

Evolutionary Special Interest Group of the Royal College of Psychiatrists



Evolutionary Psychiatry (EPSiG)

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Notes from the editor

Professors Robin Dunbar and Simon Baron-Cohen are confirmed for giving talks at the First Evolutionary SIG symposium In October 2016. We are also privileged that Professor Randolph Nesse is joining us. We are hoping to film / record the presentations and will later link them to the RCPsych website.

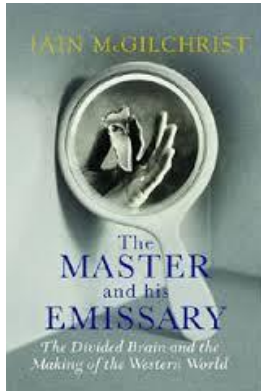
This is our 4th EPSiG newsletter. We are delighted to publish an interview with Alfonso Troisi, MD Professor of Psychiatry, from Rome. We also have an excellent review by David Geaney of “The Master and his Emissary: The Divided Brain and the Making of the Western World” by Iain McGilchrist. The book is already on my Christmas wish list.

There is also a special article on disproof or falsification in evolution. This will be the second of 3 special articles assisting members to consider the pros and cons of evolutionary psychiatry and answering some of the criticisms, or at least covering some of the issues to help us all discuss such issues. . This Article 2 will be on the potential falsifications of evolution and article 3 (Next year) on some of the criticisms levelled at EP from other anti-materialist or sometimes ultra-reductionist camps and philosophies.

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So! Onto our next review; PSTJS Ed.

The Master and his Emissary: The Divided Brain and the Making of the Western World. Iain McGilchrist.



This is an extraordinary book which could have been written by very few other people. Before he trained as a psychiatrist, Iain Mc Gilchrist was an English don, three times elected a Fellow of All Souls College, Oxford. His beautifully written work dazzles with erudition, straddling the fields of neurology, psychiatry, psychology, philosophy, literature, the arts, archaeology and anthropology.

The magnum opus is the product of twenty years of research and reflection. It was first published in 2009 to rave reviews for its exceptional scholarship and penetrating insights into what it means to be human. The book is divided into two parts, the first focusing on the structure and function of the divided cerebral hemispheres and the second looking at the history of Western culture in the light of this knowledge.

It had long been known that the left cerebral hemisphere was specialised for language and the right for visuo-spatial information, but subsequently it became evident that both cerebral hemispheres were involved in the processing of both words and images. In fact all human activities appeared to be served by both cerebral hemispheres and as a consequence interest in hemispheric differences faded.

Yet why did we evolve to have deeply divided, asymmetrical cerebral hemispheres rather than a single cerebral sphere which would have had a greater facility for interconnection? Somewhat belatedly, I find myself wondering why I hadn't reflected more on this question. It turns out the divide is evolutionarily ancient, being widespread in vertebrates, and so must have offered an evolutionary advantage to birds and animals. The advantage appears related to the necessity to keep separate two quite different forms of attention needed for survival. In birds, the left hemisphere and right eye is used for detailed focusing on a specific task such as distinguishing seeds, when eating, from background grit, while the right hemisphere and left eye is simultaneously used to scan the environment for anything that may be significant such as a predator or potential mate. Over evolutionary time the size of the connecting corpus callosum appears to have been reducing in relation to that of the cerebral hemispheres and its function is largely inhibitory, emphasising the importance of this split for homo sapiens.

By focusing on the question of what each cerebral hemisphere does, McGilchrist argues that we have overlooked the question of how they do it. With a careful, deeply referenced review of the neuropsychological research into cerebral hemisphere function from brain lesion patients, split-brain studies and temporary hemisphere inactivation experiments, he elaborates upon how the mode of attention differs between the two hemispheres. The right hemisphere's attention is open to anything of relevance in the outside world, so that we feel part of the ever changing world around us. It is personal, embodied, implicit, inarticulate and more closely connected to our emotions through the limbic system, and is the basis, particularly through the right frontal lobe, of our empathic nature as social animals. The left hemisphere, in contrast, takes a detached, analytical view of a particular aspect of the environment to give a more partial, but apparently clearer, perspective which allows readier manipulation of the world or others.

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In normal life, both cerebral hemispheres are functioning simultaneously but, so different are the types of attention employed by the two cerebral hemispheres that the very nature of the world we experience is profoundly changed when shifts in the balance between them occur. If the hemispheres are functioning in an evenly balanced way, the right hemisphere detects something which the left hemisphere can subject to detailed scrutiny before returning the information to the right hemisphere for reintegration with the whole. If the left hemisphere becomes unduly dominant it fails to recognise the importance of the right hemisphere's global perspective and functions instead in an increasingly detailed but disconnected way.

McGilchrist believes that it is not just an individual but an entire culture which can be affected in this way. He suggests that in Ancient Greece, a time of exceptional cultural achievement, the hemispheres functioned in a balanced way but subsequently the left hemisphere became more dominant until the virtues of balance were rediscovered in the Renaissance. He sees the Reformation and the Enlightenment as times of overbearing left hemisphere activity before a brief reprieve with Romanticism, then the complete triumph of the left hemisphere with industrialisation and the modern and postmodern world. The world he describes of left hemisphere dominance with its emphasis upon control and an overconfident focus upon the detail of component parts, rather than the whole, will be familiar to most practitioners of NHS psychiatry and beyond.

Although the book is not predominantly about mental illness he does attribute part of its current prevalence to Western culture. He describes schizophrenia as a condition of relative right hemisphere underactivity and left hemisphere overactivity. In addition, he draws parallels between the phenomenology of schizophrenia and our prevailing culture. A similar picture of hemisphere imbalance may be found in Autistic Spectrum Disorders, but the exact pattern obviously has differences.

It is difficult to do justice to McGilchrist's range and vision in this brief review. There is something of a paradox that he appears to have written his paean of praise to the right hemisphere very much from the perspective of the left hemisphere, so detailed are his arguments, but it is a mark of his success that people from such a wide variety of disciplines including philosophy, neuropsychology, sociology, the arts and others, have united in praising the book.

