1 *Introduction*

HOLGER SCHUTKOWSKI

Petrarch's famous ascent of Mount Ventoux in April 1336 is often said to be the first recorded example of contemplative nature experience as a value of its own, a sharp departure from the perception of nature in the context of utilitarian appropriation. Whether or not this interpretation is true, Petrarch's own account of this day (1999, p. 11) is contemplative in quite a different manner; self-reflective, pondering human virtues and vices, and realising weaknesses and imperfections in his own life course. We may be tempted to view this as part of a quest for meaning and identity, and as such as an allegory for being able to look beyond the face value of observations and facts. In this respect, then, it would resemble what the contributions in this volume try to convey by probing the potential of skeletal analysis.

It is true, what human skeletal remains reveal to us in the first instance is factual, informative, and often highly conducive to answering scientific questions. But their meaning does and must go beyond that, and is probably best described in a biocultural interpretive framework. Even though the chapters in this book represent a somewhat diverse array of essays, there are two broad themes common to the approaches put forward here; (i) the detection of human lifestyle and living conditions, providing an understanding of the cultural setting in which populations lived; (ii) the investigation of aspects of human geographical, genetic or social identity in the context of the cultural and natural environment.

This is what the title *Between Biology and Culture* attempts to invoke. Humans, unlike other animals, adapt to their environment through both culture and biology. In the course of evolution, the cultural component has assumed increasing importance and has become the signifying feature of humans. Through the invention and permanent modification of cultural traits humans have found a unique way to respond to and cope with the environment and its constraints. But however sophisticated their material representations, social organisations, subsistence modes or belief systems, these attempts eventually have repercussions on their biology, their chances for survival, opportunities for

Between Biology and Culture, ed. Holger Schutkowski. Published by Cambridge University Press.

reproduction and prospects of well-being. Human identity is essentially shaped by the biological outcomes of cultural strategies. Hence, humans sit firmly, yet not always comfortably, between their biology and culture.

To disentangle the interplay and mutual dependence of human biology and culture in past populations requires a holistic effort. The approach outlined here has its starting point in the skeletal evidence, largely represented by human remains from archaeological assemblages, which constitutes the most direct and immediate access to the study of past human biology. A wide range of advanced analytical techniques are now available to provide the data that facilitate interpretations of biocultural adaptations and identities.

Human identity is multifaceted, despite a common notion that it is always social and therefore, by inference, cultural (Jenkins, 2004, p. 4). It is in fact expressed through the interplay of biological and cultural representation in a broad sense, and would thus have to be seen as more inclusive to reflect these two sides of human nature. The majority of chapters in this volume actually address issues of identity, albeit not always explicitly, but certainly in accord with fundamental elements of its concept, i.e. similarity, difference, classification or association (Jenkins, 2004, p. 4). All these elements are connected with a process of identification, which in analytical terms would refer to the statement of links, traits, correlations and evidence sufficient to eventually establish causal relationships and meaning, which constitute and help ascribe identities.

Human activities and behaviour are characterised by cultural mediation of biological needs and expressions. Culture is intrinsic to human nature; we literally cannot live without it. Consequently, human presence in any ecological setting leaves a cultural imprint; the natural environment is shaped by cultural activity. Adaptation therefore is biocultural, and it occurs against local conditions as much as its outcomes reflect local diversity (Gamble, 2007, p. 277). Human biocultural adjustment to prevailing and fluctuating surroundings thus inevitably creates a multitude of identities, variations of those fundamental categories of place, resource and behaviour. Translated into ecological terms these identities reflect flows of matter, energy and information, the control, steering and manipulation of which is a hallmark feature of the human ecological niche (Schutkowski, 2006). The ability of humans to create and respond to the cultured environment is a cornerstone of the dual human nature. Whether biology or culture takes precedence is almost a moot point, as the two are so intimately intertwined to the point of being inseparable.

The consequence of human dependence on culture kits for survival and the maintenance of life support systems is that information gleaned from the skeletal record always has a cultural connotation, which is eventually reflected in the biochemical, morphological or genetic signatures. For example, a dietary

signal ascertained from isotope analysis can indicate what food components contributed to an individual's or a population's diet. While at face value an observation may establish the consumption of C_3 plant protein with some input from marine resources, this information at the same time provides us with a better understanding of the subsistence regime and strategies of resource use viewed against the environmental setting of a certain locality. Arguably, this is what we really want to find out. Likewise, the detection of differences in dietary habits between groups of people within a society, whether socially or biologically defined, reveals more than just group-level distinction in food consumption patterns, but rather the socio-cultural framework of availability and access to resources. Governance of material and energy flows thus becomes measurable in biological or molecular terms and, through classification and association, allows aspects of identity to become evident.

