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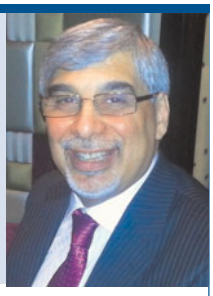
Editorial

Evolutionary biology: an essential basic science for the training of the next generation of psychiatrists



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Summary

Evolutionary science can serve as the high-level organising principle for understanding psychiatry. Evolutionary concepts generate new models and ideas for future psychiatric study, research, policy and therapy. The authors accordingly make the case for the inclusion of evolutionary biology in the postgraduate education of psychiatric trainees.

Declaration of interest

None.

Keywords

Evolutionary biology; psychiatric training; evolutionary causality; education and training; aetiology.

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The Royal College of Psychiatrists is reviewing the postgraduate curriculum following the UK General Medical Council's direction. The curriculum is expected to meet the standards set by the 'Generic Professional Capabilities Framework' (GPC). We argue that developments in evolutionary biology are compelling and their inclusion long overdue, as part of Domain 3 of the GCP (professional knowledge).

Evolutionary science assists psychiatrists in identifying disease and disorder by structuring an integrated theoretical framework of adaptive human functioning. Evolutionary perspectives clarify the formulation of questions regarding the causes of human vulnerability to mental disorder. Importantly, recognising that natural selection works through survival and reproductive success and not through good health, happiness or longevity, explains the nature of many psychobiological phenomena including those accompanied by great suffering.

Evolution affords a comprehensive scientific system of causality

Psychiatry currently focuses on issues around immediate mechanisms or proximate causes (answers to 'what' and 'how' questions). Evolutionary approaches enhance such examination through the addition of 'ultimate causation' (the answer to 'why' questions). Tinbergen's model stratifies this, organising biological traits or systems which can then be better understood by considering all four categories of causation, namely immediate mechanisms and development (proximate causes), and evolutionary (phylogenetic) history and ancestral function (ultimate or evolutionary causes).[1,2]

Consider fear and anxiety: mechanisms can be partly understood through studying the activity of relevant substrates within the brain. However, understanding brain organisation, genetic predispositions and developmental processes cannot adequately explain the function of anxiety. Although anxiety is recognised as a defensive state aiding survival by increasing the individual's readiness to deal with a range of risks, a whole range of secondary hypotheses follow from further evolutionary exploration. Nesse's 'smoke detector principle'[2,3] utilises specific evolutionary observations that, when the cost of activation of defences is trivial, (even when the risk is absent) but there is a massive cost of defence failure (if a risk is present and lethal), multiple false alarms will be allowed, which may then be misclassified as illness.

Conventional views consider genes as providing root biological causes of many traits, whereas evolutionary approaches examine fundamental questions regarding the pressures that led to the selection of these genes in terms of environmental influences over evolutionary history, as well as the developmental causes during the individual's lifetime (gene × environment interactions).

'Differential susceptibility'[4] describes trade-offs resulting in diverse phenotypic outcomes that arise from gene × environment interactions and epigenetic effects. Hence, the less-sensitive individuals thrive regardless of the quality of their early physical or emotional environment, whereas the highly sensitive individuals do worse when the circumstances are harsh, but do exceptionally well in propitious environments. Thus, the predisposition to environmental sensitivity will be selected for despite their harmful effects under adverse circumstances. This is consistent with Bowlby's attachment theory,[5] which, based on evolutionary understanding of human behaviours, was one of the major contributions to developmental psychology that permits a deeper understanding of the source of suffering and distress.

The brain should not be considered apart from the rest of the body or its environment. Psychoneuroendocrinoimmunology describes the bidirectional links between the brain, endocrine and immune systems. Human brains, nervous systems and bodies have co-evolved with a range of micro-organisms, particularly the gut microbiome. These evolutionary insights open up whole new areas of research into psychiatric disorders.

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Although the potential contribution of evolutionary biology to psychiatry remains underappreciated by some psychiatrists,[1,2] growing interest in the field is reflected by the increasing number of psychiatrists joining the Evolutionary Psychiatry Special Interest Group of the Royal College of Psychiatrists in the UK. Biological and human sciences are frequently guided by the Neo-Darwinian evolutionary framework, and evolutionary psychology and anthropology departments are established worldwide. Any new curriculum should take these developments into account. As new evolutionary techniques and knowledge progress at an unprecedented pace, it is now imperative to include these into psychiatric training. This includes relevant studies of not only developmental factors, but also the evolution of human nervous system specialisation and functioning, along with psychiatric genetic research examining questions of the ultimate causation of mental disorders.

