# Evolutionary Psychiatry (EPSiG)

# Newsletter No.3 June 2016

**Editors: Dr Paul St John-Smith (Consultant Psychiatrist Single point Of Access Team, Hertfordshire Partnership University foundation trust)**

**Contact Emails:- paul.stjohnsmith@hpft.nhs.uk or paulstjohnsmith@hotmail.com**

**Riadh Abed (Retired Consultant Psychiatrist and Medical Director; currently Medical Member of the Mental Health Tribunal Service in England)**

**Address for correspondence: abedrt@btinternet.com**

**Dan McQueen Consultant Psychiatrist (Consultant Psychiatrist, Child and Family Department, Tavistock and Portman NHS Foundation Trust & Eating Disorder Unit, Cygnet Hospital Ealing).**

## Notes from the editor

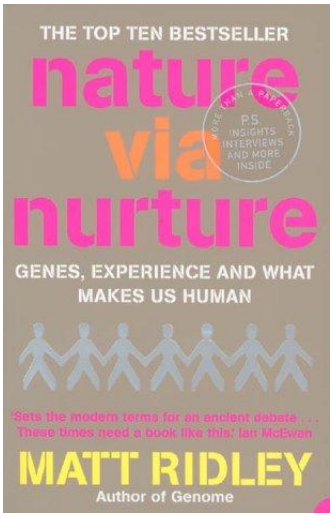
The EPSiG had its most recent committee meeting last month. Dr Annie Swanepoel presented her "Advances" article to much acclaim. We have placed the minutes on the SIG website under theThe RCPsych Evolutionary Psychiatry Special Interest Group (EPSiG) Spring Meeting Wednesday 18 May 2016.

Professors Robin Dunbar and Simon Baron-Cohen are confirmed for giving talks at the First Evolutionary SIG symposium In October 2016. The room booked at the college holds only 50 so please book your place soon!

This the 3rd EPSiG newsletter, has not only a book review on Nature via Nurture but also an interview with Professor Martin Brune. There is also a special article on how to recognise pseudoscience or "Just so stories" as opposed to science, for those interested. This will be the first 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. . Article 2 will be on the potential falsifications of evolution and article 3 on some of the criticisms levelled at EP from other anti-materialist or sometimes ultra-reductionist camps and philosophies.

So! Onto our next review;




**Nature via Nurture: Genes, experience and what makes us human**

It was with some amusement that I learnt my daughter had to read some "evolutionary" books for her A- level, over the summer. These were to be taken from a list of books on biology (mainly Richard Dawkins) and some from evolutionary psychology. I discovered I already had all of the titles except this one. Amazon was duly consulted. She narrowed her choice to either this book or a Richard Dawkins book. But before she had time to open it, I decided to take a peep at Nature via Nurture. Having already read all the Dawkins on the list, and then immediately impressed with the style, I went on to read it cover to cover.

Matt Ridley's Nature via Nurture examines the "Old Chestnut" as to whether it is nature or nurture that makes us who we are? Ultimately he concludes that the question itself is a "false dichotomy" presenting multiple examples of the ways our environment affects how our genes express themselves. It has long been a matter for debate amongst psychiatrists and psychologists as well as scientists and philosophers as to which was more important, nature or nurture. At one extreme some assert that humans are born with a blank slate and that environmental factors only, such as learning, education, experience or nutrition, (or even non-material even magical almost supernatural entities), shape a person's character. Alternatively, others claim that everything is some kind of genetic predetermination mediated through innate instincts and capabilities.

Ridley successfully explains how this dichotomy is illusory, and that both nature and nurture are essential, and indeed both are complimentary and interactive. Nevertheless humans and the human mind/brain cannot take place without the underlying genes that facilitate it. Genes involve not only coding sections but also switches. These switches controlling our 25-30,000 or so genes not only form the structures of our brains but do so in ways related to the environment and its interpretation by the brain. This sets up a feedback loop of body and behaviour. He challenges both simplistic scientism/scientific as well as folk/ naive dualistic and anti-biological concepts.

Like the example of the gene –development processes in Martin Brune's new textbook of evolutionary psychiatry, Ridley demonstrates how "psychiatric" behaviour often requires both nature and nurture. People with the low activity variant of the MAOA gene on the X chromosome are more likely to become violent and antisocial if maltreated as children, but slightly less antisocial than average if not maltreated. People with the high activity version are less vulnerable to the long-term effect of maltreatment. Thus a bad childhood environment, such as neglect or abuse does not give rise to a complete explanation of adult propensities, one also needs to consider a specific genetic variant (here, the low-activity MAOA gene), and vice-versa. This effect may just be a spandrel or exaptation rather than adaptation but it poses interesting questions.

Nature and nurture are not mutually exclusive forces but their amazing interactions are affected by not only our coding genes but also non-coding DNA promoters. Ultimately this process and subsequent diversity gives rise to all species. These species are consequently as varied as bacteria, trees and fish as well as primates, all of which have genes in common if not identical. Herein lie some of the reasons and questions asked about the incredible differences, capacities and even the cultural diversity of humans compared to other animals.

