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Darwin and His Heritage or Making the Biology a First Class Science

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In this issue of Hacettepe Journal of Biology and Chemistry, we would like to present our contribution to the celebration of one of the greatest naturalist of the history of science, Charles Darwin's 200th birthday and the 150th years of publication of his opus magnum, shortly known as "*The Origin of Species*". Undoubtedly, starting indeed the evolutionary biology as a science and establishing its very basic tenet of the variation in the organisms as the object of change that may lead finally to new species, Darwin's lasting impact and the heritage of the *Origin* mostly determines what we know of evolution both in the field and the laboratory. Though Darwin proposed strict scenarios of natural selection for the shaping of the organisms that varied, his plurality and deep insight has given impetus to a structure of evolutionary theory with great moves both with selective and nonselective dynamics such as random genetic drift that have accomplished a great deal to understand nature since the publication of the Origin 150 years ago. With fully acknowledging this arsenal of theory and practice, here we would like to present articles from the broad scope of scientists using evolution in their studies at different scales.

We are proud and to be honored that the Preface to this special issue is by Richard Lewontin, one of the greatest evolutionist of our time, founding father of molecular evolution and the great theoretical population geneticist who has contributed so much to our understanding of evolution and its social and philosophical perceptions. His preface was indeed written by him originally for the new translation of the *Origin of Species* into Turkish, which will be on bookshelves this year's Fall. We are grateful that he has given us his kind permit to print its English original here in our journal also.

Evolutionary biology has been the subject of good use and abuse since its inception in 1859. History of evolutionary biology is full of examples of its abuse, too. Hence the infamous "social Darwinism", being the brand name of that abuse that comes almost instantly to one's mind. Although evolutionists have been working on subjects as diverse as the history and causation of parasite-host relationship and the protein folding in a detailed experimental/or field settings within the framework of testable working hypotheses, abuse and misunderstanding of evolution and Darwin have produced much confusion and conflict, too.

In our first article, Suavi Aydın, a distinguished cultural anthropologist and historian of modernity, discusses the origin and the historical paths of the abuses of Darwin and evolutionary biology. He shows us how the abuses of darwin and evolution lead to approaches, such as structural-functionalist sociology, in which social context was fallaciously related to biological context making the Darwin's biological stance turned upside and blamed for the injustices of the totalitarian acts, and branded for the so-called "social Darwinism".

Human evolution has perhaps been the most attracted part of the whole evolutionary studies with its fascinating details both at both in paleontological and molecular levels. The concept of the race, with its obvious ties to the rise of colonialism after the Renaissance, has caused much misery and misunderstanding, becoming a political tool rationalizing the status quo as well, throughout the last five hundred years in its various forms. But today, thanks to the pioneering work of Richard Lewontin in the early 70's and the confirming studies of later generations of population geneticists, we know that almost 90 percent of human genetic variation is within the populations and only a fraction of some 5 percent is among the groups that classical biological anthropology has defined as the "major races". Therefore, the race is nonsense on the basis of general biology and genetics of the history of human demographical expansion. Apart from human populations being almost uniform in their genes, human evolution shows that we are not the topmost of the creatures playing its sublime teleological act on the world stage: we have ancestors at species level, too, and we share a common ancestor with the chimp- that hairy animal, with which Galen had to make dissection to extrapolate to human anatomy because the strict theological stance then had no toleration for the dismantling of wholeness of the human body that was posed sacred-from whom each of us has been separated some 7 millions year ago. The classical picture of human evolution involving Australopithecines and the other members of the homo genus has been well substantiated in general and the molecular studies of selection and random genetic drift, with the insight gained from the genome structures of human and the chimp published and revised in the past decade, has contributed much to the understanding of human evolution and the *Homo sapiens* expansion within the last 100 thousand years.

In their contributory article, two young evolutionist and population geneticist, Mehmet Somel and Efe Sezgin, summarize the molecular human evolution in a very explicitly detailed way with emphasis on parallel works on the chimp. They inform us that, in a genomic panorama, random genetic drift, that is neutral evolution, is a leading evolutionary mechanism shaping human protein coding sequences and gene expression patterns, notwithstanding that large number of genes affected by natural selection, hence adaptive evolution. Especially, genes involved in immunity, sensory perception, reproduction and apoptosis seem to be mostly evolved by positive Darwinian selection i.e. the directional increase in frequency of variants that are being favored. They also report that the evolution of the human brain gene expression is adaptive, remarking that both positively and negatively selected genes are responsible for human genetic diseases. They compare the regulatory sequence evolution of the human with the chimp emphasizing on the large similarities and discrepancies between the two species which share almost 99% of their genes!

They have a lot to say about the human demography: first, they present us many studies of human populations at DNA level that the difference between *any* two human genomes is less than 0.1 %. This figure is no wonder considering the expansion of the human from Africa with the consequent bursts of bottlenecks resulting populations being quite homogenous as indicated the very small effective size of the human, which is less than 10.000 individuals. Somel and Sezgin also present us with case studies, which are those of candidate genes affecting with considerable certainty some reasonably defined phenotypes, in the evolution of which natural selection or drift is the culprit. They conclude the point that the previously demonstrated apportionment of the human genetic diversity that there is much more diversity within a human population than that of between any "race" groups is confirmed well from the genomic comparisons of human populations. Finally, they provide us with the case studies using of the statistical genetics tools for the detection of selection and discuss the impact of selection on human genome in detail. It seems there is no way to escape the imprint of human evolution on our self image of cosmic superiority set for so long in ways that were always supposed to be fixed and rigid. But this is not to say that our cultures are evolved biological realities, other than their being the long contingently imprinted products of our history, in which fallacious superiority claims of the human being over the rest of the organisms and its conspecifics were (indeed are still, though losing strength) used to be held so passionately and fashionably.