This is even more obvious when human remains reveal ancestry and relatedness through genetic information as the most direct and immediate signifier of identity. The term genetic fingerprint speaks for itself to denote uniqueness at an individual level. But similar or even shared traits at group and population level are the molecular equivalent of a biologically founded identity, which is at the basis of a strong sense of belonging to genealogical entities. Kinship is essential for the formation of social and behavioural identities, from the day-to-day conduct within a community to marriage patterns, inheritance and mythology (e.g. Parkin and Stone, 2003). Being able to start to reveal patterns of kinship in the remote and not so distant past provides a crucial tool for hinging human biology and culture at a very fundamental level, and thus permits us to ascribe cultural meaning to genetic evidence. One may even want to mention appearance here, including morphological shape, accepting that there is distinctiveness behind variation, both culturally induced and biologically evolved.

Often, this coincides with place, geographical location or habitat. Human remains are a biocultural archive, which holds information that can be taken as a reflection of geographical identity. The cycling of chemical elements in the biosphere creates distinctive patterns visible in, for example, isotopic signatures that distinguish local from foreign, in exceptional cases even unveil traces of origin. Beyond the face value of these signatures there are clues that reveal mobility, migration and the formation of communities. But they also provide access to more elusive behavioural patterns, such as the formation of new identities by immigrants into existing, established communities, when the molecular information is combined with artefactual archaeological evidence. On the other hand, social identities can be strong and so persistent that communities would adhere to the known and familiar even under the stress of dramatically changing environmental conditions, as the example of the Norse communities in Greenland demonstrates (McGovern *et al.*, 1988). Identity may thus serve

as a socio-cultural buffer that maintains resilience until ecological disruption becomes overwhelming and destabilising.

It would seem, therefore, that the analysis of the tangible evidence of human remains and their interpretation against ambient environmental or ecological circumstances allow us to go beyond this level and explore what is at the heart of human nature – a biocultural identity.

The collection of essays assembled in this volume therefore aims to explore approaches that allow this agency to be discovered. The scope ranges from taphonomic aspects to individual life histories, from seasonality to food, from well-being to disease, from genetics to mobility, from body theory to forensic individualisation. No specific reference will be made to the acquisition of basic anthropological information, such as age or sex from the skeleton. These aspects have recently been discussed elsewhere in the context of social archaeology (e.g. Gowland and Knüsel, 2006). After a brief historical review (Chapter 2) the biocultural theme is developed first through the consideration of fundamental aspects; the establishment of identity in forensic investigations (Chapter 3), approaches to the measurement of human well-being in past and present populations (Chapter 4), the ecology of disease (Chapter 5), the importance of seasonality and climate change for the interpretation of the fossil hominid record (Chapter 6), and connotations of food and the reconstruction of past diets (Chapter 7). This is followed by a suite of essays that focus on the use of certain analytical techniques to address the biology/culture interface; the detection of early life history events taking weaning as an example (Chapter 9), the elucidation of phylogenetic, kinship and individual genetic relationships (Chapter 10) and the meaning of mobility and migration in the past (Chapter 11), preceded by an appreciation of basic taphonomic considerations and their impact on the survival of molecular and chemical information in archaeological human remains (Chapter 8). Body theory and the materiality of human remains (Chapter 12) throw a bridge back to the initial identity theme.

Chapter 2 by Don Brothwell is a concise personal account on the study of human populations over the last 150 years or so. Written by one of the doyens of international biological anthropology, the chapter offers an increasingly rare opportunity for an educating journey through topics and time, outlining developments and illustrating milestones. It is, not surprisingly, concerned with the nature of human variation and with the many attempts to systematise the complexity and interrelatedness of aspects that shape human nature in order to gain a better understanding of what biologically constitutes the uniqueness of our species. Contributions often came from scholars whose academic affiliation was outside anthropology. While this could be perceived as benevolent amateur preoccupations with a discipline that is struggling to find its focus, it was, in fact, advantageous and tremendously helpful in developing the genuine