*(Editor's note) Chimpanzees essentially have c.98% of the same genes as humans when comparing sequences of genes in homologous chromosomes or similar areas, as humans have a different number of overall chromosomes to chimpanzees. Human chromosome 2 was formed by the head-to-head fusion of two ancestral chromosomes that remained separate in other primates. In a rough and ready calculation one can see how little changes over evolutionarily long time periods can make big changes in the overall genome. Depending on how you make the comparisons, if you examine the "base pairs" difference between chimpanzees and humans, and assuming the mutation rate is approximately-constant, the difference, even over this geological time, is only somewhere around 60million base pairs (2% of total) or positions out of the possible 3 billion. Over 12 million years, assuming there is a generation gap of c. 20 years per generation, there would be c.600,000 generations in each line ; this gives a generational average mutation rate figure of about 100 mutations required (50 alone in humans and 50 in chimpanzees or around 1 per chromosome? per generation.) Many of these possible point changes/mutations that occurred were neutral and invisible but even so there is an average of 99.99999 % fidelity of copying DNA every generation. 12 million years is therefore more than enough time to account for all the changes. It is very important to reemphasise that chimpanzees have also evolved at a similar rate away from the common ancestor so the actual divergence length is doubled and only half the number of the total mutational differences need to have occurred within the human line and that these changes take place in whole populations involving thousands of individuals not just 1 individual. Also it is important to know that severely disadvantageous mutations are weeded out before birth as they are incompatible with life.*

Ridley looks at the implications of the millions of years since the chimpanzee-human line diverged, considering their lifestyles, diet, culture, social structure and living environment which have altered how the genome produces our body and how it can act in a given situation. Environment and our genome remain in a constant interactive flux. Signals from our perception and the interpretation of our senses, affect our brain and bodies to determine ultimately whether we will survive and reproduce and pass those genes on. Those populations that do this most successfully for a given environment, including an environment of change, may become more successful and so Evolution thereby takes place imperceptibly.

His discussion on IQ was interesting. The older you grow, the less your family background predicts your IQ and the better your genes predict it. An orphan of brilliant parents adopted into a family of dullards might do poorly at school but by middle age could end up a brilliant professor of quantum mechanics. An orphan of dullard parents, reared in a family of Nobel Prize-winners, might do well at school but by middle age may be working in a job that requires little reading or little deep thought. Numerically, the contribution of "shared environment" to variation in IQ in a western society is roughly 40 percent in people younger than 20. It then falls rapidly to zero in older age groups. Conversely, the contribution of genes

to explaining variation in IQ rises from 20 percent in infancy to 40 percent in childhood to 60 percent in adults and maybe 80 percent in people past middle age. (Matt Ridley).

His discussions of schizophrenia were less convincing to me, taking the condition as almost a unitary entity and its disease status presupposed. I accept this is not a specialist psychiatric book and must be read with that in mind. In chapter 4 he examines how schizophrenia can have a variety of cumulative causes. Schizophrenia can be seen as having proximate causes such as "excessive levels of dopamine in the brain". He goes on to examine how dopamine levels vary according to environmental stimuli (e.g. excitement) and can also be altered by food and street drugs or medication. But the length of dopamine receptors, which determine how much dopamine is absorbed in specific parts of the brain, is genetically determined. Schizophrenia is therefore partly determined by the type of dopamine receptor genetically inherited and the levels of neurotransmitters determined by nutrition and external stimuli. He also examines viral infection theories and developmental theories, combining both genes and environment. He examines the "reelin" hypothesis whereby reduced reelin production has been implicated in schizophrenia, bipolar depression and autism. The cause of this includes prenatal infection with influenza virus, epigenetic hypermethylation of DNA, or a mutation in the RELN gene on chromosome 7, among others. Both genes and the environment can play a role. Finally, he examines how arachidonic acid (AA) metabolism and function is faulty in the membranes in people with schizophrenia. I know there are advocates of this but I felt this was accepted as "fact" rather easily.

I enjoyed his examples and metaphors in the comparison of 12 hairy/bearded scientists, which interestingly include not only Darwin but also Mendel, Kraepelin and Freud. He also thoughtfully examines the different ways of defining or using the word "gene". He suggests 7 functions or ways that the word "Gene" might have been viewed including by some of these "Famous Bearded men", as follows:-

1) Genes are units of heredity that archive wisdom accumulated from millions of years of evolution (Mendel's definition)

2) Genes are recipes for building proteins through RNA (Watson and Crick's definition)

3) Genes are developmental switches expressing themselves in specific tissues (Jacob and Monod's definition)

4) Genes are "pangens" that can be reused in many different ways inside the body (De Vries' definition)

5) Genes ensure the healthy development of organs in an expected environment (Garrod's definition)

6) Genes are selfish replicators striving for their own survival (Dawkin's definition)

7) Genes are devices for extracting information from the environment (Tooby and Cosmides' definition)

According to Ridley, (human) nature is then achieved via nurture. This is perhaps nowadays self-evident but many observers of human behaviour seem to take one extreme or the other or alternatively, orthogonally take a facile acceptance of evolution ("Of course we evolved, but evolutionary theory has nothing useful to say about human behaviour or psychiatry?), without

looking at the proximate "hows" and more importantly from an evolutionary perspective, the ultimate "whys". This book introduces some of these complex interactions that are so well characterised and explored by Tinbergen's "4 questions" model. I found it a well researched and well written book in a style that kept me interested. It is a "should read" for students human behaviour. PSTJS Ed.

## Interview with Martin Brune 2016 by Riadh Abed

1. *What triggered off your interest in evolutionary theory in relation to psychiatry/psychology?*

   My initial interest was to study biology, rather than medicine, because as a pupil, I was much influenced and impressed by the writings of Dutch and German ethologists Tinbergen, Lorenz and Eibl-Eibesfeldt, and I developed an early interest in nonverbal communication.

2. *Why, would you say, is evolution important to the understanding of mental disorder?*
   Evolution is important because it provides a scientifically sound framework for the study and treatment of mental disorder. There are several relevant approaches including ones derived from Behavioural Ecology (i.e. Life History Theory) and other pertaining to ethology, the only framework to explain the meaning of nonverbal communication, which is often much more relevant than verbal report, but direly understudied in the context of mental disorder.
   Above all, most psychiatrists seem to disregard the fact that an evolutionary theory of human behaviour that also explains much about psychopathological conditions has been around for half a century – attachment theory à la Bowlby and Ainsworth.

