

Molecular Anthropology is dead, long live Molecular Anthropology

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Origins of molecular anthropology

The field of molecular anthropology was first acknowledged and named in 1962 by Emile Zuckerkandl at a Wenner-Gren Foundation-sponsored conference that brought together leading anthropologists and evolutionary biologists behind the Modern Synthesis (Hagen 2010). Soon after in 1968, the term “anthropological genetics” was coined by Derek Roberts in a lecture at the UK’s Royal Anthropological Institute (Crawford 2019). Since its inception, molecular anthropology has been characterized by the application of techniques from disciplines like biochemistry, population genetics, and evolutionary biology to address questions of interest to anthropologists. These questions include understanding historic and prehistoric human migration and kinship patterns, biological adaptations to varied environments, and human origins. Today, anthropological genetics sits at the overlap between the fields of human genetics and biological anthropology, sharing theory and methods of analysis with the former but with an emphasis on fieldwork and collaboration with small-scale and indigenous communities from the latter. As such, its practitioners have been trained and identified professionally as biologists and human geneticists as often as they have as anthropologists. Today, geneticists answering classical anthropological questions continue to conduct research across a variety of academic departments, including human genetics, ecology and evolution, general biology and medical

affiliations – in addition to named anthropology departments (Reynolds et al. 2020; Scelza et al. 2020a).

In this perspective, we ask: 1) are anthropology departments still a suitable home for anthropological geneticists? 2) what are the limitations of this affiliation relative to other departments? and 3) what role can geneticists with anthropological interest/training contribute to the field of genetics? We begin with a brief history of molecular anthropology in the US and specifically the training of anthropological geneticists in US anthropology departments. We recognize the rich history of molecular anthropology in Europe as well, but it falls beyond the scope of the current article. We next address some of the practical challenges of conducting genetics research in anthropology departments and why it is still relatively uncommon for an anthropology department to have a geneticist. We close with a few major areas that we believe the field of anthropological genetics is ideally positioned to contribute to the larger fields of human genetics and anthropology over the next decade. We argue that molecular anthropology has been an interdisciplinary endeavor since its inception and that bringing together these various lines of research is where the strength and future of the discipline lays: to study biomedical phenotypes from an evolutionary perspective, changes in cultural and kinship patterns from a genetic perspective, and collaboration with and development of methods for small-scale communities as just a few examples.

A brief history of molecular anthropology in the US

The history of anthropological genetics is fairly shallow, given both its recent origin and interdisciplinary nature. Early pioneers in the 1960's, such as Luigi Luca Cavalli-Sforza, Morris Goodman, and James Neel worked in medical schools, using immunological and blood group markers to reconstruct phylogenetic relationships among human populations and between humans and the great apes (Crawford 2019; Hagen 2010). Some of the earliest training of geneticists in anthropology departments also took place in the 1960's under Frank Livingstone (who trained Ken Weiss and Alan Fix) at the University of Michigan, Sherwood Washburn at UC Berkeley (who trained Vincent Sarich) and William Howells (who trained Henry Harpending among others) at Harvard.

Each subsequent generation of researchers have made use of expanding genetic technologies to provide further insights into anthropological questions, while bringing more researchers from outside anthropology under the umbrella of molecular anthropology. The revolutionary introduction of PCR in the mid-1980s catalyzed important work on the phylogeny of human uniparental markers by Rebecca Cann, Mark Stoneking, and Michael Hammer (Cann et al. 1987; Hammer 1995) under the direction of Allan Wilson in the department of Biochemistry (UC Berkeley) and led to more than a decade of work on these markers by molecular anthropologists. The American Association of Anthropological Geneticists was formed in 1994 and has served as an important professional network for molecular anthropologists through its annual meetings with both the American Society of Human Genetics and the American Association of Physical Anthropologists.