He has received many grateful responses from readers who feel that he has illuminated the nature of their own existence, and I would count myself among them. His description of the two types of attention characteristic of each cerebral hemisphere resonated strongly with me. How, for example, when walking in the countryside with your mind on nothing particular, you can feel at one with your surroundings but if your attention is grabbed by a pressing concern, that feeling evaporates while you attempt to solve the problem; or the distinction within psychiatry between Jaspers' understanding and explanation of an individual's mental state, the former feeling more personally connected and rewarding but the latter yielding greater apparent objectivity yet a more partial account.

I would recommend the book to anyone wishing to deepen their understanding of themselves and their world, though the depth and breadth of the scholarship on display means that it is not a book to be skipped through. It is a treasure chest of fascinating information that frequently gives one pause for thought. The Royal Society of Arts (RSA) Social Brain Centre were sufficiently impressed by its importance to host an event to probe the arguments and to

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explore its practical and policy implications for our society. The ensuing document, available on the RSA website, is well worth reading in its own right.

For people interested in evolutionary psychiatry, I would consider it essential reading. It demonstrates, in the most convincing way, the importance of a deep, evolutionary understanding of the normal functioning of the brain, and the mind it subserves, before we can start to discover what may be going wrong in mental disorder. The genetic evolution of our asymmetrical, bihemispheric brain, in turn, may play a significant role in our cultural evolution.

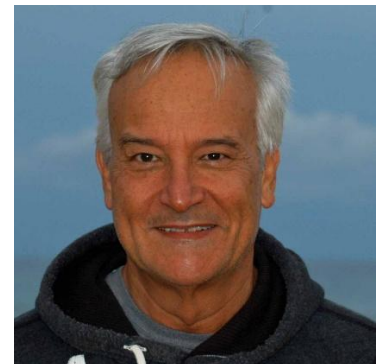
If you are tempted to buy a copy, it is worth knowing that both the hardback and paperback editions contain his detailed footnotes, but only the hardback version contains the extensive bibliography (although it is available on line). It is a book that I find myself regularly returning to, and while it is easy to be wrong about these things, my guess is that it will be regarded as a seminal book in the decades to come. It certainly deserves to be.

David Geaney. Formerly Consultant Psychiatrist and Honorary Senior Clinical Lecturer (University of Oxford)

Interview by Riadh Abed

Alfonso Troisi, MD

**Professor of Psychiatry, Department of Systems Medicine,
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What triggered off your interest in evolutionary theory in relation to medicine/psychiatry/psychology?

During my medical training, I carried out extensive ethological research on nonhuman primates, focusing on social behavior and the development of mother-infant attachment. I was fascinated by the comprehensiveness of the ethological approach to the study of behavior (i.e., the four whys described by Niko Tinbergen: proximate causation, ultimate causation, ontogeny and phylogeny) and, by comparison, I was disappointed by the limited view of psychology and psychiatry. Since then, I decided that my research and clinical activity in psychiatry would be inspired by evolutionary theory.

Why would you say is evolution important to the understanding of mental disorder?

Evolutionary theory is relevant to psychiatry for a variety of reasons. I would mention the three reasons I like most.

First, psychiatry lacks a formal definition of what constitutes a mental disorder, and the failure to set a valid distinction between mental health and mental illness has largely undermined its scientific credibility. Psychiatry's difficulty in defining mental disorder derives from its difficulty in defining mental health. To identify what has gone wrong with the individual's mental and behavioral functioning, one should have a detailed idea of how the individual functions or would function when nothing is going wrong. In this regard, evolutionary explanations of human mind and behavior have much to offer psychiatry. Evolutionary behavioral science is for psychiatry what physiology is for the rest of medicine.

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Second, the approach of mainstream psychiatry to individual differences is basically based on typological thinking: homogeneity in a population is the natural state and variation is the result of some sort of interference. Rejecting typological thinking, evolutionary theory suggests that it may prove useful to think about individual differences in human behavior in terms of adaptive within-species variation, including some of those deviant profiles that are currently defined as psychiatric disorders or psychological dysfunctions. A hallmark of modern evolutionary models is the capacity to integrate explanations focusing on species-typical patterns with explanations focusing on individual differences that diverge from these modal patterns.

Third, recent findings from molecular genetics and developmental psychology are questioning dichotomies that have dominated psychiatric thinking for centuries (i.e., brain vs. mind, genes vs. environment, biology vs. psychology, nature vs. nurture). To integrate these new findings, we need new theoretical models that explain why (not only how) genes interact with environments in shaping individual phenotypes, what are the pros and cons of behavioral plasticity, and which and when behavioral systems are more sensitive to environmental influences. The development of these new models will not be possible without the contribution of evolutionary sub-theories such as life-history theory, attachment theory, and sexual selection theory.

Why have psychiatrists and doctors in general been slow to embrace evolutionary theory?

First, medicine is a practical science, and clinicians pay little attention to those disciplines that have an apparent scarce utility for their everyday practice (and this is what they think of evolutionary medicine and psychiatry.) Second, physicians know very little of evolutionary biology. In general, their view of evolutionary theory is limited to the traditional notion of common descent. Contemporary evolutionary science is a complex field including a variety of theories and concepts that are not taught in medical schools.

Is it important to include evolutionary science into the undergraduate and postgraduate curriculum and if so what would be the best strategy to achieve this end?

Yes, definitely. Probably the best way to achieve this end is to combine a top-down strategy (i.e., to promote the evolutionary approach among academics who design medical curricula) with a bottom-up strategy (i.e., to engage medical students' interest through lectures, workshops and seminars.) In both cases, the emphasis on clinical implications of the evolutionary approach is the key to success.

In your view why is there still no evolutionary psychiatry university departments and no academic journals dedicated to the subject whereas there are many dedicated to evolutionary psychology?

