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Editorial

The era of genetics and genomics and its impact on parasitic diseases

Parasitic diseases, especially those caused by metazoans or the macroscopic parasites have been known to man from ancient times. While direct demonstration of a parasite stage remains the gold standard in diagnosis of parasitic infections, we have come a long way from the limited choice of observing stools for amoebae, ova or cysts (AOC) or a blood smear for parasites.

Genetics based diagnostic tools such as PCR and its variations such as Real Time PCR and multiplex PCR have been optimized for diagnosis of almost all parasitic diseases. Even in the local setting, PCR based diagnostic testing is available for parasitic infections such as malaria, leishmaniasis and toxoplasmosis and for several others at research level. Phylogenetic analysis has become almost a natural extension of the use of availability of gene sequencing with this technology being applied to understand the origin as well as diversification of a parasite species of interest.

The developments in the field of genetics coupled with advances in computing platforms and big data analytics has in turn led to an era of omics (genomic, transcriptomic, proteomic and metabolomic) which is now at the disposal of parasitologists. Proceeding from early parasite genome sequencing projects such as those of *Plasmodium falciparum*, *Trypanosoma* spp and *Leishmania major*, omics technology has been applied to many parasitic infections to understand pathogen adaptations, virulence and drug resistance mechanisms. Functional evidence from transcriptomics and proteomics has also added to this knowledge. While metabolomics has helped to identify specific pathways at different stages of the life cycle of parasites which can be targeted by anti-parasitic drugs, study of epigenomics of host-parasite interactions has shed light on manipulation of host defense mechanisms by the parasites. Advances in metagenomics has enabled investigation of both host and parasite-associated microbiota as determinants of disease outcome.

The developments in the above fields have made significant progress in understanding parasite pathogenic mechanisms, host susceptibility and contributed to development of novel diagnostics and therapeutic approaches. However, in a background where most of these advances take place in developed countries, the challenge lies in translating this knowledge and technology into operational reality which benefits developing countries, where most of these parasitic infections are endemic. Implementation of these genomics based approaches should be based on prioritized health needs of the local population and done in a manner which does not dispose of well-established and cost effective public health and clinical practices. Point of care diagnostics is one such application which stands to reap immediate benefits from these applications in an endemic setting. In the context of therapeutics where personalized or targeted treatment options are likely to bear a higher per patient cost, the emphasis should be on using the 'omics' approaches for preventive measures including vector control where appropriate.

Even if expensive infrastructure is not in place, a resource limited setting can be an active partner in these developments by building upon the high-end basic research to contribute to translational and implementation components. The best possible use of local expertise should be made in these endeavours and policies in place should facilitate capacity building, for instance creating an

environment conducive for collaborative work and technology transfer, so that we make the optimum use of these advances for the improvement of health of the local population.

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