Abstract:
Mathematical Modelling of the Cellular and Population Dynamics of HIV and AIDS.

Both the cellular dynamics of the Acquired Immune Deficiency Syndrome (AIDS) and the spread of the disease in human subpopulations are considered, based on models involving ordinary and partial differential equations. A comprehensive literature survey is given and the papers considered are grouped, analysed and compared. Physical parameters and results obtained in the various papers are compared.

After a brief introduction, the effects of the Human Immunodeficiency Virus (HIV) in the blood and the corresponding immune response to this virus are studied in Chapter two. The dynamics of various cell populations, including uninfected, latently and actively infected CD4+ T lymphocyte cells and virus particles are modeled. Models are also given of the interaction of HIV and the effect of various treatments of HIV (including combined therapy treatment) on the cell populations.

In Chapter three the effect of the disease on human populations is considered. The populations are separated into Susceptibles, Infecteds and Infectious, and AIDS patients. The rate of infection term and the reproductive rate are discussed as well as population growth rates, with some models suggesting that AIDS is capable of turning positive population growth rates in Africa negative over a time period of a few decades. Two-sex models, age-dependent models and delay models are also given, all focusing on different aspects of the disease progression. The formation and dissolution of sexually active partnerships is also considered together with partner mixing between different subgroups.