Such an evolutionary framework has the ability to integrate many different schools of psychiatry, from biological psychiatry to the psychotherapies. For example, the universal capacity for low mood is now understandable as an adaptation shaped by natural selection. Low mood is thus activated under foreseeable conditions, such as loss, setbacks or failures that signal threats to the attainment of vital biosocial goals. Low mood is then conceptualised as the result of a number of diverse causal processes having direct relevance to treatment. These include:[2]

(a) Mood regulation mechanism is functioning normally and low mood is adaptive in this instance.
(b) Mood regulation mechanism is functioning normally, but low mood is maladaptive in this instance, e.g. as a result of mismatch (see Box 1).
(c) Mood regulation mechanism threshold is abnormal and low mood is either excessive or deficient (harmful dysfunction model).
(d) Depression arises as a by-product of other biological processes, e.g. inflammation or starvation.

Box 1 Evolutionary causes for vulnerability to disease and disorder

Mismatch
Life history factors
Overactive defence mechanisms
Co-evolutionary considerations: consequences of the arms race against pathogens
Constraints imposed by evolutionary history
Trade-offs
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
Extremes of adaptations

Evolution provides the basis for asking new questions about the nature of mental disorder

Neglecting evolutionary processes may lead to conceptual errors in understanding the nature of health, disease and individual variation. For example, equating statistical deviance with psychopathology ignores the basic biological fact that individual variation lies at the core of evolutionary processes, and thereby illuminates many diverse features of psychiatric conditions.[3]

In contrast to the 'syndromal' approach of the DSM/ICD classification systems and the 'bottom-up' biological approach of the Research Domain Criteria, evolutionary approaches are 'top-down' systems that make explicit theoretical assumptions. They utilise high-level organising principles derived from evolutionary insights regarding the adaptive significance of various brain systems. Evolutionary approaches can help resolve a range of issues that beset current psychiatric classification systems, including explaining patterns of comorbidity, addressing heterogeneity within diagnostic categories, bridging psychopathology with individual differences and accounting for developmental features of mental disorders, including life-course trajectories.[3]

Some of the benefits of evolutionary thinking are as follows:[2]

- asking new questions about why evolution has left us all vulnerable to mental disorders;
- providing a way to think clearly about development and the ways that early experiences influence later characteristics;
- providing a foundation for understanding emotions and their regulation;
- providing a foundation for a scientific diagnostic system;
- providing a framework for incorporating multiple causal factors that explain why some people get mental disorders and others do not.

Evolution resolves many conundrums as to why and how disease and disorder exist or persist, considering a range of scenarios where mental distress arises from otherwise functional systems. Consequently, the evolutionary taxonomy of treatable (undesirable) mental health conditions goes beyond harmful dysfunctions.[3] It also provides a framework for exploration of sex differences in vulnerability to disorder, which is much needed in psychiatry, as many disorders affect men and women differently. Evolutionary concepts are already influencing clinical thinking in oncology and around antibiotic resistance. It is time to place relevant evolutionary approaches within psychiatry.

Evolution is a fundamental basic science for psychiatry and medicine

The recent Delphi study[6] on medical training identified the most relevant evolutionary concepts and principles. Accordingly, we propose that psychiatric trainees acquire the following basic evolutionary competences:

(a) recognising how natural and sexual selection processes shape adaptations (physical and psychological traits);
(b) understanding of the utility of Tinbergen's four causes and assimilating evolutionary causal processes for the persistence of disease and disorder (Box 1);
(c) utilising the basics of evolutionary genetics, including selection, mutation, drift, intra-genomic conflict and genomic imprinting;
(d) comprehending the concepts of kin selection and inclusive fitness, as well as other models;
(e) understanding the basic concepts of evolutionary behavioural ecology.

The organisation of large amounts of underpinning information into a smaller network of key ideas and core principles can help students and trainees understand the significance of and interrelationships among the seemingly disparate array of information. The evolutionary model we propose promotes this, teaching that a wide variety of strategies are adaptive over evolutionary time scales. Hence, whether a genetic tendency is adaptive or not depends on the environment, and traits such as fearlessness and extreme caution may both be adaptive in different environmental niches.

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Evolution's trademark contribution is that it identifies the mistake of automatically equating distress with disease and disorder. This encourages clinicians to consider the possible consequences of treating potentially adaptive states of defence activation in individual patients. Although not treatments in themselves, evolutionary ideas have applications in our everyday clinical contacts. For example, introducing patients with anxiety and panic disorders to the evolutionary concept of the smoke detector principle (see above) or the harm-avoidance model of obsessive–compulsive disorder. In addition, evolutionary thinking can illuminate and inform public health strategies for reducing epidemics such as depression, suicide and drug misuse. Understanding the evolutionary mechanisms behind our unique universal human vulnerabilities enables a depth of understanding and empathy that will enhance the insights of future generations of psychiatrists increasing their effectiveness and providing new research strategies, while simultaneously reducing stigma, shame and blame.

Some of the terms used in this editorial may be unfamiliar, but the value and relevance of these evolutionary processes for understanding behaviour has become indispensable. Terms can be explored further in the Evolutionary Psychiatry Special Interest Group Glossary (https://www.rcpsych.ac.uk/docs/default-source/members/sigs/evolutionary-psychiatry-epsig/evolutionary-psychiatry-glossary-2.pdf?sfvrsn=707dd6b_2).

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