For many decades psychiatry was influenced by the psychodynamic and sociological perspectives. Now, neuroscience is the top dog. Evolutionary psychiatry cannot be assimilated to either of these theoretical views. In addition, in medicine and psychiatry, business matters more than in psychology and the evolutionary approach has little to offer in this regard. However, the fact that evolutionary psychiatry is not secluded in dedicated university departments or academic journals might be an asset. Evolutionary thinking should fertilize all psychiatry, avoiding becoming another parochial school of thought.

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How can evolutionary psychiatry fend off the accusations of promulgating ‘just so’ stories?

In my view, the criticisms are a combination of valid objections against misuse of the evolutionary approach and naive misunderstandings of what evolutionary psychiatry really is. Often evolutionary explanations of mental disorders have reinterpreted psychiatric conditions as either mismatches between past adaptations and current environments or adaptations to these mismatches. This view leaves no room for simple breakdowns which occur because our brains can malfunction, just as our bodies can.

Why have there been so few interventions in psychiatry based on evolutionary science?

In current medical thinking, the prevailing metaphor is that of the body as a machine that the doctor is called upon to fix when it breaks; the doctor’s role is that of an engineer who uses therapeutic technology in the service of patients’ health and well-being. If we embrace the engineering mentality that conceptualizes successful treatment as the reversal of immediate reasons for illness, the therapeutic relevance of the evolutionary approach is negligible. It is highly improbable that evolutionary studies will lead to the discovery of a new drug to cure psychotic symptoms or a new type of psychotherapy to ameliorate borderline traits. Yet, if we accept a broader concept of the aims of therapeutic interventions, the perspective changes. In medicine, the aim of therapy is not only to reverse the pathogenesis (i.e., proximate mechanisms) of illness but also to restore the congruence between a patient’s individuality and the conditions of the environment. If therapy is conceived of in these terms, the therapeutic and preventive relevance of the evolutionary approach emerges clearly. For example, think of the impact of Bowlby’s evolutionary theory of attachment on the procedures of pediatric hospitalization.

What would you say is your most important contribution to evolutionary Psychiatry?

Difficult question. Ultimately, the real importance of scientific contributions is determined by peers’ judgment over time. Based on this criterion (as reflected by the number of quotations), my most important contributions are *Darwinian Psychiatry* and the ECSI (Ethological Coding System for Interviews), a list of nonverbal behaviors widely used to refine diagnosis and assess outcome in psychiatric patients.

Is the textbook (Darwinian Psychiatry) you co-authored with the late Michael McGuire in need of updating and if so, are you planning to publish a new edition?

In 2014, Michael McGuire and I signed a contract for a new book to be published by Oxford University Press (OUP). Our intention was to write a different book, a book for clinicians dealing with the problems they face in their everyday practice, not a second edition of *Darwinian Psychiatry*. The tentative title is “*A Clinician’s Guide to Darwinian Psychiatry*”. I have worked with Mike on this project until few weeks before his passing away in February 2016. I am keeping on writing the book although the loss of my coauthor and friend is irremediable.

In 2013, I published a book in Italian entitled *La Mente Dipinta (The Painted Mind)*. The English version of the book is scheduled for publication in spring 2017 by OUP. The focus of the book is on human mind viewed from an evolutionary perspective, including dysfunctional emotions and behaviors relevant to psychiatry. The original feature of this book is that each chapter was inspired by a painting masterpiece, and a substantial portion of the text is

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devoted to introduce the reader to the artistic significance of the works and to biographical notes concerning the painters who made them.

What aspect of your evolutionary work are you most proud of?

The integration of evolutionary science into my everyday clinical practice. It's of great help in understanding my patients' problems and their difficulties in reaching their goals. Contrary to common belief, an evolutionary view adds empathy and compassion to clinical work.

What advice would you like to offer to your fellow evolutionary psychiatrists?

Keep up with progress in evolutionary sciences, focus on the problems that clinicians and patients consider most important, and restrain your tendency to invent adaptationist explanations for every psychiatric symptom or syndrome.

Resources and Website

There are no new changes to the website

Future SIG meetings

The first EPSiG symposium on OCT 4th 2016 is now full

<http://www.rcpsych.ac.uk/workinpsychiatry/specialinterestgroups/evolutionarypsychiatry.aspx#meetings>

Further dates for meetings etc have been discussed but not confirmed due to discussion with the college on potential availability of rooms. However these are the proposed dates so far.

Future meeting dates include:-

Jan 13th 2017 AGM Meeting @RCPsych

May 19th 2017 Committee Meeting @RCPsych

Nov 10th or 17th 2017 EPSIG Symposium #2

Getting Evolutionary Psychiatry into mainstream psychiatry and MRCPsych exams

We hope to discuss this topic at the end of our symposium in October so I hope members will stay on to look at the options. Dr. Agnes Ayton is continuing leading on this. One aspiration of the SIG is to get Evolutionary Psychiatry ideas into mainstream psychiatry. This is something that we consider a high priority. This involves getting it into the MRCPsych curriculum (probably Paper 1) and to have a few questions each exam.

Articles for the newsletter

We still need articles, reviews and interviews for the newsletter. Please send to me at

paulstjohnsmith@hotmail.com Any evolutionarily inspired ideas or topics in 100 words, and book reviews and small articles are always welcome.

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EPSIG Special Article No2.

What could falsify Evolutionary Psychiatry? PART 1

By Paul St John-Smith , Annie Swanepoel and Riadh Abed

Introduction

In psychiatry, medicine, philosophy, and various brain sciences there are those who dismiss evolutionary models and particularly evolutionary psychiatry (EP) as being wrong, irrelevant or a simplistically adaptationist; a pseudoscience or a “just so story”. We wrote an article about how to detect actual pseudoscience in our previous newsletter. Accordingly some ignore EP or use rhetorical slurs giving it ridiculous sounding terms like Neuromania and *Darwinitis*. Thus there are claims that evolution and in particular, evolution as applied to human behaviour, is scientifically or otherwise false. Those assertions need to be examined carefully, analysed and answered appropriately.

