poietic activity became even more evident, and, through the process of remodeling of the bone, the lattice spaces grew wider and the bony trabeculae narrower, until by the 5th week there was no bone in the center and only a shell of bone surrounded the new marrow (Fig. 6).

All normal hemopoietic elements were present on the imprints of the tissues, and normal ratios were maintained. Mitotic figures indicated that the proliferation of blood cells was occurring in the reconstituted marrow. These nodules of ectopic marrow have been recovered as long as 6 months after implantation.

The ultimate size of the reconstituted tissue depends on the size of the implanted tissue. When the implant is too small, it may not survive at all; we have been unable to obtain survival and growth of marrow pieces smaller than 3 mm in diameter. When the implanted tissue was of adequate size, the implants in well-vascularized areas were uniformly successful. This indicates that in reorganization of marrow a critical size is involved; this fact may account for the failure of earlier attempts to grow the marrow in rabbit ear chambers (*3*).

The best supportive tissues for the growth of these marrow implants have been the spleen and kidney; their suitability may be related to the intense vascularity of these tissues. Regeneration of the marrow evidently requires a rather intensely vascular tissue, although the bone formation can take place with less vascular support. Fragments implanted in adipose tissue, for example, did not always survive. When regeneration did occur, the ratio of bone to marrow was greatly increased.

Implantation of autogenous marrow in seven New Zealand white male rabbits and in one female beagle dog has resulted in the same reconstitution of the hemopoietic tissue at the ectopic sites.

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Falciparum Malaria Transmissible from Monkey to Man by Mosquito Bite

Abstract. Anopheles freeborni *mosquitoes were infected by feeding on a New World monkey,* Aotus trivirgatus, *infected with the Malayan IV strain of* Plasmodium falciparum. *After a normal incubation period, the infection was passed to a human volunteer through the bites of these mosquitoes, demonstrating for the first time the practicability of using a simian host as a donor for the infection of mosquitoes with this species of human malarial parasites.*

It was recently reported that the New World monkey *Aotus trivirgatus* (owl or night monkey) can be experimentally infected with the human malarial parasites *Plasmodium vivax* (*1*, *2*) and *P. falciparum* (*3*). These reports were indeed welcome since they offered, for the first time, an experimental animal well within the means of most laboratories interested in research on human malaria. Before these discoveries were made, the chimpanzee (*4*) and the gibbon (*5*) were the only suitable experimental animals that could be infected with human malarial parasites.

In our research program on human malaria, whenever infected mosquitoes are required, it has been necessary to subject volunteers to prolonged, though modified, clinical illness while waiting for gametocytes to be produced. Infection of small, inexpensive monkeys with human malarial parasites would preclude the necessity of employing volunteers for infecting mosquitoes.

We began to study, in owl monkeys, several strains of *P. falciparum* obtained from colleagues (Camp strain, Uganda strain). To date, all attempts to infect mosquitoes with these strains have failed. Recently, we have not only infected owl monkeys with one of the strains of *P. falciparum* resistant to chloroquine, which we maintain for study (Malayan IV), but have also transmitted this strain from the owl monkey back to man by mosquito bite.

On 13 February 1968, blood from volunteer M.I. infected with the Malayan IV strain of *P. falciparum* was inoculated into owl monkey AO-23. Patent infection obtained 27 days later. The infection was passed by blood to a second owl monkey, AO-25. *Anopheles freeborni* mosquitoes fed on this monkey became infected and exhibited sporozoites in the salivary glands 14 days later.

Nine mosquitoes from this lot, four of which had sporozoites in the salivary glands, were allowed to bite volunteer B.R. on 15 April 1968. Eleven days later, patent infection obtained in this volunteer. On day 12, the first paroxysm, with shaking chills and fever of 101.2°F (38.4°C), was observed. Two days later (day 14) fever of 104.0°F (40°C) was recorded. By day 16, the parasite count in volunteer B.R. was approximately 37,000 per cubic millimeter of blood, and fever of 105.0°F (40.6°C) was recorded.

The fact that this transmission was possible is not only interesting, but indeed unexpected on the basis of previous reports. Whereas mosquitoes fed on owl monkeys infected with *P. vivax* became infected (*1*), gametocytes in chimpanzees or gibbons infected with *P. falciparum* are immature and cannot undergo development in mosquito vectors (*4*, *6*). Geiman and Meagher (*3*) stated that immature and eventually mature gametocytes appear in owl monkeys infected with *P. falciparum.* However, no reports of the ability of such gametocytes to infect anopheline mosquitoes are available.

It remains to be seen if *P. falciparum* can be transmitted back to the monkey from man through the bites of infected mosquitoes. If such transmission can be achieved experimentally, the implications of these cycles of transmission, insofar as they relate to malaria eradication and control, are obvious.

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