3. *Why have psychiatrists been slow to embrace evolutionary theory?*

   This is because most psychiatrists don't see the therapeutic implications that an evolutionary approach could entail.

4. *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?*

   Definitely yes, not only with regard to psychiatry, but to medicine in general. The best way, in my view, would be to incorporate evolutionary thinking right from the first course on anatomy, physiology etc., always focusing on "why" questions, as has been suggested by Tinbergen in 1963.

5. *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?*

   As already expressed, the major obstacle is the apparent insignificance of evolution (as a historical process) for treatment (recent demand).

6. *How can evolutionary psychiatry fend off the accusations of promulgating 'just so' stories?*

   This is an important point. There has been much theorizing in evolutionary psychology and psychiatry alike, but not enough empirical work. More testable predictions, and actual testing of hypotheses are essential to fend off accusations of promoting Kipling-like stories.

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

   Because it is difficult to implement insights from evolutionary theory into practical treatment. I am optimistic, though, that this is a developing field. Compassion-focused therapy is one such approach. One may also utilize insights from life history theory to explain patients how they organise their interpersonal behaviour and what they can do to change it and adjust it in more appropriate ways. For example, an individual who experiences the (social) world as a dangerous environment may act as if short-term goals are more relevant that achieving long-term goals, and this may impact on one's risk-taking behaviour, investment in partners, friends, and children etc.

8. *What, would you say, is your most important contribution to evolutionary Psychiatry?*

   Perhaps the "Textbook of Evolutionary Psychiatry and Psychosomatic Medicine". It is a humble beginning, I know, fraught with shortcomings and flaws, but perhaps something psychiatrist can build upon if they are interested in the matter. Aside from the book, I have tried to think about how we can integrate evolutionary ideas into conceptual and nosological considerations of psychiatric conditions. Above all, I have come to think that we need more empirical work, and not necessarily more theorising, if we want to assign to evolutionary theory a role in psychiatry and medicine in general. So, I studied "theory of mind" in relation to everyday function in psychosis, sex differences in the content of delusions, nonverbal behaviour during interaction of psychiatric patients, with and without a pharmacological challenge using oxytocin. I have also had a special interest in brain research and have conducted, in cooperation with colleagues from the anatomy department, studies on "von Economo neurons", which have been assigned a special role in human evolution. Another point of interest to me has been the study of abnormal behaviour or "psychiatric conditions" in nonhuman animals, especially apes in captivity. I have never carried out proper research in this domain, except that I contributed to a few articles and projects on the matter, but I believe that a cross-species comparison perspective can also help create new ideas with regard to human psychopathology.

9. *What aspect of your evolutionary work are you most proud of?*

   This is a difficult question. I would be proud of my work if I could see any impact on medical education and on how psychiatrists and psychotherapists think about

psychiatric conditions. To achieve this, I believe, it is essential to show that evolutionary thinking can also have a role in therapeutic processes, but this is even more challenging. Personally, I think that life history theory or behavioural ecology, a sub-discipline of evolution by natural selection can provide us with tools to tackle this question.

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

I would like to suggest approaching patients as fellow human beings. They are not so much different from ourselves. Sometimes, their views on the world, mainly on their social environments, are distorted for reasons that lie in their personal history, perhaps genes, or the interaction of genes and environment. I personally like the "not-knowing" stance according to mentalisation-based therapy, in combination with a compassionate view on patients' problems. This is a more general offer to my fellow psychiatrists. I would like to encourage evolutionary psychiatrists to develop ideas that can be empirically tested, and ideally, put them to test. This is the only way to convince non-evolutionary psychiatrists and sceptics that the approach has some merits to the benefit of our patients. MB.Ed RA

**Resources and Website**

There are no new changes to the website

**Future SIG meetings**

**The first EPSiG symposium on OCT 4th 2016 is now open for booking on the website**
This is now available on the Royal college website http://www.rcpsych.ac.uk

The EPSIG symposium event can now be booked by accessing
http://www.rcpsych.ac.uk/workinpsychiatry/specialinterestgroups/evolutionarypsychiatry.aspx#meetings

To pay to attend please click on the 'book online now' button on the webpage.

Further dates 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 or 27th 2017 AGM Meeting @RCPsych
May 19th 2017 Committee Meeting @RCPsych

Nov 10th or 17th EPSIG Symposium #2

**Getting Evolutionary Psychiatry into mainstream MRCPsych and exams**

Dr. Agnes Ayton is continuing her exploration of these possibilities. 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 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.

## EPSIG Special Article No1.

# Just so story and pseudoscience detection kit

**By Paul St John-Smith, Riadh Abed & Annie Swanepoel**

*"In the discovery of secret things, and in the investigation of hidden causes, stronger reasons are obtained from sure experiments and demonstrated arguments than from probable conjectures and the opinions of philosophical speculators".* William Gilbert 1544 -1603

(Gilbert was an English scientist and author of De Magnet, inspirational to and a direct influence on Galileo who described Gilbert as the founder of the experimental method of science.)

In science and philosophy, a "just-so story" is an unverifiable and unfalsifiable narrative explanation for a cultural practice, a biological trait, or behaviour of humans or other animals. The expression was popularized by Rudyard Kipling with his "Just So Stories". These charming stories are fictional and deliberately fanciful tales for children, in which the stories pretend to explain animal characteristics, such as the hump on the camel.

