Pergamon

PII: S0020-7519(97)00111-2

International Journal for Parasitology, Vol. 27, No. 10, pp. 1135–1145, 1997

Printed in Great Britain
0020-7519/97 $17.00+0.00

Molecular Methods for Diagnosis and Epidemiological Studies of Parasitic Infections

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Abstract—Singh B. 1997. Molecular methods for diagnosis and epidemiological studies of parasitic infections. *International Journal for Parasitology* 27: 1135–1145. Direct microscopy is widely used for the diagnosis of parasitic infections although it often requires an experienced microscopist for accurate diagnosis, is labour intensive and not very sensitive. In order to overcome some of these shortcomings, molecular or nucleic acid-based diagnostic methods for parasitic infections have been developed over the past 12 years. The parasites which have been studied with these techniques include the human Plasmodia, *Leishmania*, the trypanosomes, *Toxoplasma gondii*, *Entamoeba histolytica*, *Giardia*, *Trichomonas vaginalis*, *Cryptosporidium parvum*, *Taenia*, *Echinococcus*, *Brugia malayi*, *Wuchereria bancrofti*, *Loa loa* and *Onchocerca volvulus*. Early methods, which involved hybridisation of specific probes (radiolabelled and non-radiolabelled) to target deoxyribonucleic acid (DNA), have been replaced by more sensitive polymerase chain reaction (PCR)-based assays. Other methods, such as PCR–hybridisation assays, PCR–restriction fragment length polymorphism (PCR–RFLP) assays and random amplified polymorphic DNA (RAPD) analysis have also proved valuable for epidemiological studies of parasites. The general principles and development of DNA-based methods for diagnosis and epidemiological studies will be described, with particular reference to malaria. These methods will probably not replace current methods for routine diagnosis of parasitic infections in developing countries where parasitic diseases are endemic, due to high costs. However, they will be extremely useful for genotyping parasite strains and vectors, and for accurate parasite detection in both humans and vectors during epidemiological studies. © 1997 Australian Society for Parasitology. Published by Elsevier Science Ltd.

Key words: Diagnosis; parasitic infections; malaria; DNA; polymerase chain reaction; PCR–RFLP; PCR–RAPD

INTRODUCTION

Microscopy remains the "gold standard" for diagnosis of parasites and indeed it is simple, can be rapid and does not involve the purchase and maintenance of expensive equipment. However, various problems are associated with microscopy as a diagnostic tool. For example, some parasites are morphologically similar or are very small and difficult to stain and detect. Consequently, well-trained microscopists are essential for accurate identification, and this holds true for many parasites. Furthermore, culture of parasites may be necessary as in the case of chronic *Trypanosoma cruzi* infections, where the numbers of blood trypomastigotes are low. Specialised media and laboratory facilities are required for culture and these are generally not available in countries where these infections are endemic. Besides, there is a relatively long period before results are obtained. Diagnosis by microscopy is also extremely labour intensive, especially when a large number of samples need to be screened in a relatively short time, such as during epidemiological studies.

In order to overcome some of the difficulties encountered using microscopy for parasite diagnosis, serological diagnostic methods have been developed. However, these methods have problems of their own. For example, it is difficult to differentiate between a current and previous parasite infection, and serological tests are of limited value when examining indi-

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