

Genetic and Functional Goals of Science of the East and West and the Dynamics of Science

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Abstract: Genetic and genomic information now available for the malaria parasites, their mosquito vectors and human host, can be harnessed to both develop these tools and monitor their effectiveness. Here we review and provide specific examples of current technological advances and how these genetic and genomic tools have increased our knowledge of host, parasite and vector biology in relation to malaria elimination and in turn enhanced the potential to reach that goal. We then discuss limitations of these tools and future prospects for the successful achievement of global malaria elimination goals.

Keywords: Parasitic disease, Eradication, Infectious disease, Genetic diversity, Plasmodium, Vaccines, Malaria control

Since the nineteenth-century, physical anthropologists have studied issues such as childhood development, disease and evolution. However a recurring and often dominant focus has been the use of biology to understand politically significant peoples, and especially ethnic groups and their histories. This article tentatively identifies what I call ‘genetic ethnology’ as the latest in a long series of scientific projects of this kind, and examines potential implications for its politicisation. The present article identifies practices and relationships in genetic ethnology that appear to parallel those that supported ethnic classification in race anthropology. I have previously argued that scientific race anthropology played a key role within the important contemporary social project of classifying the unique combination of ethnic groups that made up each nation (McMahon, 2016, p. 2). Three characteristics of ethnic groups particularly shaped the simultaneously scientific and political practices of classifiers. Ethnic groups were (a) socially and, often, politically significant, (b) usually constructed as communities of common descent, but nevertheless (c) experienced in practice through culture, society and politics. Physical anthropologists could therefore claim expertise about them but rarely did so within a purely scientific context. They also interacted continuously with the construction of national identities among the general public and political actors and collaborated with social sciences and humanities in order to connect biology with culture (McMahon, 2019, pp. 34–35). Sharing this project, genetic ethnology is also interdisciplinary, bringing together anthropologists, human geneticists, archaeologists, linguists and other scholars. Science is a human activity, and scientific contributions have come from people from a wide range of different backgrounds and cultures. Historians of science increasingly see their field as part of a global history of exchange, conflict and collaboration. Elimination of malaria entails reducing

to zero the incidence of locally acquired malaria infection in a specified geographic area as a result of deliberate efforts, with continued measures in place to prevent re-establishment of transmission. The past decade witnessed unprecedented efforts to control malaria, including renewed political and financial commitment and increased availability of both old and new strategies and tools. World Health Organization recommends a multi-pronged strategy to control and eliminate malaria, which includes vector control interventions, preventive therapies, diagnostic testing, treatment with quality-assured artemisinin-based combination therapies (ACT) and strong malaria surveillance. Significant progress has been achieved in malaria control worldwide over the past decade, with impressive reductions in transmission occurring in many endemic regions, including Sri Lanka. These successes have stimulated renewed hopes for achieving the ambitious goal of global eradication of malaria.

Currently, tools such as ACT, insecticide-treated bed nets (ITNs) and rapid diagnostic tests (RDT) have become widely available. Many countries have adopted the use of ACT as first-line treatment as they are safe and highly effective in curing infection. Primaquine is currently the only drug available to treat the liver stage (hypnozoite) of *Plasmodium vivax* infection (i.e. radical treatment). There have been significant increases in the availability and use of parasitological testing (both RDTs and microscopy) in recent years. However, further funding and technical support are required to help countries to achieve universal diagnostic testing of suspected malaria.

Genotyping methods of studying natural variation and population structure have evolved from the traditional microsatellite-length polymorphisms to shotgun sequencing, single nucleotide polymorphism (SNP) discovery, and genotyping using arrays or a variety of other high-throughput, low-cost approaches. Since the first malaria genome was sequenced in 2002,²⁶ around 700 000 unique SNPs (with numbers continuing to increase) have been identified by concerted sequencing efforts, genomic tiling arrays as well as low-density SNP arrays. Genome-wide maps of diversity in geographically diverse strains of *P. falciparum* have been produced demonstrating the potential utility of SNP genotyping in identifying genes subject to recent natural selection and for understanding population genetic parameters of this parasite.