Since its use by Stephen Jay Gould in 1978 in his criticism of the (*overly*) adaptationist program that aimed to explain how (*almost every*) biological and psychological traits were shaped by selection, the expression "Just So Stories" has become a pejorative phrase, similar to the term "pseudoscience". This has become an over-inclusive derogatory term for any evolutionary psychiatry hypothesis and is used to prevent any further discussion. However, hypotheses, by definition, require further empirical assessment, and are therefore, essential for scientific progress. Consequently we maintain we should not avoid stories in science, as long as they have good explanatory value and make testable and falsifiable predictions.

The term "pseudoscience" is used for a claim, belief, or practice presented as scientific, but which does not adhere to the full if any scientific method. A field, practice, or body of knowledge can reasonably be called pseudoscientific when it is presented as if it is consistent with the norms of scientific research, but it demonstrably fails to meet these norms. We will consider how to identify these norms below. Pseudoscience is often characterized by contradictory, exaggerated or unprovable claims using over-reliance on confirmation rather than rigorous attempts at refutation. There is a notable lack of openness to independent evaluation by other experts in the field and an absence of systematic practices when rationally developing pseudoscientific theories. The term "pseudoscience" is often used by detractors as a term for complex endeavours such as psychiatry; the detractors claim it suggests something is being inaccurately or even deceptively portrayed as science. Accordingly, those labelled as practicing or advocating pseudoscience often dispute the characterization. So! How can a reasonable sceptic tell the difference?

Science is distinguishable from revelation, theology, or spirituality in that it offers insight into the physical world obtained by empirical research and testing. Pseudoscientific beliefs

are widespread especially among alternative medicine enthusiasts, people working outside their area of expertise and especially journalists and people working to preformed political agendas. The demarcation between science and pseudoscience has philosophical and scientific implications. Differentiating science from pseudoscience has contemporary important practical implications in psychiatry and healthcare. Distinguishing scientific facts, hypotheses and theories from pseudoscientific beliefs (such as those found in astrology, alchemy, medical quackery, occult beliefs, and creation science; combined with appropriate understanding of scientific concepts), should be part of medical education, scientific literacy and psychiatric training! We consider it pertinent to assist in this process using the case of Evolutionary Psychiatry (EP).

EP involves significant challenges in order to be widely accepted. However, it is impossible to debate or inform someone who is ideologically opposed to evolution. Some sceptics do have valid questions to ask but others are just deniers and detractors with pre-suppositional opposition to the endeavour. As such some may be "cranks". This is a term used for a person who holds an unshakable belief (not necessarily delusional) that most of his or her contemporaries (but not like minded cranks) consider being false. A crank belief is so wildly at variance with beliefs commonly held (in this case by science), as to be ludicrous. Some cranks appear to be ultra-sceptics. However, they tend to be one sided and sceptical only about conventional science and medicine but not about their own wild speculations. Cranks characteristically dismiss all evidence or arguments which contradict their own beliefs, making rational debate a futile task, and rendering them impervious to facts, evidence, and rational inference.

In psychiatry, like in all other fields, there are cranks. Psychiatry as an endeavour is complex, incomplete and sometimes counterintuitive but unconventional ideas are not automatically cranky. The criteria for assessing any adaptive significance of any trait especially behaviour, is admittedly complex and remains necessarily tentative. EP goes further by seeking explanations not for adaptations, but for apparently suboptimal traits, that can be viewed as maladaptations (Nesse). Many researchers are now addressing such questions and Martin Brüne's new textbook emphasizes these aspects of EP. However, according to Nesse, no consensus exists about how best to formulate and test hypotheses about traits that leave brains vulnerable to psychiatric disorders. Solutions to this challenge will likely emerge. Furthermore specific questions may be addressed using a variety of methods. Methods that fail will be discarded. In order to qualify as science any medical theory should have a number of validating criteria for its acceptance which includes: that it should be parsimonious (Occam's razor), useful and pragmatic, consistent internally and externally, empirically testable and falsifiable, based on multiple observations/techniques (triangulation), correctable and dynamic as well as progressive and provisional.

Usually, theories (in the scientific sense) are large bodies of work that are a composite of the products of many contributors over time and are substantiated by vast bodies of converging evidence. They unify and synchronize the scientific community's view and approach to a particular scientific field. Science is not a fixed permanent body of knowledge; it is necessarily dynamic and changes at the cutting edges. The development of theories is a key element of the scientific method as they are used to make predictions about the world. If these predictions repeatedly fail, the theory is revised to reflect what is observed and to be more accurate and predictive. So in science a theory is a well-substantiated explanation for a series of facts and observations that is testable and can be used to predict future observations; not a personal hunch or cranky notion. Medical and particularly psychiatric knowledge is often transitory, but only some (and not all) of what researchers find is made obsolete, or

even falsified, by new findings. That is not a weakness but strength! Our best understanding of phenomena will alter with changes in our way of thinking, our tools for looking at nature, and what we find in nature itself. Any "knowledge" incapable of being revised with advances in data and human thinking does not deserve the name of knowledge (see Jerry Coyne 2015).

Those processes that work will be kept, improved, and applied to new problems. We hope that along the way, philosophers of science will offer perspective and constructive suggestions. Our article here does not attempt to bypass that process, and it certainly does not propose a general solution to the challenges of testing hypotheses about all mental health issues. Instead, we consider some philosophical and practical strategies that have proved effective for formulating and assessing hypotheses about evolutionary aspects of mental disorders. Nesse has also organised ten questions which arise routinely in the process of assessing such hypotheses. Considering each question systematically can help to minimize errors. Nesse describes them as "like a pilot's checklist for projects in evolutionary medicine preparing for take-off". Furthermore we observe that simplistic attempts to offer general advice about scientific methods are easy to ridicule. According to Medawar an "Imaginativeness and a critical temper are both necessary at all times, but neither is sufficient". Because both are rarely well developed in the same person, science progresses by imaginative scientists proposing a variety of ideas that are winnowed by others with "a more critical cast of mind". The creative process is ineffable, so advice on scientific methods inevitably emphasizes errors.