So what would or could disprove Evolutionary Psychiatry (EP)? When one comes to consider the individual details, what exactly does that question actually entail or even mean? Overall, what does “*proof*” in a biological or medical science involve? Is psychiatry even a science as distinct from a method of practice? These questions seem, just at first viewing, reasonable. Asking them may be more of a denier’s rhetorical ploy, as distinct from a rational request about information or requesting details for the purposes of scientific discussion. The primary question, “*What would disprove the evolutionary basis of Evolutionary psychiatry?*” is also by its structure, a potentially over inclusive or over-generalised question, leading to major difficulties in framing any straightforward answers in ways that allow immediate illumination or rational debate. One should of course not just reply with similar ad hominem, counter assertions or contemptuous rhetoric. In the above form the question appears syntactically correct, but involves multiple concepts and is therefore, unanswerable with any single piece of evidence, however correct or explanatory. Answering the one issue then invites the denier to move the goalposts and assert that another issue is not explained by EP and thereby seemingly demonstrating EP’s falsity or fatal incompleteness.

Psychiatry, for instance is not one thing, it is a whole branch of medicine devoted to the diagnosis, prevention, study and treatment of mental disorders. These disorders or conditions often labelled “illnesses” include various problems, difficulties and abnormalities that are affective, behavioural, cognitive and perceptual. That however begs the question as to what constitutes a mental disorder and who gets to determine whether the phenomenon is a disease or illness. Psychiatry itself is a profession but the mental health endeavour contains a whole range of disciplines and models including sciences and the humanities. No one thing could disprove all of psychiatry in one go because it is not a single entity or enterprise.

Similarly, evolution is a general or meta-theory, not just one predictive hypothesis in a single refutable domain. So by extension, the question “What would falsify Evolutionary Psychiatry?” is as unproductive and illuminating as the general questions “what would falsify physics, quantum mechanics or inorganic chemistry?” Why would anyone try to ask the question in that way (Except to make a political point)? Nevertheless the question has some rhetorical or propaganda value and has political leverage in the public mind so we will break it down into several components that make more sense, so that individual issues can be identified, scientifically interrogated and answered independently.

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These primary component questions include:-

- 1) What would falsify Evolution? This will be the main focus of Part 1
- 2) What would falsify psychiatry as an endeavour?
- 3) What would falsify or at least *disqualify* EP from being relevant to psychiatry?
This will be the main focus of Part 2

These component questions also need further inspection and breaking down. “What would falsify Psychiatry?”, or more relevant clinically, “What would invalidate the application of psychiatry within medicine?”, or similar questions, are not our prime concern or priority for defence. These topics have been covered elsewhere! Such debates have raged for years and cannot be given enough time and not be done justice within the space of this article. Many arguments still rage over psychiatry’s epistemological status and identity as a true applied science, and even a legitimate branch of medicine. We will have to leave others to answer these old chestnuts elsewhere. Needless to say we are all practicing psychiatrists, albeit reasonable sceptics, so you might guess where our range of views lie! So we will limit ourselves in this article to consider initially “What would falsify evolution”? We will further consider “What would prevent evolutionary ideas being applied to humans and such issues” in our next newsletter.

Falsificationism and “Proof”

The first essential characteristic of an evolutionary *science* is that it must be potentially falsifiable. The concern with falsifiability gained prominence because of Karl Popper’s contributions to scientific epistemology which included “falsificationism”. Popper stressed the problem of demarcation distinguishing the scientific from the unscientific and made falsifiability the major demarcation criterion, such that what is unfalsifiable is classified as unscientific or a pseudoscience. This fundamental feature of a scientific theory was mentioned by Popper in his initial criticism of Darwinism, though when apprised of the evidence, he fully recognised that evolutionary biology was a science! (The Mendelian underpinning of modern Darwinism has been well tested *and so has the theory of evolution* which says that all terrestrial life has evolved from a few primitive unicellular organisms, possibly even from one single organism. (Popper, 1978, p. 344 ;).

Popper later wrote “The fact that the theory of natural selection is difficult to test has led some people, anti-Darwinists, to claim that it is a tautology. . . . I mention this problem because I too belong among the culprits. Influenced by what these authorities say, I have in the past described the theory as “almost tautological,” and I have tried to explain how the theory of natural selection could be untestable (as is a tautology) and yet of great scientific interest. My solution was that the doctrine of natural selection is a most successful metaphysical research programme. . . . [Popper, 1978, p. 344]. I have changed my mind about the testability and logical status of the theory of natural selection; and I am glad to have an opportunity to make a recantation. . . . [p. 345] And:-

Darwin’s theory of adaptation was the first non-theistic one that was convincing; and theism was worse than an open admission of failure, for it created the impression that an ultimate explanation had been reached. [Popper 1976, p. 172]. He (*also*) concluded that there is an asymmetry, scientific theories cannot be proved outright, they can only fail to be disproved. This involves pointing out what evidence could or does, disprove the theory.

However if a theory cannot ever be disproved, such as with Bertrand Russell’s “Last Tuesdayism” it makes no difference whether it is true either way as it explains away

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everything but predicts nothing. It is only verbalism (a use of words where the words are considered as being the predominating importance over evidence or reality) thus obscuring ideas and is not useful in a predictive scientific sense. Russell framed this as follows: “There is no logical impossibility in the hypothesis that the world sprang into being five minutes ago, exactly as it then was, with a population that "remembered" a wholly unreal past. There is no logically necessary connection between events at different times; therefore nothing that is happening now or will happen in the future can disprove the hypothesis that the world began five minutes ago” (Bertrand Russell, *The Analysis of Mind*, 1921, pp. 159–60). A theory like that, compatible with ALL future observations is not predictive or useful in any way; in evolution, such a claim becomes a Just-so story. But evolution does not work that way as we will demonstrate in a section on predictability.

