into left arm. Mild Montenegro reaction but no infection resulted. A non-immune volunteer was readily infected with leptomonads from the same suspension.


January 12, 1965. Challenged with approx. 500,000 leptomonads of strain *L. mexicana* L11 (M379) into left arm. Strong Montenegro reaction verging on mild Arthus reaction, but no infection. Hamsters inoculated with leptomonads from the same suspension became infected.
March 17, 1965. Challenged with approx. 50,000 leptomonads of the panamanian strain L7 (SH24) into right arm. Mild Montenegro reaction. Hamsters and two Rhesus monkeys, inoculated in the nose with the same number of leptomonads from the same suspension, became infected.

April 2, 1965. Small, hard papule about 3mm diameter developed at site of inoculation.

April 14, 1965. Lesion incised and intra and extra-cellular LD bodies seen in stained smears.

June 10, 1965. Lesion ulcerated and approximately 10mm diameter. Infection terminated by treatment with pentostam.

DISCUSSION AND CONCLUSIONS

As we expected, past infection with a panamanian strain of *Leishmania* rendered the first volunteer immune to further challenge with the same parasite. Furthermore, it had also conferred complete protection against *L. mexicana* infection.

The second volunteer twice proved immune to further challenge with *L. mexicana* – up to 4¼ years since his original infection with that parasite. He was susceptible, however, to infection with the panamanian parasite.

It would appear that in this case *L. mexicana* infection did not impart even a partial immunity to panamanian leishmaniasis. On the contrary, the lesion in the volunteer appeared earlier and developed more quickly than the infections in two hamsters and two Rhesus monkeys inoculated with the same number of leptomonads, at the same time.

ADLER (1963) has shown that *L. braziliensis* is antigenically distinct from *L. mexicana* and he has also pointed out (personal communication) that our L7 (SH24) strain from Panama is
antigenically different from these two species, and our present findings support this conclusion. While we would like to denote this difference in assigning a specific name to the panamanian parasite, this is at present impossible until it has been similarly compared with *L. guyanensis* – the name given to the parasite causing pian bois, notably in the geographically allied areas of the Guianas.

Incomplete cross immunity has for long been known in the major and minor forms of *L. tropica* infections of man in Central Asia. In the present work we have indicated two further instances of incomplete cross immunity in *L. braziliensis* – *L. mexicana* infections in Rhesus monkeys (LAINSON and BRAY, 1966) and *L. mexicana* – panamanian-cutaneous-leishmaniasis in man. This “one-way immunity” is possibly explained by the hypothesis that some species of an organism possess antigens that are capable of exciting protective antibodies to other closely related species, while these other species may not be capable of a reciprocal action owing to the absence of such antigens.

**SUMMARY**

A volunteer immune to panamanian cutaneous leishmaniasis was found to be immune to *L. mexicana* infection.

A volunteer immune to *L. mexicana* infection was found to be completely susceptible to panamanian cutaneous leishmaniasis.

It seems that *L. mexicana* and the causative agent of panamanian cutaneous leishmaniasis are antigenically distinct. The relationship between the panamanian organism and *L. guyanensis* is still to be ascertained.

**REFERENCES**


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