Nesse notes that "Medawar's observation is particularly germane for studies in this area of EP. Traits that leave bodies vulnerable to disease spur the imagination. Each one is a mystery. Hypothesis formation begins by imagining how existing traits could be 'redesigned', so they are less likely to cause disease. Some individuals are resistant to HIV infection, some have no appendix, and some fight off tuberculosis easily. Why not all of us? Why didn't natural selection shape bodies less vulnerable to diseases? Such questions inspire students to wonderfully creative explanations, many of which are, unfortunately, preposterous. Subtle aspects of evolutionary theory are rarely the problem. Far more often, mistakes arise from difficulty in framing the question or from elementary errors".

In his book "The Demon-Haunted World", Carl Sagan gives advice for deriving at conclusions, as well as advice for avoiding logical and rhetorical fallacies. Together, the set of warning signs for common fallacies constitutes what Sagan very politely calls a "Baloney Detection Kit." We will call it a "Just So Story / Pseudoscience Detection Kit" (JSS/PDK). Sagan categorizes a range of logical and rhetorical fallacies documented below. See Boxes 1-3. He states: "In rational thinking and science we may start with ideas, information, data, and experimental results, and observations, measurements, often called 'facts'. We then invent, if we can, a rich array (as many as credibly examinable) of possible explanations for the findings or information and systematically confront (systematically test) each explanation with the facts". In the course of medical and scientific training, we should be equipped with this kit. The JSS/PDK should be brought out as a matter of course whenever beliefs, theories or new ideas are offered for consideration. If the idea survives examination by the tools in our kit, we may grant it warm, although tentative, acceptance. If you're so inclined, especially if you don't want to buy pseudoscience even when it's reassuring to do so, there are precautions that can be taken; there's a tried-and-true, consumer-tested method…….it is called organised scepticism or science.

**Box 1**

**Summary of Carl Sagan's Tools for sceptical thinking.**

1) Seek independent confirmation of alleged facts.
2) Encourage an open debate about the issue and the available evidence.
3) "In science, there are no authorities. At most, there are experts."
4) Come up with a variety of competing hypotheses explaining a given outcome. Considering many different explanations will lower the risk of confirmation bias.
5) Don't get too attached to your own ideas, lest you get reluctant to reject them even in the face of evidence to the contrary.
6) Quantify whenever possible, allowing for easier comparisons between hypotheses' relative explanatory power.
7) Every step in an argument must be logically sound; a single weak link can break the entire chain.
8) When the evidence is inconclusive, use "Occam's Razor" to discriminate between hypotheses.
9) Pay attention to falsifiability. Science does not concern itself with unfalsifiable propositions.

What sceptical thinking boils down to is the means to construct, and to understand, a reasoned argument and, especially important, to recognize a fallacious or fraudulent argument. The question is not whether we like or feel comfortable with the conclusion that emerges out of a train of reasoning, but whether the conclusion that emerges out of a train of argument follows from the premise or starting point and whether that premise is true.

**Among the tools for sceptical argument are:**

- Wherever possible there must be independent confirmation of the "facts". Authorities and experts from opposing disciplines and ideologies that agree, are probabilistically, more likely to have arrived at an independent truth. The more convergence there is from different methods the better. This process is called "Triangulation". An example would be to get self-report, parent and school feedback on ADHD core symptoms to evaluate a treatment effect.
- Whatever is "believed" by only one group without testable evidence, is often a product of political or cultural adherence and is characteristic of some political stances and religions in particular. Believing something on "faith" can be intellectually dangerous especially when the belief is held in the face of evidence to the contrary or with lack of verifying evidence.
- What can be asserted without evidence can be dismissed without evidence (Christopher Hitchins' rule). A premise with no evidence is not automatically false but arguments stemming from it cannot demonstrate that the premise is true. (That would be circular reasoning). Importantly the burden of proof is on the person making a claim and not on the sceptic. Failing to have evidence that unicorns do not exist does not prove their existence.
- Encourage substantive debate on the evidence by knowledgeable proponents of all points of view. Debate is not just assertion, contradiction or denial by someone who doesn't like the facts. Looking for the most likely (testable) explanation of the evidence is the methodology.
- Arguments from authority carry little weight; "authorities" have made mistakes in the past. For example, smoking was thought by the medical establishment to be beneficial for digestion and relaxation. The first doctor who showed the link with lung cancer was considered to be a heretic for many years! Perhaps a better way to say it is that in science there are no authorities; at most, there are experts. Authorities in one field though such as Physics or Chemistry carry no automatic authority or expertise in

Psychiatry, Medicine or Biology, though there is a requirement for biological explanations not to contravene the laws of physics etc.