It also makes little sense to consider whether evolution as a whole can be falsified, it’s like asking the question “Can physics be falsified?” or “Can sociology be falsified?”. Evolution, physics, and sociology are all extremely broad, conceptual frameworks, not single questions. It is much more informative to ask questions of single aspects, hypotheses or processes predicted within the framework of the theory of evolution. Those questions are closer to what can be supported or refuted by evidence, using materialistic explanations. Note however, there is a critical difference between “unfalsifiable” as applied by creationists to evolutionary theory and “unfalsifiable” as applied by scientists to creationism. When sceptics complain that evolution is unfalsifiable, they complain that scientists are too flexible in their stance. When enough new anomalous data changes theoretical understanding, scientists change the relevant aspect of their theories, and thus scientific theories are rarely overthrown in a full paradigm shift. Furthermore one suspects some antipsychiatrists, post modernists and creationists keep their theories unfalsifiable because they do not want them tested, knowing they can never pass the test. That is a very different type of unfalsifiability. However a claim can be so evidentially and undeniably true (not false), that in practice it is also unfalsifiable.

Thus requiring a whole body of clearly demonstrable replicated evidence to meet the test of falsifiability is a misunderstanding of the requirements in Popper’s concept of the falsifiability. For example historically, World War 2 cannot be falsified in that sense. Individual situations and reports about what happened during the course of the war can though be examined. All falsifiability requires is that it could have been false if the evidence had been otherwise.

What scientific or other evidence could falsify evolution?

Disproving evolution first requires looking at what the theory actually predicts and seeing where it can be shown to make incorrect predictions. It is easy to be side-tracked by specifics of the theory, such as individual evolutionary pathways of certain features, and confuse these with what would falsify the overall theory of evolution by natural selection. Deniers do this whenever a new discovery is made in biology that causes scientists to rethink some pieces of evolution. To avoid this problem, it is best to be clear what evolution entails. See Box 3. Most non-scientists seem to be quite confused about precise definitions of biological evolution. When discussing evolution it is important to distinguish between the existence of evolution per se and the various theories about the mechanism(s) of evolution. Biological evolution is a change in the genetic characteristics of a population over time. That this happens is a demonstrable fact. Biological evolution as a corollary of the same observations also refers to the common descent of living organisms from shared ancestors.

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The evidence for historical evolution, genetic (DNA), fossil, anatomical, etc. is also now so overwhelming that it is also considered a fact. The theory of evolution thus describes observations as well as the mechanisms that cause evolution. **So in this respect evolution is both a fact and a theory.**

Biological evolution refers to populations and not to individuals and that the changes must be passed on to the next generation. In practice this means that, Evolution is a process that results in heritable changes in a population spread over many generations. This is a good working scientific definition of evolution; one that can be used to distinguish between evolution and similar changes that are not evolution. Another common short definition of evolution can be found in many textbooks: "Any change in the frequency of alleles within a gene pool from one generation to the next", or "descent with modification". So, evolution is "a process that results in heritable changes in a population spread over many generations" Darwin formulated the specific scientific theory of evolution by natural selection, published in his book *On the Origin of Species* (1859). He theorised that Evolution by natural selection is a process demonstrated by the observation that more offspring are produced than can possibly survive, along with three facts about populations:

- 1) Traits vary among individuals with respect to morphology, physiology, and behaviour (phenotypic variation),
- 2) Different traits confer different rates of survival and reproduction (differential fitness in a given environment), and
- 3) Traits can be passed from generation to generation (heritability of fitness).

Any of these 3 is in principle capable of being falsified.

Thus, in successive generations members of a population are replaced by progeny of parents better adapted to survive and reproduce in the biophysical and social environment in which natural selection takes place. This teleonomy (NOT TELEOLOGY!) is the quality whereby the process of natural selection creates and preserves traits that are seemingly fitted for the functional roles they perform. Natural selection is the only known cause of increasing the numbers or frequency of such adaptation but not the only known cause of evolution. See BOX 3. Other, nonadaptive causes of microevolution include mutation and genetic drift and more recently genetic engineering etc.

In the early 20th century the modern evolutionary synthesis integrated classical genetics with Darwin's theory of evolution by natural selection through the discipline of population genetics. The importance of natural selection as a cause of evolution was accepted into other branches of biology. Moreover, previously held notions about evolution, such as orthogenesis, deistic evolutionism, Lamarckism, Mutationism and other beliefs about innate "progress" within the largest-scale trends in evolution, became obsolete scientific theories.

Scientists continue to study various aspects of evolutionary biology by forming and testing hypotheses, constructing mathematical models of theoretical biology and biological theories, using observational data, and performing experiments in both the field and the laboratory. Consequently there are many conceivable lines of evidence that could have potentially falsified Neo-Darwinian evolution. These include observations that there was only a completely static fossil record, with no change in any geological strata no matter what the age and those life-forms had not changed for all of life's history of over 3 billion years. It also presumes that dating techniques (and physics in general) are scientific and accurate.

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As Evolution is based on three main principles, variation, heritability and selection, evolution must necessarily occur if all three are correct. Many features of evolution appear given only these three guiding principles. If any of these were shown to be fatally flawed then the theory would be untenable. There are thus a range of findings and experiments that could have falsified evolution in the century-and-a-half since Darwin published his theory, but not one has.

Box 1: Demonstration any of the following would end the theory of evolution:

- | |
|--|
| 1) If it could be shown that changes in DNA or mutations do not occur. |
| 2) If it could be shown that when changes or mutations (in the germ line) do occur, they cannot not be passed down through the generations. |
| 3) If it could be shown that although changes/mutations are passed down, no change/mutation could produce any sort of phenotypic change that drives natural selection. |
| 4) If it could be shown that gene frequencies never change between generations perhaps by demonstrating a mechanism that would always prevent any gene changes. |
| 5) If it could be shown that selection or environmental pressures do not favour the reproductive success of better adapted individuals (for a specified environment). |
| 6) If it could be shown that there are adaptations in one species good only for a second species. |
| 7) If it could be shown that even though selection or environmental pressures favour the reproductive success of better adapted individuals, these "better adapted individuals" (at any one time) can never change into other species or that humans in particular are not derived from ape-like ancestors and are not related to any other mammals. |
| 8) If it could be shown that organisms with identical DNA have different genetic traits. |
| 9) In the sub group of EP , the endeavour would be shown to be false with the above demonstrations (1-8) plus if it could be shown that biology has nothing to do with human behaviour, psychology, brains or minds and by extension psychiatric disorders. |
| 10) If it could be shown that Mental disorders had no genetic component nor heredity (A corollary of 9) |
| 11) If it could be shown that no outside environmental, social or cultural influences affect any human biological process and or those processes have no influence on survival or reproduction (fitness). |

Footnote: There are plenty of adaptations in species that are good for other species, but also help members of the first species: these are the basis of mutualisms. (Cleaner fish, for example, remove parasites and dead tissue from other marine fish, but thereby gain a meal.) But we don't expect to see—and don't see—adaptations in one species that evolved solely for the benefit of another species.