One of the basic insights that can be gained from the *Origin* is that the variation in any character of the organisms cannot permit to classify them in strict, categorical terms assuming noncontuinity, a heritage of Darwin who rightly insisted that sharp boundaries drawn between the species do not exist and belonged to the ideas of independent creation. This insight, having taken and put into test with its diverse study paths by evolutionist of diverse interests, is now the basic guide underlining the understanding of evolution in both in nature and its applications in wide subjects spanning from the insecticide resistance to human diseases with complex genetic background.

In his article, Utku Perktaş, a young promising nonclassical ornitologist with evolutionary and ecological backgrounds, gives examples from the works done in Turkey on bird species of rigid categorical classification that are not real when looked at with an evolutionary and ecological perspectives in a context of geographical variation. He shows, in particular, the subspecies delieanation for the geographical variation assumed for the various forms of bird species should be taken cautiously, emphasizing on the lack of statistical evaluation of the variation in traits resorted in such studies.He then rightfully concludes that both the variation in morphology should be subjected to sound multivariate testing and the morphological data should be supported by the works at molecular (DNA) level if they would be the subject of any systematic study.

Perktaş, finally, dwells upon the relationship between the variation and its evolutionary dynamics, which is the rational follow that any study concerning the variation should come to take. Summarizing the now one of the best instances lifetime scientific devotion on a subject, the 40 years of study on the

Galapagos finches (Darwin's finches) by Peter and Rosemary Grant, he conclude that the variation in any trait could be related to natural selection when especially the ecological correlates observed are well intertwined with it.

Evolutionary biology has provided the very basic theoretical frame of the studies of the vector biology, for it cannot be separated from its basic ecological concerns of distribution and abundance which have also been an intensive focus of evolution for so long. The classically defined ecological relationships between a parasite and its host are indeed the end results of their coevolutionary history and the approches to the problems of vector biology are becoming increasingly based on the unification of the methodologies that are both ecological and evolutionary in outlook.

In his contributory article, Bülent Alten, who is one of the leading figures among the vector biologists with focus on Turkey, with evolutionary ecological arsenal of tools in his works on mosquitos and phlebotomin sand flies, reviews in detail his and collaborators long term study on the distribution and speciation of the subgenus *Paraphlebotomus* that have many species members transmitting dangerous parasitic diseases such as leishmaniasis quite frequent in Turkey, especially in the East Mediterranean and Southern east parts. Citing the works of theirs and of those who have been active on the subject, he shows how an evolutionary as well as an ecological approach could lead to the understanding the historical and current local distribution of the phlobotomin flies. He emphasizes that efficient uses of the molecular variation such as that of ribosomal DNA together with the application of the now widespread geometrical morphological reasoning, could clarify the species statutes and the distributions of this important disease vectors.

Size does matter much in the evolution of the organisms, affecting the mating behavior and success, desiccation resistance, efficient use of the food and the locomotion, not to mention the widely established correlation of size with the geographical-temperature gradients, known as the Bergman's rule. Indeed, evolutionary analyzes of body size have shown that size and shape are targets of natural selection in which size traits can be used effectively to infer the presence of selection along a thermal or spatial cline.

In our closing article, two young and productive mammalian scientists, Hakan and Mutlu Kart Gür, inform us in this respect with their carefully obtained results of their long term study on the body size variation and hibernation patterns in the ground squirrel, *Spermophilus xanthoprymnus*, native to Anatolia (Anatolian ground squirrel). Their study of body size uses the traits of skull and starts with the intraspecies phylogenetic methodology based on the partitioning the total variance in size. Their finding that almost the two thirds of the variance in size can be attributable to interlocality i.e. to populations being more less isolated within their distribution range, points to one of the basic tenets of evolution, that is, change in any character can be assorted with interaction of ecological correlates at the population level before speciation occurs. Indeed, the phylogenetics in their works reflects the presence of a track of body change across the populations along a decreasing temperature gradient,

hence the famous Bergmann's rule. Secondly, focusing on the hibernation patterns they obtained both in field and laboratory from the samples covering almost complete range of the species, they construct their explanation of the body size variation on basic ecophysiological observation that fat reserving as the source of energy during hibernation is the effector. In brief, they show us, in the relationship they have revealed between the variation in size and that of the fat storage during hibernation, how a geographical variation in a character at a gross morphological scale can be related by a well defined pattern of variation in lower mechanistic level associated with one of the general physiological correlates of the organism.

Finally what we can say is that evolutionary biology always makes sense of otherwise would-be a pile of information flow in biology, hence ever strongly emphasizing the stament of great Dobzhansky, "nothing in biology makes sense except in the light of evolution". It seems that evolutionary biology seems to get higher than ever for an understanding of nature, as shown by the new era of genomics, transcriptomics, proteomics and metabolomics guided by the freshly demanded look that is gained by the modern studies of biology from the interaction between any organism and its environment at multitude of scales and its developmental biology.