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THE ORIGINAL OLYMPIC SPIRIT: THE EVOLUTION OF ATHLETES AND THE TINY MARGINS BETWEEN GOOD AND GREAT

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The original Olympic Games, started in Greece in the 8th Century B.C., were meant to honor Zeus, and yet, they were distinctly secular. From the very beginning, the Games were meant to display aspects of the physical form, which ancient Greeks already displayed in sculpture, and to celebrate the evolution of performances achieved by young athletes. That is, from the very beginning, the Games were created with the expectation that it would give a stage both to human physical diversity, and to a relentless march of improvement. It is amazing to think that ancient Greeks already had an idea of the evolution of sports performances, and the symbol of an improving society that they could provide. Still, it's unlikely that even the prescient founders of the Olympics could have envisioned the level of performance today.

Over the last few generations, sport has opened to the world. (Another aspect of the ancient Games was the truce that was mandated during the contests, to provide unity to the Hellenic world.) A consequence of the spread of competition has been an extraordinary acceleration in performance levels. Excellence has spread so thoroughly that, today, the difference between an athlete who is legendary, like Usain Bolt, and one who finishes in anonymity just a single stride behind him, is less than 1% of performance. The evolution of sport that ancient Greeks began has led us to a place of such narrow convergence, that the difference between good and great is vanishingly small. The question, then, is how we got here, and how athletes can continue to carry on the legacy bestowed by the original Olympians. This talk will address how athletes got here, and how they can push ever faster, higher, and stronger.

David Epstein will demonstrate the tiny gaps in performance that have come to separate elite athletes, and will explain the often surprising skills that separate the very best athletes from everyone else. He will address how those skills are developed, and whether anyone can develop them. He will then lead the audience on a tour through the remarkable differences that have emerged in the last century in the bodies of elite athletes, and how this has pushed sport forward. Epstein will discuss his own experience as a competitive runner, and use it to explain the most important breakthrough in sports genetics. Ultimately, he will show what this generation of athletes should do if they are to find the ever smaller advantages that will continue the evolution of performance first envisioned in ancient Greece, and thereby embody the original Olympic spirit.

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NEW TECHNOLOGIES FOR INTERFACING WITH THE BRAIN

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One of the most important scientific and technological frontiers of our time lies in the interface between electronics and the human brain. Interfacing the most advanced human engineering endeavor with nature's most refined creation promises to help elucidate aspects of the brain's working mechanism and deliver new tools for diagnosis and treatment of a host of pathologies including epilepsy and Parkinson's disease. Current solutions, however, are limited by the materials that are brought in contact with the tissue and transduce signals across the biotic/abiotic interface. Recent advances in electronics have made available materials with a unique combination of attractive properties, including mechanical flexibility, mixed ionic/electronic conduction, enhanced biocompatibility, and capability for drug delivery. I will present examples of novel devices for recording and stimulation of brain activity that go beyond the current state-of-the-art in terms of performance, compatibility with the brain, and from factor. I will show that modern electronic materials offer tremendous opportunities to design devices that improve our understanding of brain physiology and pathology, and can be used to deliver new therapies.

Professor George Malliaras received a BS in Physics from the Aristotle University (Greece) in 1991, and a PhD in Mathematics and Physical Sciences, cum laude, from the University of Groningen (the Netherlands) in 1995. After a two year postdoc at the IBM Almaden Research Center (California), he joined the faculty in the Department of Materials Science and Engineering at Cornell University (New York). From 2006 to 2009 he served as the Lester B. Knight Director of the Cornell NanoScale Science & Technology Facility. He joined the Ecole des Mines de St. Etienne in 2009 and started the Department of Bioelectronics. His research on organic electronics and bioelectronics has been recognized with awards from the New York Academy of Sciences, the US National Science Foundation, and DuPont. He is a member of the Hellenic National Council for Research and Technology, a Fellow of the Royal Society of Chemistry, and serves as an Associate Editor of Science Advances. He is a co-author of 200+ publications in peer-reviewed journals that have received over 16,000 citations. His h-index is 71 (google scholar, 11/16).

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HUMAN GENE EDITING: THE DAWN, THE ZENITH, AND THE DUSK

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Sienna, a character in Dan Brown's Inferno asserts that "Humans have evolved incrementally over millennia, inventing new technologies along the way – rubbing sticks together for warmth, developing agriculture to feed ourselves, inventing vaccines to fight disease, and now, creating genetic tools to help engineer our own bodies so we can survive in a changing world … genetic engineering is just another step in a long line of human advances… If we don't embrace them, then we are as undeserving of life as the caveman who freezes to death because he is afraid to start a fire." While these are the words of a fictional character, many among us (including worldly scientists) hold this view.
Meanwhile, many others maintain that there is no compelling ethical or scientific justification to begin tinkering with the human genome. While there are some "disease genes" that we might all agree should be eradicated, we don't know (and can't know) what will improve the human species. The long-term worry here is that one or more scientists will boldly go where none have gone before in selecting modifications for the population at large, with a view to altering the human species. Those who share this concern question the wisdom of embracing volitional evolution.

In this presentation, I will critically examine the ethics of human gene editing with particular attention to the debates on germline modification and human enhancement. I will comment on the roles and responsibilities of the scientific, corporate and political elites who seek to direct the science. In closing, I will invite the audience to reflect with me on how we might go about forging a global consensus on how best to use gene editing technology for the common good.

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STRESS AND CHRONIC DISEASES

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Chronic stress, associated with impaired function of the Stress System, contributes to the development of behavioral and somatic pathologies. By definition, stress is a state of disturbance of the complex dynamic equilibrium, that all living organisms must maintain, and is subserved by the Stress System comprised by the Hypothalamic-pituitary-adrenal Axis and the Arousal/Sympathetic/Parasympathetic Nervous Systems. The stress system functions in a baseline circadian fashion and on demand in response to stress and interacts with other systems of the organism to regulate a variety of behavioral, endocrine, metabolic, cardiovascular and immune functions. The experience of chronic perceived or real uncontrollable intense stress may lead to a prolonged state of disturbed, harmful homeostasis or cacostasis, that may result in several behavioral and somatic disorders, including, respectively, anxiety, depression, psychosomatic disorders and substance abuse, and obesity/ metabolic syndrome and their comorbidities, cardiovascular disease and osteoporosis, as well as impaired reproductive and immune functions. Autoimmune and inflammatory nosologies, hypofertility and increased susceptibility to certain infections and cancers are also associated with chronic stress. Developing children and adolescents are particularly vulnerable to the effects of chronic stress. Both behavioral and biologic pathways are involved in the connection between chronic stress and obesity/metabolic syndrome. Emotional “comfort” eating, lack of sleep, impulsive behaviors and selection of specific foods often characterize stressed individuals. In addition to specific behaviors, dysregulation of the stress system through disturbed secretion of CRH, cortisol and the catecholamines, in concert with concurrently elevated insulin concentrations, leads to development of central obesity, insulin resistance and the metabolic syndrome. In children, chronic alterations in stress system activity may have additional effects on cognitive and emotional development, timing of puberty, and final stature. Obese children and adolescents are frequently entangled in a vicious cycle between distress impairing self-image and distorted self-image maintaining and worsening distress.

Chrousos, G.P. (2009) Stress and Disorders of the Stress System. Nat. Rev. Endocrinol. 5: 374-381