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Critics of evolution often claim that 1-8 above have already been shown, but on closer examination they never give any data demonstrating that; only repeating their own circular assertions usually arguments from ignorance and incredulity! We don't see any of these anomalies, and so the theory of evolution is on solid ground. Despite a million chances to be wrong, evolution always comes up right. That is probably as close to a scientific truth as we can get.

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Statements 9 to 12 contain aspects of disagreements between mainstream psychiatry and the anti-psychiatrists or critical psychiatrists that assert varieties of the notion that evolutionary theory explains nothing of importance about our minds and also there are no significant biological causes of mental illness. We will deal with this in more detail in the last article.

Conversely critics that are ultra-reductionist biologists claim all mental illness is simply reducible to neurotransmission and cell biology and therefore they have no need of evolutionary models. However if a psychiatric disorder has any genetic or hereditary components to it, evolutionary questions must be considered. Criticism of evolutionary psychology, the sister discipline, is slightly different but overlaps to an extent. That criticism also involves questions not only of testability, falsifiability and predictive value but also, and evolutionary assumptions (such as modular functioning of the brain, and large uncertainty about the ancestral environment), the importance of non-genetic and non-adaptive explanations, as well as political and ethical issues due to interpretations of research results (see Rose Hilary, 2000). This is dealt with in our next special article.

Evolution is obviously falsifiable in principle because we can think of an unlimited number of potential observations that would be fatal anomalies for the above Darwinian Theory. See below. For example J.B.S. Haldane famously stated that "fossil rabbits in the Precambrian" would disprove evolution. This has been a talking point in philosophy of science as it is a quick rebuttal to the accusations that evolution is not falsifiable. However, the reality of disproving evolution in this manner is more complicated. As science is based on interplay between theory and evidence (Hypothetico-deductive) a single point of data would not be enough to completely destroy the whole theory. The phylogenies would necessarily need revising, but this is not synonymous with progression due to Natural Selection. Progression over time seen in the millions of fossils unearthed around the world is exactly what evolutionary theory predicts. Unicellular organisms, for example, appear before multicellular ones. Jawless fish precede jawed fish. Lunged fish precede amphibians. Amphibians precede reptiles. Reptiles with scales precede mammals and birds with modified scales (fur and feathers). Mammals precede primates, precede humans. Nevertheless all it would take is one or two exceptions to seriously challenge the theory of common descent at least. Here are some further examples of those possible observations that would falsify current neo-Darwinian theory, as in examples 1 to 5.

See Box 2

Box 2: Examples of observations that would falsify neo-Darwinian theory
A) Starting tomorrow, all human children will be born with fully-functional gills.
B) A completely new human species is created de novo without any related ancestors, in full view, perhaps not based on any existing DNA sequences, or indeed not based on DNA at all (n.b. not a cell line created by a laboratory such as Craig Venter's).
C) Primary observation(s) of new organism(s) even just one special creation, being created in nature, by an observable specific process would refute common descent by Darwinian evolution. This nowadays has to be slightly qualified by whether it was produced in nature or by a human biotechnologist or by a supernatural being, deity or alien. Just finding a new species does not count, especially if it is based on DNA and had genes related phylogenetically to (pre)-existing species. These all have slightly different implications.
D) Finding unrelated chimeras of different and diverse lineages such as mermaids or centaurs or trees that had frog's legs etc and which are not explained by genetic engineering/hybridisation by humans, or symbiosis, where two whole organisms come together, would be problematic.
Hypothesis : Nature would have creatures that overall appear unrelated (by DNA) in any way currently

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described; which it could do if unrelated beings and novel life forms were specially or repeatedly created de novo!

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To summarise, if evolution is a scientific theory, then there must be conceivable observations that could show it to be wrong. A summary of what the theory states is therefore required.

See Box 3.

Box 3: Summary of what evolution (including human) entails so it could be refuted-

1. Evolution occurs, demonstrated by gene frequency changes in populations over generations.

2. Significant evolution takes time and it usually (though not always) requires hundreds to thousands of generations to occur.

It is not instantaneous, and it is the population and species rather than the individual that evolves.

3. Lineages of organisms split, or speciate, so that the single lineage that gave rise to life 3.5 billion years ago has undergone numerous splitting events to produce the millions of species alive today (and also the even more millions that went extinct). These splits can be mapped and DNA where available verifies the phylogeny

4. The converse of #3: any pair of living species has a common ancestral species sometime in the past. That is, if you trace the DNA like any pair of twigs on the tree of life, you will find a node where the line from the trunk bifurcates to produce them.

5. The process producing the appearance of design in organisms is blind, stochastic, purposeless natural selection. However it is not entirely random in the domain of what survives, reproduces and is passed on.

6. Evolution occurs through selection processes which involve the non-random selection of random mutation.

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If these parts of the theory don't all stand together, for example, if you could have evolution without branching: that would mean that only one long-evolved species would be alive today, or you could have evolution, but not occurring by natural selection.

Finally, you could have evolution but not gradualism: every population could experience great saltational leaps in one generation. This is related to theories of (Macro) Mutationism and a type of sudden leap forward. This is unlikely as any one creature suddenly changing to another species would have no other similar creature with whom to reproduce; each being a different species, so two breeding new individuals would have to have the same compatible massive mutational change. This is improbable.