- Examine more than one idea or hypothesis from different angles. If there's something to be explained, think of all the different ways in which it could be explained. Then think of tests by which you might systematically disprove each of the alternatives. What survives, (the hypothesis that resists disproof in this systematic selection among "multiple working hypotheses"), has a much better chance of being the right answer than if you had simply run with the first idea that caught your fancy. If something is untestable it is probably scientifically unusable or irrelevant. Explanations that include anything and everything, although consistent internally, cannot predict anything or be falsified by any future finding, are facile and vacuous.
- Try not to get overly attached to a hypothesis just because it's yours. It's only a pit stop in the pursuit of knowledge. Ask yourself why you like the idea. Compare it fairly with the alternatives. See if you can find reasons for rejecting it. If you don't, others will.
- Ask yourself or the proponent of a position or theory "What observation or evidence could falsify the position, idea, theory or change my (your) mind"? If nothing can, it is scientifically worthless. Popper, Karl (1959).
- Quantify. If whatever it is you're explaining has some measure, some numerical quantity attached to it, you'll be much better able to discriminate among competing hypotheses. What is vague and qualitative is open to many explanations. Of course there are the truths to be sought in the many qualitative issues we are obliged to confront, but finding them is more challenging.
- If there's a chain of argument, every link in the chain must work (including the premise). *Post hoc* "rescue" hypotheses to justify failure as a type of excuse are to be tested separately, they do not justify holding on to the current idea as it is currently formulated. Requiring permanent excuses and frequent rescue claims means an idea is worthless.
- Occam's razor. This convenient rule-of-thumb urges us when faced with two hypotheses that explain the data equally well, to choose the simpler. [Simpler = the conclusion which relies on the least number of unsupported propositions]. A supernatural explanation isn't simpler. You can say: "it's a miracle" but that actually explains no testable process. As such it is worth absolutely nothing; it just potentially stops any further investigation or exploration.
- When something isn't or cannot yet be known or fully understood, just stating that "Evolution explains it" can be a place-filler but it is not a substitute for understanding how that came about. Stating a "Just So Story", e.g. adding in a djinn to punish the camel with a hump, does not help and complicates the matter, as now not only the hump, but also the djinn needs to be explained. Shave it off using Occam's razor.
- Always ask whether the hypothesis can be, at least in principle, falsified. Propositions that are untestable and unfalsifiable are not worth much in the scientific sense. Consider the grand idea that our Universe and everything in it is just an elementary particle, e.g. an electron in a much bigger Cosmos. But if we can never acquire information from outside our Universe, such an idea can never be disproved. However the case that a theory "Has not been falsified" as in the case of the general theory of evolution, is not the same as "Is not falsifiable". The falsifiability of evolutionary theory will be the basis our next article.
- You must ultimately be able to check out all assertions. Inveterate sceptics must be given the chance to follow your reasoning, to duplicate your experiments and logic and see if they get the same result. In medicine, experimental design is imperative

to reduce the stunningly large effects of confirmation, ascertainment, selection, measurement, observational, recall, publishing and a whole host of other evidentially fatal biases.

The reliance on reason and carefully designed and controlled experiments or measurable predictions is the key, as we tried to stress earlier. In addition to teaching us what to do when evaluating a claim to knowledge, any good detection kit must also teach us what not to do. It helps us recognize the most common and perilous fallacies of logic and rhetoric. Many good examples can be found in politics, because their practitioners are so often obliged to justify two contradictory propositions. Sagan states "We will not learn much from mere philosophical contemplation. It is tempting to rest content with the first candidate explanation we can think of; childhood myths often hold great sway. One hypothesis is probably better than none but a bad hasty explanation or fixed belief is not better than none. But what happens if we can invent several? How do we decide among them? We don't. We let experiment do it". Francis Bacon provided the classic reason: "Argumentation cannot suffice for the discovery of new work, since the subtlety of Nature is greater many times than the subtlety of argument."

In similar vein but from the field of sceptical journalism Michael Shermer comes to a similar strategy.

See Box 2,

## Box 2

**Michael Shermer's questions to aid sceptical thinking**

1. How reliable is the source of the claim?
2. Does this source often make similar claims?
3. Have the claims been verified by another source?
4. How does the claim fit with what we know about how the world works?
5. Has anyone gone out of the way to disprove the claim, or has only supportive evidence been sought?
6. Does the preponderance of evidence point to the claimant's conclusion or to a different one?
7. Is the claimant employing the accepted rules of reason and tools of research, or have these been abandoned in favour of others that lead to the desired conclusion?
8. Is the claimant providing an explanation for the observed phenomena or merely denying the existing explanation?
9. If the claimant proffers a new explanation, does it account for as many phenomena as the old explanation did?
10. Do the claimant's personal beliefs and biases drive the conclusions, or vice versa?

As Michael Shermer states, "Clearly, there are no fool-proof methods of drawing the boundary between science and pseudoscience. Yet there is a probabilistic solution. Science deals in fractions of certainties and uncertainties, where evolution and big bang cosmology may be assigned a 0.9 probability of being true, and creationism and UFOs a 0.1 probability of being true. In between are borderline claims… In all cases, we remain open-minded and flexible, willing to reconsider our assessments as new evidence arises. This is, undeniably, what makes science so fleeting and frustrating to many people; it is, at the same time, what makes science the most glorious product of the human mind."

In addition to teaching us what to do when evaluating a claim to knowledge, any good JSS/PDK must also teach us what not to do. It helps us recognize the most common and perilous fallacies of logic and rhetoric. A fallacy is an incorrect argument in logic and rhetoric which undermines an argument's logical validity or more generally an argument's logical soundness. Fallacies are either formal fallacies or informal fallacies. Many good examples can be found when practitioners are obliged to justify contradictory propositions

See a list of fallacies: Box 3.