multi-valence approach of biological anthropology. The chapter identifies certain areas as having been drivers towards the development of a comprehensive scientific remit, from evolutionary aspects to adaptability and population genetics, at the same time alluding to major themes discussed in the chapters to follow. In particular, human palaeontology still captivates large audiences in the attempt to satisfy a widespread curiosity about our ancestry in deep time. No matter whether one tends to be a lumper or a splitter, the role of environmental change in shaping the evolution of large brains, and morphological and behavioural variation in general, remains a key issue, and the importance of ecological considerations in clarifying this cannot be underestimated. In a similar vein, this also holds for the appreciation of Holocene biometric and non-metric human skeletal variation. Essentially, at the heart of this notion is the question of how the nature-nurture dichotomy can be reconciled by integrating the properties of the natural and social environments in our interpretation of growth patterns and demographic profiles or the remarkable human capacity for adaptability. Brothwell's conclusion that the study of human remains and, in particular, the deciphering of their chemical and molecular information, will continue to grow and ramify (Katzenberg and Saunders, 2008), anticipates one of the threads running through this volume.

Quite unlike connotations in the popular trivialisation of crime scene work in the media, forensic anthropology has a deeply humanitarian and ethical role; the biological identification of human remains with a view to establishing identity and thus providing not only closure to an ongoing inquest, but making an important contribution to the healing and grieving process. In Chapter 3, Sue Black describes the context and the practical implications of forensic anthropology and its service to justice. Subject to courtroom scrutiny, the sometimes arduous task of extracting biological information from often degraded, commingled or otherwise compromised remains seeks to attach statistical probability to 'sameness' of remains under study and a putative target individual, in order to assign beyond reasonable doubt the congruence of information needed to match biological profile and real persona. Verification of methods and procedures used to ascertain this information is crucial, and the combination of antemortem records and postmortem data in achieving identification must be guided by scientific rigour. Case studies relating to investigations of homicides and war crimes, as well as to aiding the identification of victims from natural mass disasters, demonstrate what a powerful tool forensic anthropological analysis, with its multiple strands of evidence gathering, has become. But it shows first and foremost how instrumental it is in helping to find certainty and consolation for family and friends, and in establishing identity for the deceased.

To take anthropological data beyond individual characterisation and to collate them at population level or even in meta-analyses of multiple assemblages offers

the possibility for the detection of long-term trends and patterns in the standard of living of both biological and socio-cultural groups within past societies. Whilst measures to assess quality of life have a long tradition in economics using goods and services as proxy currencies, the use of (skeletal) biological information has only recently been recognised as a promising method to identify the biological standard of living, health and, by implication, well-being. In Chapter 4, Richard Steckel provides a detailed account of the potential of this cross-over approach by comparing traditional material-led analyses with the obvious advantages provided by direct observation of archaeological human remains. One major conclusion, borne out by the Western Hemisphere Project (Steckel and Rose, 2002), is that the mass-statistical analysis of certain skeletal indicators, assembled in a health index, against social and ecological variables does produce meaningful correlations and evidence of biocultural adaptation. These results are inevitably broad-brushed, but this is inherent to this type of analysis. It is even more difficult, however, to match trends derived from the skeletal record with a widespread concept in the social sciences: that of happiness. But it might be worthwhile to explore if and how this translation could be tackled. The chapter ends with a fascinating outlook on the potential role of nanotechnology in the assessment of health and well-being in modern times, leaving the reader with a sense of disappointment over the naturally limited scope of skeletal data in the face of prospects to measure brain activity and biochemical markers as a reflection of well-being.

No doubt, the detection of overall associations in global studies between terrain, vegetation or settlement patterns and morbidity is an encouraging start. But there remains the need for a better understanding of the ecological factors, both natural and cultural, that govern the ability of humans to survive under the widest possible range of environmental conditions, yet at the potential risk of increased susceptibility to disease. Whatever the occurrence and frequency of skeletal lesions are actually able to reveal about health in the past (see Wood *et al*., 1992), the incorporation of ecological concepts currently applied to questions in public health and disease control into palaeopathological interpretation seems to hold promise. By focusing on certain aspects of human disease ecology in Chapter 5, Donald Ortner and Holger Schutkowski explore the effects of the interplay of biological and cultural factors in the co-evolution of human hosts and pathogens, while at the same time considering the reflection of deficient natural environments in skeletal alterations. The latter provide an inexhaustible reservoir of instructive case studies, of which some are presented here, for example fluorosis and scurvy. Major subsistence transitions and mobility appear to have had the greatest impact on human morbidity. Fundamental changes, such as the adoption of agriculture and sedentism, would have resulted in the readjustment of material and energy flows in a given habitat and provided the

means for novel socio-cultural expression as well as population growth. However, they would have also been accompanied by challenges or even threats due to zoonotic or vector-borne diseases. Expansion into new habitats, be it through pioneering or conquest, provided new pathways for infections and spread of diseases, often with devastating consequences. Despite such difficulties biocultural adaptation supports at all levels the survival and maintenance of individuals and populations.