Predictions from Evolutionary theory in general.

Creationists some post modernists and have asserted that true science must make predictions, but as evolution only describes what happened in the past, it is not predictive. This argument has several fatal flaws: for details see Box 4.

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Box 4

1. The theory of Evolution can be predictive, and yet still only describe what happened in the past. As we do not have complete knowledge of the past, we can make predictions about what has already occurred (known as “retro-dictions”). This is a prediction of what should be found, (that is not already known), if the theory is accurate; predicting general traits/locations of future fossil finds, and sequences in DNA.

2. Other numerous predictions are possible based on the theory of evolution including bacterial/viral/parasite resistances to antibiotics/pesticides, also predicting population responses to selective breeding attempts.

3. Evolution cannot be used to precisely predict exactly what will happen in the distant future. Meteorology predicts effectively only one week into the future. However, it can inform and predict what general changes might be expected to happen and in what circumstances.

4. Here are some general examples of predictions that could be extrapolated from the theory of evolution.

- 1 Species with high reproductive rates will have a better chance of surviving environmental change than species with low reproductive rates.
- 2 Species from a common gene pool separated into group A and group B and isolated for generations over a longer period of time and exposed to different environmental conditions will eventually become unable to reproduce with members of the other group.

5. It is also possible to predict the outcome of some macro-evolutional experiments, but they are difficult to confirm it due to finite human life-spans.

6. Darwinian evolution suggests that all organisms on Earth derive from a common ancestor. This ancestor has not been identified through fossil records (and probably cannot be), but its existence is a necessary consequence of the fundamental genetic unity of all life on Earth. A prediction is that a Darwinian phylogeny of existing differences will be a clue to lead us to the biochemical phylogeny DNA differences and thus the original primitive ancestor DNA. (DNA phylogeny is concordant with observed family tree is amazingly concordant with fossil morphology)

7. As a negative argument; “What other theory has made better risky, unknown, predictions? Anti-evolutionists fail to realize that there have been no scientific predictions in the field, accurately made by any deniers. Although some deniers may claim that climate change was predicted for instance, by the Bible and described in the Book of Revelations, this is unfalsifiable, as the time frame was not given. Also even if it were proven that current events are not caused by God, they would still claim that God will cause predicted events in the future.

8. Evolution requires a huge amount of time to operate and thus effectively one prediction by default was that the Sun and the Earth had to be far older than previously thought! This incidental requirement when viewed as a prediction was verified by the discovery of the Sun’s nuclear fusion.

Footnote *Ironically in some ways science is always initially only “historical” as it is primarily based on prior observations which by definition have occurred in the past,. Then and only then are theories formulated and future observations predicted. Mendeleev only described past events when first designing and drafting the periodic table.*

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One early prediction of evolution, amongst others, was that transitional species would be found and added to the fossil record, as they have been, though denied by anti-evolutionists on spurious arguments such as that nobody can say whether they left offspring or that there are now 2 gaps that need intermediates for explanation.

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What Popper calls the historical sciences, *do not* literally make predictions about long past unique events which obviously would not be logical or testable. They can however make post or retro-dictions. These sciences make *hypotheses* involving past events which must predict (that is, have logical consequences) for *the present state* of the system in question. Here the testing procedure takes for granted the general laws and theories and is testing the specific conditions (or initial conditions, as Popper usually calls them) that held for the system. A scientist, on the basis of much comparative anatomy and physiology, might *hypothesise* that, in the distant past, mammals evolved from reptiles. This would have *testable consequences* for the *present* state of the system (earth's surface with the geological strata in it and the animal and plant species living on it) in the form of reptile-mammal transition fossils that should exist, in addition to other necessary features of the DNA, developmental systems, and so forth, of the present-day reptiles and mammals.

What would falsify common descent and humans as evolved animals?

Common descent is the theory that all life evolved from one common ancestor, or groups of ancestors. Morphological and, more recently, genetic evidence puts common descent pretty close to being outright proven, but there are still ways to falsify it. Common descent could easily be disproved (without even seriously challenging the theory of evolution) if we discovered a form of human life that was not related to all the life we know - most simply, by finding a person that does not use any of the nucleic acids (DNA and RNA) for information storage and retrieval. This would be exemplified in the situation of a multiple genesis, where different forms of life began at completely different points. As Popper put it "You only need to observe one black swan to falsify the statement that all swans are white".

Repeatability and Complexity

What about repeatability? It is the observations that must be repeatable, if only to establish their validity independently of any one person's authority. This does not mean that the hypothetical mechanism or the phenomenon concerned must be repeatable or reproducible. In the experimental laboratory where the phenomena being studied are short-lived and transient, it is usually necessary to reproduce them in order to repeat the observations. But scientists must wait for the recurrence of natural phenomena—such as eclipses, earthquakes, seasonally recurring biological phenomena, and so forth. Yet, if a phenomenon is a stable, more or less permanent long-term condition, observations may be repeated anytime. A geologist may return to a geological formation to repeat or make new observations, or an anatomist or palaeontologist may re-examine a specimen, either corroborating or refuting someone else's previous observations. Clearly, then, a hypothesis postulating a unique past event is scientific—as long as it has observable consequences for the present that can be repeatedly verified by any observer. Thus we may conclude (as Popper did) that evolutionary theories or historical hypotheses about origins are no different than other scientific theories as far as their logical features are concerned and are just as falsifiable as hypotheses in the form of general laws and theories.

Charles Darwin made the case, that his theory could be disproved a little differently, when he said, "If it could be demonstrated that any complex organ existed which could not possibly have been formed by numerous, successive, slight modifications, my theory would absolutely break down. But I can find out no such case." This case resembles some claims that the brain or the mind is too complex to have evolved or the corollary that evolution and biology cannot explain any of it. If the eye is complex, the brain is even more so. But we suggest this is not

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the case and that for discussion at the right emergent level, evolutionary psychiatry has an important part to play in understanding mental conditions.

