CHAPTER 38

Malaria

MARTIN D. YOUNG

Synonyms. The synonyms of malaria in general are ague, jungle fever, paludism. Synonyms of malaria due to *Plasmodium vivax:* benign tertian, *vivax* malaria. Synonyms of malaria due to *Plasmodium falciparum:* malignant tertian, subtertian, estivo-autumnal, E-A, *falciparum* malaria. Malaria due to *Plasmodium malariae* is designated quartan malaria or *malariae* malaria. Malaria due to *Plasmodium ovale* is designated *ovale* malaria.

Definition. Malaria is an acute and chronic infection characterized by fever, anemia, splenomegaly and often serious or fatal complications. It is caused by protozoa of the genus *Plasmodium.* Four species occur naturally in man, namely: *P. vivax* (Grassi and Feletti, 1890), Labbé, 1899; *P. falciparum* (Welch, 1897) Schaudinn, 1902; *P. malariae* (Laveran, 1881) Grassi and Feletti, 1890; and *P. ovale* Stephens, 1922. There are many strains in these four species.

Distribution. The normal range of malarial infections is between 45° north and 40° south latitude. In certain areas these limits are wider (Fig. 38–1). Malaria due to *P. vivax* is more widely distributed than the other types. It is the prevalent infection in most areas within the temperate zones but is widespread throughout the tropics as well. *Plasmodium malariae* is comparatively rare; it is observed most commonly in temperate areas and in the subtropics. *Plasmodium falciparum* tends to predominate throughout all tropical regions. *Plasmodium ovale* is relatively uncommon; the majority of cases have been reported from Africa, although some have been found in Asia, Europe and South America.

Etiology. The *life cycle* of the parasites causing malaria in man consists of an exogenous sexual phase, termed sporogony, with multiplication in certain anopheline mosquitoes, and an endogenous asexual phase, termed schizogony, with multiplication in man.

The *exogenous,* or *anopheline, phase* of the cycle begins when a suitable anopheline mosquito ingests blood containing the mature sexual forms, the gametocytes. Within a few minutes after reaching the insect's stomach, the male cell or microgametocyte extends actively motile flagellum-like structures, each of which contains a portion of the nuclear chromatin of the parent cell (Fig. 38–2). These flagella shortly become detached to form microgametes, which migrate to the female cell or macrogametocyte. Meanwhile the latter has undergone maturation in preparation for fertilization. Completion of these changes marks the end of gametogony; subsequent fertilization of the macrogamete by a microgamete initiates the processes of sporogony.

When a microgamete enters the female cell, fusion of the nuclear chromatin from each parent occurs, and shortly thereafter the fertilized cell elongates and becomes motile, forming the ookinete or traveling vermicule. This penetrates the wall of the mosquito's stomach, finally lodging beneath the outer layer.

It then undergoes progressive vacuolization to form a growing oocyst (Fig. 38–3). The nuclear chromatin subdivides repeatedly, its particles becoming arranged along cytoplasmic strands bordering the vacuoles. From each particle of chromatin in the protoplasmic mesh a filamentous structure extends into the lumen of a vacuole. The chromatin particles become incorporated in these filaments to form sporozoites. At maturity the oocyst consists of a spongelike spherical body that projects into the body cavity of the insect. In a suitable infected vector several hundred oocysts may be found on