Single nucleotide polymorphism genotyping has thus far been useful in discovery of biomarkers of important traits in the parasite, vector and the host, which includes drug resistance, virulence factors, insecticide resistance, immune evasion and modulation mechanisms and infection resistance. Therefore, surveillance and monitoring of these biomarkers have enabled policy makers to make informed decisions regarding the choice of treatment and vector control measures. However, for genotyping to be of ideal value in malaria elimination, the biomarkers should be of low cost and easily and reliably identified in real-time in the field setting, so that informed point-of-care diagnosis and treatment options will be made possible. Use of such principles to make available high-tech but affordable, efficient and effective tools that are of practical value in the field might indeed be a reality.

Social science genetics is concerned with understanding if, how, and why genetic differences between human beings are linked to differences in behaviours and socio-economic outcomes. Our review discusses the goals, methods, challenges and implications of this research endeavor. We survey how the recent developments in genetics are beginning to provide social scientists with a powerful new toolbox they can use to better understand environmental effects and illustrate this with several substantive examples. Furthermore, we examine how medical research can benefit from genetic insights into social-scientific outcomes and vice versa. Finally, we discuss the ethical challenges of this work and clarify several common misunderstandings and misinterpretations of genetic research on individual differences.

This powerful tool has the potential to re-programme mosquito genomes, leading to modification or eradication of vectors of disease including malaria, with possibilities for malaria eradication. To conclude, the overall prospects for expanding the 'map of malaria elimination' are clearly encouraging and potential opportunities are seemingly endless with technological advances moving at an unbelievably rapid pace. Therefore, in this context, even the far-off dream of achieving the status of eradication of malaria might not be too optimistic a view to hold.

Genetics is the study of reproduction and variation in living organisms. It was already known in primitive society that certain characteristics of animals and plants can be passed from one generation to another, and this knowledge was used in animal husbandry and agriculture through selective breeding. However, modern genetics as a science that understands the mechanisms of reproduction began to develop only after the work of Gregor Mendel (19th century). Mendel discovered that reproduction is a fundamentally discrete process with independent functions. These basic units of reproduction are now called 'genes'. In the cells of an organism, genes are physically located in DNA molecules and carry the information needed to build and control the cellular components. Although genetics play a large role in determining how an organism looks and behaves, the overall outcome depends not only on genes, but also on the environment surrounding the organism. For example, a person's height is determined not only by genes, but also by the nutrition and health he received in childhood.

The main task of genetics is to reveal the development of signs and characteristics of organisms and their transmission to future generations by researching the structure and functions of chromosomes, genes and nucleic acids (DNA, RNA), which are the material bases of heredity. Genetics includes the study of the occurrence of genetic variation in organisms under the influence of various physical and chemical factors and its importance in the evolution of organisms. Creation of productive varieties of cultural plants, productive breeds and strains of animals and microorganisms; development of methods of their prevention and treatment based on the study of the causes of the appearance of hereditary diseases; studying the factors of the ecological environment that have a negative effect on heredity and genetically justifying the preservation of the gene pool represents the practical problems of genetics research.

Farabi also points out that the good life of people depends on the manager, the new leader, his various qualities, and he wants to help him in this regard. In his opinion, the leader's humanistic features are important in this position: "Whoever does not have the ability to inspire someone to the actions necessary to achieve happiness and happiness, and is powerless to carry out this action, such a person They learn these guidelines from their past leaders, but at the same time, the future leader will learn from the patterns and guidelines of the past. If he finds it necessary to reform, he will change it according to the requirements of his living conditions.

Beruni put forward this idea in his "India" work: "He is literate in thought and purpose with virtue and power to be a leader interested in management and political affairs by nature, leaving the state to his successors and their own parents. Every command given by one who intended them not to oppose their forefathers is as firm as a mountain standing in front of the one who is commanded, and even after many times and long ages pass by that command, the next ones also obey it." 6. According to him, the governor, who is inclined to rule by nature, should be firm in his opinions and views, and should obey the advanced opinions expressed by wise men in the implementation of his work. The main task of the just mayor is to establish equality and justice between the high and low classes, the powerful and the weak. Another important task of the mayor is to take care of the development of science and scientists.

Therefore, Beruni was able to contribute to the development of management and leadership teachings with his humanitarian ideas. He advocated mutual understanding, equality and justice in government, which are always valuable ideas.

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