In deeper time, evolutionary change in the hominin line is frequently associated with environmental variability as a proxy for circumstances that allow selective advantages to become manifest. Analysis of mineralisation patterns archived in dental enamel provides a tool that utilises indelible recording structures for the reconstruction of seasonality, here as an indication of rainfall, and the effect of short-term oscillations in environmental conditions on evolutionary pathways. In Chapter 6, Gabriele Macho suggests that it is the unpredictable nature of such short-term variability rather than global climatic fluctuations, which would have likely created a scenario where large brains, and by implication more behavioural flexibility, provided the capacity for innovation and thus for better and more sustained chances for differential reproduction and survival. In contrast, longer-term variance in climatic conditions seemed to have little effect on, for example, the evolution of Australopithecines, while the combination of overall change and short-term unpredictability of environmental conditions, i.e. the constant challenge of coping with changing circumstances on different scales, would have facilitated the evolutionary emergence of large-brained species of the genus *Homo*. The explicit incorporation of ecological/environmental information to interpret climate-sensitive micromorphological features from both fossil hominids and associated faunal remains not only contributes to reconstructing scenarios of climate change but to establishing the environmental evolutionary framework of our own remote ancestry.

Arguably, much of our evolutionary history is connected with the necessity to discover, explore and use food resources from a variety of very different habitats. Environmental variation at variable scales and the selection pressure towards bigger brains and a flexible behavioural repertoire would have greatly helped the inquisitiveness required to exploit the advantages of a truly omnivorous and non-specialist diet. Since the invention and mastery of controlled fire, at the latest, humans have developed a capacity to take food consumption beyond the mere satisfaction of basic needs. How far back exactly this can be traced will probably remain unknown forever, but it would appear reasonable to assume that today's pronounced desire to use food and diet as a signifier of cultural identity represents the sophisticated echo of a tradition that is connected with the very beginnings of humanity. Humans transfer diet into meaning and in Chapter 7 Holger Schutkowski investigates how food as cultured biology can

be analysed in the skeletal record. Chronic or sustained episodes of nutritional stress, often culturally induced, can be detected as osseous pathological alterations but would rather reflect the negative side of a deficient condition. Isotopic analysis, however, has generated data that allow direct dietary information to be gleaned from calcified tissues. This has led to the detection of major and more subtle dietary differences on the level of entire groups or populations. Being able to identify such patterns then facilitates their interpretation against ecological basic conditions and socio-cultural variation to reflect both adaptation through human/environment interaction and self-expression.

Any attempt to extract such biomolecular information from archaeological samples rests on the assumption that we have a basic understanding of those processes that govern the preservation of this information, or at least, given the complexity of it, understand enough to ascertain whether the data generated are reliable and not taphonomically compromised. In Chapter 8, Matthew Collins and colleagues have contributed an erudite lesson on the potentials as well as the numerous pitfalls associated with this approach. By taking ancient proteins as an example, they guide us through the different stages of decay that contribute to deterioration but also differential preservation of this promising group of biomolecules. Some of the deterioration that can be detected is culturally induced, for example the kind of heat treatment we refer to as cooking, which causes proteins to be structurally altered and in this modification become indicative of the thermal history of a sample. Another form of chemical modification in proteins, racemisation, the gradual transformation of one enantiomer into its mirror sterical configuration, has become an important dating tool. Protein residues in prehistoric pottery are able to take the identification of dietary components beyond the bulk analysis, while the detection of protein sequences offers a possibility to differentiate faunal samples at the genus level and thus contribute to the understanding of resource exploitation patterns. The list of potential applications is long and the prospects exciting.

The combination of isotopic analysis and the recording of macroscopic mineralisation defects in dental enamel offer a unique opportunity to discover events in early stages of life history, as Louise Humphrey demonstrates in Chapter 9. One of those stages is the weaning period, when breastfeeding is gradually replaced by the introduction of solid foodstuffs. Whilst in dietary terms this simply constitutes the transition from a carnivorous to an omnivorous human being, the physiological and often also psychological effects can be traumatic enough to leave visible traces, known as linear enamel hypoplasias. The increasing intake of protein sources other than breast milk alters the isotopic signal recovered from dental tissues formed at various points in early life and thus helps define the transition period more exactly. A detailed knowledge of the

timing of weaning in past populations supports the interpretation of mortality patterns associated with those periods when children are particularly susceptible to disease and immunologically compromised. High or low mortality rates around the time of weaning also reflect the buffer capacity of individuals and populations and are therefore a powerful indicator of living conditions and coping mechanisms under different socio-ecological regimes, in other words a proxy measure for successful biocultural adaptation. Perhaps even more importantly, the identification of patterns in the timing of weaning has an evolutionary ecological dimension (Voland, 1998). Not only is an earlier onset of weaning associated with a more sedentary as opposed to a foraging nomadic lifestyle, it also allows inferences to be made about birth intervals and thus offers a potential route into elucidating reproductive behaviour and parental strategies in the past.