## Box 3 Relevant common fallacies include:

1) *Ad hominem* (attacking the person instead of the argument; "Darwin was a racist").
2) Argument from authority ("because an eminent person said it, it must be true" "Vitamin C cures cancer and colds" Linus Pauling).
   Who are you to question an authority such as Freud, Pauling, God or whoever?
3) Argument from adverse consequences ("Belief in the theory of evolution leads to atheism and eugenics; therefore I will go to hell and so the theory of evolution is false.).
4) Appeal to ignorance ("You can't prove that aliens do not exist, therefore they exist").
5) Special pleading (God must have a good reason to be completely invisible and to have designed such a dangerous world for the creatures *He* "loves". We can't know what this reason is because it is so profound that human minds cannot comprehend it. Deists do not need to explain how God does things, or how he came to exist. It's a "mystery.") .
6) Begging the question a form of circular reasoning, providing what is essentially the conclusion of the argument as a premise; ("mental illness would disappear if people pulled up their socks" or "schizophrenia is a psychotic illness because it treated with neuroleptics").
7) Observational selection (lights and sound announce winners in a casino, making them more visible than losers. This creates the impression that winning are more likely than it is).
8) Statistics of small numbers ("cannabis is safe because my friend smoked it and is fine").
9) Misunderstanding of the nature of statistics ("most people die in hospital, therefore stay away!").
10) Inconsistency ("women should have equal rights, as long as they know their place").
11) *Non sequitur* (e.g. hitting children "for their own good").
12) *Post hoc, ergo propter hoc* (literally "it happened after, so it was caused by" – e.g. the crowing rooster causes the sun to rise or "This patient has bipolar disorder because he is on Lithium actually affirming the consequent!).
13) Excluded middle, or false dichotomy (People who are depressed are either ill or have a reasonable justification for being sad) i.e. there are no spectrum or continua.
14) Slippery slope ("If we allow doctor-assisted suicide, we will lose control of how we all die").
15) Confusion of correlation and causation ("Windmills make wind, because when they turn fast, the wind blows" or "Ice cream sales are correlated with death by drowning, so ice cream consumption causes people to drown.).
16) Straw man ("Evolutionary theory claims humans are descended from chimpanzees" – dismissing an inaccurate claim and argument without looking more closely at the actual argument about common ancestry or evidence in DNA etc).
17) Suppressed evidence, or half-truths ("I did not have sexual relations with that woman" – Bill Clinton).
18) Weasel words ("streamlining efficiency" instead of "austerity cuts").
19) Equivocation – the misleading use of a term with more than one meaning (by glossing over which meaning is intended at a particular time). Survival of the fittest is obviously wrong as many people who are not fit live to old age and have lots of children. This is not understanding what Darwin meant, as he referred to the "best fit" with the environment and not being strong and healthy "fit".
20) Ecological fallacy – inferences about the nature of specific individuals are based solely upon aggregate statistics collected for the group to which those individuals belong. (People with schizophrenia are dangerous).
21) False attribution: Appeals to an inexpert, unqualified, unidentified, biased or fabricated source in support of an argument. Fred Hoyle's infamous statistical analysis calculating the impossibility of evolution stating" it is comparable to the chance that a tornado sweeping

through a junkyard might assemble a Boeing 747", utterly ignorant of the gradual (ratchet) processes occurring over thousands of millions of years leading to descent with modification and thus evolution of man by natural selection.

22) Fallacy of the single cause (causal oversimplification) – it is assumed that there is one, simple cause of an outcome when in reality it may have been caused by a number of only jointly sufficient causes. Depression is caused by Serotonin.
23) Moralistic fallacy – inferring factual conclusions from purely evaluative premises in violation of fact–value distinction. For instance, inferring "is" from "ought" is an instance of moralistic fallacy. Moralistic fallacy is the inverse of naturalistic fallacy defined below.
24) Naturalistic fallacy – inferring evaluative conclusions from purely factual premises in violation of fact–value distinction. For instance, inferring ought from is (sometimes referred to as the "is-ought" fallacy) is an instance of naturalistic fallacy. Naturalistic fallacy is the inverse of moralistic fallacy.
25) Reification (hypostatization, or the fallacy of misplaced concreteness) – a fallacy of ambiguity, when an abstraction (abstract concept or hypothetical construct) is treated as if it were a concrete physical entity. Examples "Evolution figured out how to get around these problems", or "Natural selection guided the development of this trait". Natural selection and Evolution are descriptive concepts they do not teleologically or literally figure-out or guide anything.

However just using the word "fallacy!" and labelling an opponent's position as such, is also not a sufficiently reasoned argument! Contempt for a claim or theory alone is not evidence against a theory nor is failing to understand a theory, but knowing the existence of such logical and rhetorical fallacies helps our endeavour.

There is one important fallacy that opponents of evolution and EP particularly use: "The argument from incredulity". This is a logical fallacy that occurs when someone decides that something did not happen, or is false because they cannot personally understand how it could happen. (It includes Fred Hoyle's infamous statistical analysis calculating the impossibility of evolution). It is also called an argument by lack of imagination, argument from personal incredulity and is a limited version of the argument from ignorance or *argumentum ad ignorantiam.* This fallacy lies in an unstated premise. If a theory is impossible for a person to understand, it does not mean nobody understands it and that consequently it is false; it may only mean that person's skill, knowledge or imagination is limited. For example, just because it is difficult to understand how an eye could evolve, does not mean it did not (see Richard Dawkins' "The blind watchmaker").

Related to arguments from ignorance is the "Dunning- Kruger" effect which is a cognitive bias in which relatively unskilled persons suffer illusory superiority, mistakenly assessing their ability to be much higher than it really is. Dunning and Kruger attributed this bias to a meta-cognitive inability of the unskilled to recognize their own ineptitude and evaluate their own ability accurately. This process leads ideological opponents of EP to make fallacious claims about EP, and also "not even wrong arguments" lacking the meta-cognitive ability to recognise that they don't know enough even to make a wrong argument, never mind a right one. As such they fail to recognize their own lack of skill, fail to recognize the extent of their inadequacy & fail to recognize genuine skill in appropriate others.

Like all tools, the JSS/PDK can be misused, applied out of context, or even employed as a rote alternative to thinking. But applied judiciously, it can make all the difference in the world-not least in evaluating our own arguments before we present them to others.