Conclusions

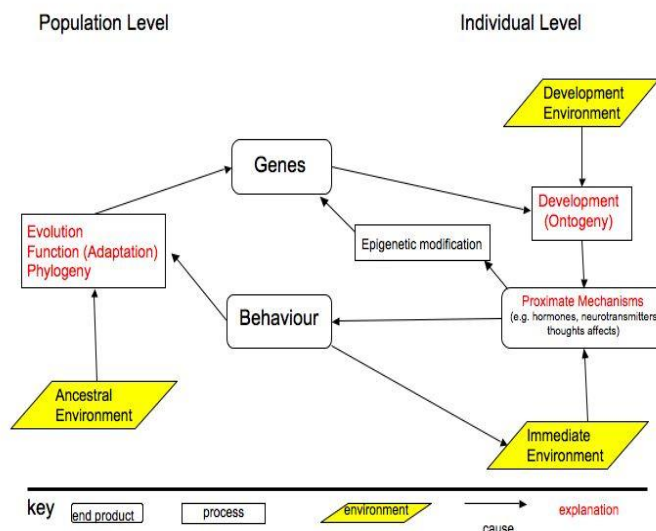
Evolutionary Psychiatry is an interdisciplinary field at the intersection of evolutionary biology, psychiatry, medicine, public health, epidemiology, genetics, anthropology, sociology, biochemistry & psychology. It takes Neo-Darwinian theory as a starting point. It uses insights from comparative animal evolution, ethology, palaeo-anthropology, culture, philosophy & other humanities. If Neo-Darwinian theory is falsified Evolutionary Psychiatry would have to be rethought out. However in practical everyday uses Tinbergen's questions are one systematic helpful way of approaching causation and behaviour using evolutionary hypotheses.

See Box 5

Box 5: Tinbergen's 4 Questions

- | | |
|---|--|
| 1 | What are the mechanisms that cause the biological phenomenon? |
| 2 | How does that develop in an individual (ontogenesis)? |
| 3 | How did it evolve (phylogenetic history)? |
| 4 | What was the function and fitness value of the trait/system/behaviour? |

Diagram 1 Tinbergen N. On aims and methods of ethology. *Zeitschrift für Tierpsychologie* 1963; 20: 410-33.



Finally evolution as a general theory has not been falsified and can be utilised in Homo sapiens. Humans are animals and have evolved as shown by their DNA and fossils. The human brain has also evolved. The truth, slowly emerging from science (from evolutionary biology to psychiatry and neuroscience, from philosophy of mind to ethology) is that we are indeed unique as individuals and very special kinds of creature.

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An evolutionary perspective on mental disorders asks new questions about why natural selection has left us all vulnerable to mental disorders, questions with several kinds of possible answers. See Box 6.

Box 6: Pathways that mediate the influence of evolutionary processes on disease vulnerability (adapted from Gluckman et al).

- Mismatch: exposure to evolutionarily mismatched or novel environment
- Life History factors
- Excessive defence mechanisms
- Co-evolutionary considerations: losing the arms race against pathogens
- Constraints imposed by evolutionary history
- Sexual Selection and its consequences
- Balancing selection: maintaining an allele that raises disease risk
- Demographic history and its consequences
- Selection favours reproductive success at the expense of health

EP thereby offers the beginnings of the kind of functional understanding for mental health professions that physiology provides for the rest of medicine. EP provides a framework for a deeper and more empathic understanding of individuals, and explains aspects of how relationships work using ideas from kin selection, parental investment, attachment theory etc. EP provides a way to think clearly about development and the ways that early experiences influence later characteristics, and a foundation for understanding emotions and their regulation. It also provides a foundation for a scientific diagnostic system, and a framework for incorporating multiple causal factors that explain why some people get mental disorders while others do not.

Ultimately ultra-reductionist law-based theories of science derived from physics, in which explanation arises from simple laws, poorly match the nature of the problems confronting psychiatry. Progress in psychiatry cannot be made just through the study of cell biology; it requires the study of subjective or personal situation and meaning accounts, followed by the challenging task of integration. The evolutionary approach is to integrate these internal and external factors in order to understand the multiple factors, also including design mechanisms that derail the key mind/brain functions that are disordered in psychiatric illness. Finally, research into, understanding of and dissemination as well as application of EP within clinical psychiatry is the primary purpose of the EPSiG. This process is our long term goal and it will be the subject matter of our future articles.

Sources:-

Alas, Poor Darwin : Arguments Against Evolutionary Psychology. Harmony; 1 Amer ed edition (10 October 2000).

What Did Karl Popper Really Say About Evolution? Author(s): Frank J. Sonleitner 1986 Volume: 6 Number: 2 Page(s): 9–14; Popper, K. R. 1981. Letter. *New Scientist*, 87:611.

1978. "Natural Selection and the Emergence of Mind." *Dialectica*, 32:339-355.

1976. *Unended Quest. An Intellectual Autobiography*. LaSalle, IL: Open Court.

1972. *Objective Knowledge: An Evolutionary Approach*. Oxford: Clarendon Press.

Evolutionary Special Interest Group of the Royal College of Psychiatrists

1963a. "Science: Problems, Aims, Responsibilities." *Federation Proceedings*, 22:961-972.

1963b. *Conjectures and Refutations*. London: Routledge and Kegan Paul.

1957. *The Poverty of Historicism*. Boston: The Beacon Press.

Bertrand Russell, *The Analysis of Mind*, 1921, pp. 159–60).

Index to Creationist Claims, edited by Mark Isaak, 2006

<http://www.talkorigins.org/indexcc/CA/CA211.html>

Tinbergen N. On aims and methods of ethology. *Zeitschrift für Tierpsychologie* 1963; 20: 410-33.

Nesse RM, Williams GC. *Why We Get Sick: The New Science of Darwinian Medicine*. Vintage

Books, 1996. Gluckman P, Beedle A, Hanson M. *Principles of Evolutionary Medicine*. Oxford University Press, 2009.