Since the invention of the polymerase chain reaction (Mullis and Faloona, 1987) the study of ancient and modern DNA has received a boost commensurate with the significant advances it has facilitated for the detection of genetic relationships between taxa, populations and individuals, not only, but particularly, related to our hominin ancestry and anatomically modern humans. In Chapter 10 Beth Shapiro and colleagues review a number of high-profile applications where DNA has helped to clarify or shed new light on conventional views. With regard to our own phylogenetic relations there seems to be consistent evidence now that significant evolutionary differences exist between Neanderthals and modern humans, even though the absolute extent of this is currently under investigation. The reconstruction of gene flows plays an important role here. Migration events, which have shaped the population, and thereby genetic, history of countries and geographical areas can now be underpinned by DNA data and provide a much better understanding of genetic roots and relationships. The Anglo-Saxon colonisation of Britain is a case in point for frequent large-scale genetic admixtures throughout Europe which, despite the distinct cultural differences we are seeing today, should remind us of continued shared and common ancestry (Cavalli-Sforza *et al*., 1994). The analysis of DNA equally contributes to the elucidation of natural selection and human variability, for example in those traits that are linked to major biocultural developments (lactose tolerance) or adaptations that were once beneficial but prove deleterious today (thrifty genes) under changed environmental and cultural conditions.

Sparked by the seminal study on Bell Beaker people ten years ago (Grupe *et al*., 1997) strontium, and later lead, oxygen and sulphur, isotope analysis has become an established tool for attempts to provenance materials and people. Comparable to studies using DNA, it is now being widely applied to investigate migration and mobility in the past, and contribute answers to the paradigmatic

question of whether it is ideas or people that travel (or both) and spread biocultural innovation in their course. In Chapter 11 Douglas Price develops this idea, providing examples mostly from the Americas, by demonstrating how foreign individuals can be identified in skeletal assemblages and whether or not a likely place of origin can be assigned. While isotopic ratios are usually very useful in revealing those samples that do not match local isotopy, it is much harder to tell where these immigrants actually came from. Very detailed knowledge and data of the surrounding geology, soils and water are necessary to make any informed suggestions, as ongoing discussions over the provenance of the 'Amesbury Archer' demonstrate. Three prominent examples, from Grasshopper Pueblo, Teotihuacán and Copán are successful in both respects; they help understanding of the supra-regional importance of a proto-urban pueblo site, as well as the social fabric and funerary archaeology of ancient cities. The case study of the Iceman should be taken as a memento that different approaches and different results may in fact support the same conclusion. Provenance analysis from the chemical composition of calcified tissues provides geographical identity and reflects a life history, not just the circumstantial place of burial.

The bioarchaeology of human remains does encompass all the themes introduced here, but has its poignant representation in an attempt to interpret the body as an expression of socio-cultural concepts and circumstances. Archaeological human remains allow for the reconstruction of the living body, because skeletal traits that denote shape, size and alteration of form due to, for example, disease or cultural practice reflect events and episodes of individual life histories. The living body is mindful and active, it is engendered and material and hence much more than La Mettrie's notion of 'man a machine'. It is in fact a product of both biological and cultural influences, and the dynamic of these influences translates into skeletal appearance – an obvious example would be culturally prescribed cranial deformation. As Kirsi Lorentz advocates, in Chapter 12, there are both the need and the means for a more comprehensive approach that uses different, complementary avenues to take the meaning of skeletal remains beyond the bone.

The continued advancement of diagnostic methods, both morphological and molecular, helps establish the biological identity of human skeletal remains in unprecedented detail and accuracy. Yet, only its appreciation within a human ecological context, i.e. by incorporating conditions of the natural environment as well as cultural, social and political circumstances of the past, provides the framework required for the detection and interpretation of what is at the heart of human dual nature, our biocultural identity. Be it individual life histories, ascertained through osteobiography, or signifiers at group or population level, human remains hold the keys to understanding our place between biology and culture.