The completion of the Human Genome Project at the turn of the 21st century again served as a catalyst for the expansion of anthropological genetics, with the decreased cost of genotyping and the shift from single-locus studies to studies on genome-wide datasets. For most of the past century, humans were not considered

an appropriate model system for genetics, but this exponential increase in data, particularly in the area of ancient DNA, has attracted many more researchers into anthropological genetics.

Challenges of molecular anthropology in anthropology departments

Anthropological geneticists have continued training students throughout its 60+ year history, with the academic descendants of Michael Crawford, David Glenn Smith or more recently Anne Stone, found in many US anthropology departments today. However, it remains relatively uncommon to find a geneticist in an anthropology department in the US. There are several explanations for this. The cost of doing genomic work is still very high (hundreds to thousands of dollars per sample), especially as the field has come to understand that sample sizes in the tens of thousands are required to answer important genotype-phenotype questions that biological anthropologists are interested in (e.g. evolution of obesity, autoimmunity). Anthropological geneticists therefore require very large startup costs compared to other anthropological sub-disciplines, to not only pay for lab renovations and equipment but for the initial data they will need to successfully compete for grant funding. Many departments are unable to make such an investment in these scholars. Another challenge is the teaching course load in anthropology departments. Anthropology faculty at major research universities typically teach 4 courses per year. Compared to the typical course load in biology departments (2 courses per year) or medical schools (<1 course per year), it becomes clear that teaching loads are a major impediment to research productivity (research, grant and manuscript writing) for anthropological geneticists.

Moving forward

Despite these challenges, we believe that there are advantages to conducting genetics research in an Anthropology department. Human genetics

research, particularly in the areas of ancient DNA and medical genetics, has drawn substantial criticism in recent years with the growing awareness of the poor representation of non-European populations in genomics research (Popejoy and Fullerton, 2016) and the lack of meaningful engagement with indigenous groups in particular (Claw et al. 2018; Wagner et al. 2020). There are myriad reasons for the current lack of representation in genetic databases, including histories of research misconduct and the resulting mistrust that remains in many communities, as well as the difficulty and accessibility of sampling many of these communities. Most biomedical genetic cohorts are being collected for research at hospitals or clinics. In areas with limited medical infrastructure or with communities who are less likely to access clinics, this model of cohort collection will not work. Anthropological geneticists, because of our experience with fieldwork and long-term relationships with specific under-represented communities, are ideally situated for increasing the diversity of genomic datasets and ultimately the equity of personalized medicine around the world. Efforts are being made to increase the diversity of genomic datasets, many of which include young researchers with a background in anthropological genetics (Daya et al. 2019; Stevenson et al. 2019; Wojcik et al. 2019).

Many indigenous and other minority communities around the world have varying histories of discrimination, scientific exploitation, legal challenges over territory, and hence genetics research poses substantial risk and concern. Recent articles have recommended that researchers improve culturally competent engagement and collaboration, return of results, benefit sharing and the building of research capacity in the indigenous and other underrepresented communities that are involved in genetics research (Claw et al. 2018; Wagner et al. 2020). Many of these things are already being done by some molecular anthropologists (Bankoff and Perry 2016; Malhi 2019), which highlights one of the strengths we can provide to human genetics as a whole. Anthropologists tend to form long-term relationships with the communities they work with over the course of

several years. This allows the researcher to assess the potential risks and benefits of a project and address any concerns the community has before and during a project (Scelza et al. 2020b).

Training and practicing genetics in an anthropology department gives researchers some important advantages when dealing with these issues. When embedded in an Anthropology department, we have found that topics such as fieldwork in marginalized communities, culturally appropriate practices for sampling and returning results, ethical and political concerns of indigenous communities are discussed frequently and organically. Interacting with other researchers such as human biologists and cultural ecologists working on related questions in these communities provides an important environment for understanding these important issues and developing strategies to give under-represented communities a seat at the table. Furthermore, the protracted relationship between molecular anthropologists and collaborating communities allows the researcher to fully engage the community in the project, shifting course as new questions and concerns arrive. This provides opportunities for training of community members in research methods to directly answer research questions from the community.

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