*The Fine Art of ''Baloney Detection" is an essay by Carl Sagan in his seminal work against pseudoscience, The Demon-Haunted World.*

Randolph Nesse employs similar reasoning and gives practical advice for the process of examining claims. He gives helpful guidance by way of instructions in the specific case of Evolutionary hypotheses. His tests for Evolutionary vulnerability are presented below in table1 as "Ten questions for evolutionary studies of disease vulnerability"

See table 1

**Table 1**

**Nesse's Ten questions for evolutionary studies of disease vulnerability**

***Task 1: Define the object of explanation precisely.***

Q1. Is the object of explanation a uniform trait in the species, or is the goal to explain variations in a trait among groups or individuals?

Q2. Has the object of explanation been influenced by evolution?

Q3. What kind of trait is the object of explanation?

a. A fixed human trait, such as the narrow birth canal
b. A facultative trait, such as the capacity for sweating
c. Human genes, in the most general sense of the term
d. Pathogen traits, such as the level of virulence
e. Pathogen genes, such as those that confer antibiotic resistance
f. Somatic cell lines, such as those in tumours or the immune system

***Task 2: Specify the kind of explanation sought***

Q4. Is the goal to explain the evolution of the trait, or its proximate mechanisms?

Q5. Is the goal to explain the trait's phylogeny, or the evolutionary forces that shaped it?

***Task 3: List and consider all viable hypotheses***

Q6. Are all viable hypotheses considered and given fair consideration, or are some hypotheses neglected, while others receive favoured treatment?

Q7. Could different vulnerabilities cause the disease in different individuals or subgroups?

Q8. What categories of explanation are under consideration?

a. Mismatch of bodies with environments they did not evolve in
b. Co-evolution with pathogens that evolve faster than hosts can
c. Constraints on selection, such as time required, genetic drift, and mutation
d. Trade-offs, especially costs associated with apparently superior alternative possible traits
e. Reproductive success at the expense of health
f. Defences such as fever and pain that cause harm and suffering, but were shaped by selection because they offer protection in certain situations

Q9. Could multiple explanations be correct?

***Task 4: Describe the methods used to test the hypotheses***

Q10. What methods are used to test the hypotheses?

a. Consistency with evolutionary theory
b. Modelling using quantitative methods
c. Comparative methods, i. Comparisons among species ii. Comparisons among subgroups of a species, iii. Comparisons among individuals who vary in a trait
d. Experimental methods i. Extirpation or disruption (e.g. studies that knock-out genes or block fever) ii. Augmentation (e.g. administration of extra testosterone) iii. Examining regulation of a facultative trait to see if it behaves as predicted iv. Observing evolutionary changes in the lab or the field
e. Examining the details of fit between observed form and a postulated function

*(From R Nesse Evol Appl. 2011 Mar; 4(2): 264–277.)*

**Conclusion**

The recent interest in EP and its applications comes from attempts to understand traits that leave brain or minds (depending on your perspective and the emergent level or level of abstraction), vulnerable to disease. As Nesse concludes "Such questions are especially fascinating because each is a mystery wanting a solution. It is not surprising that they inspire creative hypotheses". However, in science, creativity and criticism need each other. As Medawar puts it: "The most imaginative scientists are by no means the most effective; at their worst, uncensored, they are cranks. Nor are the most critically minded. The man notorious for his dismissive criticism, strenuous in the pursuit of error, is often unproductive, as if he had scared himself out of his own wits – unless indeed his critical cast of mind was the consequence rather than the cause of his infertility" (Medawar 1969).

EP explanations of traits that leave us vulnerable to disease will flourish and advance psychiatry to the extent that they can maintain a balance between the creative and the critical. The concepts, toolkit and ten questions posed here are no substitute for knowledge and experience, just as a pilot's pre-flight checklist is no substitute for flight training. Nonetheless, they may help to prevent confusion and common errors. We hope this assists in establishing, a dialogue between fact and fantasy and consider only the actual and the possible, so we can distinguish between what is worthless from the start, already verifiably false, could be true and ultimately, what is in fact really the case.

To quote ourselves:- We are aware that evolutionary psychiatry has its vocal critics and detractors. We do not believe that it is possible to convince those who object to evolution on ideological or religious grounds. However, we fully understand and even sympathise with the position of those whose objections arise from concerns regarding the need to maintain high standards of scientific rigour and the avoidance of 'just so stories'. We would suggest, however, that some of the most prevalent 'just so stories' have nothing to do with evolution and include assertions such as that all mental disorders are diseases or alternatively that mental illness is a myth. We believe that evolutionary inspired theories and hypotheses must ultimately stand or fall or be modified on the basis of empirical evidence and not through dogma or appeal to authority.

We suggest that without a broad, interactionist evolutionarily-grounded approach, psychiatric trainees are likely to feel bewildered by and discouraged from exploring other modes of scientific investigation and understanding, to the detriment of their patients and also to their

own professional satisfaction. However although using the evolutionary model encourages eclecticism and considers how brain/minds are influenced by and influence a whole range of biopsychosocial-cultural issues, we should not seek eclecticism at any evidential cost.

Psychiatrists do however need to recognise that patients have complex profiles and need to be treated as unique individuals with their own values and priorities respected .Whether something can be done medically is not the same issue as to whether it should be done. "Is" questions differ from "Ought" questions. These ethical issues are not resolved simply by science. Also in certain circumstances "comforting myths" remain an important mode of treatment and care for some distressed people, albeit acting through what have been called placebo mechanisms. Ultimately EP will stand on whether it predicts anything productive, helpfully systematises psychiatric knowledge and is clinically useful; but that is for another day!

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