BOOK REVIEW

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Review of: *Molecular Photofitting*

If the reader is wondering, as this reviewer did, what this massive 695-page reference text on "molecular photofitting" is all about, I'll give you a hint. It is not a novel way of recovering photographic images using quantum electrodynamic principles or indeed the recovery of any other form of digital evidence. Instead it involves DNA (the "molecular" part of the title) and an individual's physical appearance (hence "photofitting"). The somewhat confusing title is an audacious attempt by the author Tony Frudakis to pen an appropriate moniker to an emerging field (of which he is a recognized leader) that attempts to infer an individual's physical appearance by the molecular genetic analysis of crime scene DNA. For what it is worth I don't think the metaphor will catch on. However, what should catch on is that this is an authoritative ground-breaking reference text that any forensic scientist using, or contemplating the use of, Ancestry Informative Markers (AIMs) or other SNPs to infer phenotype, should possess. The book is strictly for scientists and will probably be best understood by those that have a relatively sophisticated understanding of population and quantitative genetics and biostatistics. Importantly it will serve as a resource that the scientist can refer to when educating investigators about the advantages, options, and appropriateness of molecular phenotyping in a particular case, especially if the services of the author's company DNAPrint Genomics are being considered.

The concept behind molecular phenotyping (and this book) is that certain physical traits such as hair, skin and eye color, and craniofacial features are distributed across the world's continents according to geography and ancestry and that determining an individual's biogeographical ancestry (BGA) from a crime scene physiological stain can predict that individual's likely appearance with respect to these traits. The author provides convincing proof that this can indeed be achieved with varying degrees of certitude depending, *inter alia*, upon the chosen ancestral populations, the AIM marker set used, and the particular ancestry of the individual concerned.

The basic principles of population genetics as it relates to population differentiation by genetic drift are provided in the first chapter by a guest author, Mark Shriver, who himself is an authoritative figure in AIMs research. The important concepts of BGA (the strictly biological and heritable component of race) and ancestry (both genomic and genealogical) are introduced next followed by a couple of chapters on the theoretical and practical considerations behind BGA estimation. The latter includes a comprehensive discussion on the different ways of measuring the ancestral genetic contributions to contemporary hybrid populations including

Bayesian algorithms that use software such as STRUCTURE and ADMIXMAP as well as an approach that involves a maximum likelihood estimate (MLE). The author does a good job of rationalizing why he and his company have chosen an MLE algorithm together with a four ancestral population model (West African, European, Indigenous American, and East Asian) for apportioning BGA. Three chapters form the meat of the book and provide a detailed characterization of the admixture SNP panels developed by the author including both the more familiar continental markers and a European sub-continental set.

The author discusses the innovative concept of reverse facial recognition that queries individual genomic ancestry admixture estimates (IGAAE) obtained from a DNA analysis from an individual against an atlas of digital photographs taken from people who have similar IGAAE scores in an attempt to provide investigators with a range of facial features expected of the individual in question. Indeed, fellow forensic scientists may derive some fun in trying to recognize some of their colleagues whose portraits and putative ancestries are clearly portrayed in some of the figures.

In a comprehensively written chapter the indirect methods of phenotypic prediction by BGA are contrasted with the direct methods of iris, skin and hair color that seek to molecularly characterize candidate functional genes that encode components of the melanin biosynthetic pathway. Chapters on casework applications and the politics and ethics of genetic ancestry prediction complete this epic monograph.

Unfortunately, a significant number of the figures are either difficult or impossible to read due to poor resolution and this definitely detracts from a complete understanding of the associated text. A suggestion would be for the author and/or publisher to provide high resolution figures on an accessible web site. Another one of the weaknesses of the book is that it often makes direct reference to sets of AIM markers marketed by DNAPrint Genomics using either the company name or trademark names such as Ancestry by DNA, DNAWitness, EURO 1.0, etc. The author, to his credit, admits to this rather shameless advertising and argues that the "naming of names" is justifiable since no other well-characterized AIMS panels existed at the time of writing (as then a few non-DNAPrint AIM panels have been reported including, e.g., those developed by the SNPforID Consortium).

One gets the impression that this book represents a labor of love and a catharsis of sorts for the author and he is to be congratulated for providing the forensic community with this important compendium of BGA theory, practice, and provocative ideas for the future. It is a significant contribution to the forensic scientific literature.

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