Research Psychologists' Roles in the Genetic Revolution

Hill Goldsmith, Morton Ann Gernsbacher, John Crabbe, Geraldine Dawson, Irving I. Gottesman, John Hewitt, Matt McGue, Nancy Pedersen, Robert Plomin, Richard Rose, James Swanson

Contents

Goldsmith et al. on Patenaude et al. 318
Kéri on Patenaude et al. 319
Patenaude et al. reply 319

DOI: 10.1037/0003-066X.58.4.318

Research Psychologists' Roles in the Genetic Revolution

Hill Goldsmith and
Morton Ann Gernsbacher
University of Wisconsin—Madison

John Crabbe
Veterans Affairs Medical Center, Portland, Oregon

Geraldine Dawson
University of Washington Autism Center

Irving I. Gottesman
University of Minnesota, Twin Cities Campus, and University of Virginia

John Hewitt
University of Colorado at Boulder

Matt McGue
University of Minnesota, Twin Cities Campus

Nancy Pedersen
Karolinska Institutet

Robert Plomin
King's College London

Richard Rose
Indiana University Bloomington

James Swanson
University of California, Irvine

As psychologists involved in genetic research, we write to broaden the perspective of the important article in this journal by Patenaude, Guttmacher, and Collins (April 2002), "Genetic Testing and Psychology: New Roles, New Responsibilities." Patenaude et al. explained new roles for counselors and therapists in helping clients deal with genetic information given advances in understanding genetic liability for many disorders. They also envisioned roles for psychologists in understanding individuals' perception of genetic risk and in studying ethical aspects of genetic testing. We agree that psychologists have much to contribute in these areas. In treating research issues, Patenaude et al. briefly noted that psychologists may also play a role in psychiatric genetics, particularly in "the careful elucidation of diagnostic criteria in studies seeking clues to the genetic underpinnings of mental disorders" (p. 275). Indeed, the phenotyping problem is crucial in both human and animal genetics, and psychologists have much to contribute to this issue. These contributions apply not only to psychiatric diagnoses but also to a range of medical disorders with behavioral involvement and to normal-range behavioral dimensions that at the extremes may be considered by some as disorder. As phenotypic and endophenotypic assessments become more sophisticated than simple diagnoses, that is, as phenotyping for genetic studies of complex disorders becomes increasingly quantitative, multivariate, developmentally sensitive, and neuroscience oriented, psychologists' skills will be in even more demand. Already, psychologists have led the way in finding linkages and using association data for some phenotypes, such as reading disability and attention-deficit disorder in humans, and for the molecular genetic analysis of alcohol-related traits in mice. For some complex mental disorders, it is becoming increasingly clear that susceptibility genes affect continuously distributed traits and that the definition of such traits depends on a sophisticated understanding of the neuroscience of behavior. Psychologists should be critical to this endeavor.

Moreover, research psychologists already are extensively involved in many facets of genetic research beyond phenotyping. Several of us are involved in genetic research, including genome scans, linkage and association studies, work with transgenic and knockout mice, microarray technology, many types of quantitative genetic studies, and genetic counseling for psychological disorders. Our psychology graduate students study molecular genetics and genomics, as well as molecular and systems neuroscience. In doing so, they are preparing to follow traditions of psychologists' contributions to genetic research dating back to selective breeding of rats for behavioral traits in the 1930s. The future of molecular genetic research lies in going beyond locating and identifying genes to learning how genes work, the field of functional genomics. Although functional genomics is usually viewed in terms of the bottom-up strategy of molecular biology that begins with understanding the protein products of genes (proteomics), a top-down psychological level of analysis that considers the behavior of the whole organism might also pay off both scientifically and clinically. Among the issues that can be addressed with a top-down approach are how genetic effects interact and correlate with experience, how genes contribute to change and continuity in development, and how genetic effects contribute to comorbidity between disorders and heterogeneity within disorders. If involvement in these areas of research seems out of character to nonpsychologists, we simply note that today's research psychologist may well also self-identify as a neuroscientist, as a statistician, or even as a geneticist. Old disciplinary boundaries have changed considerably.

In summary, the role of research psychologists is to understand mind, brain, and behavior, and research psychologists have the responsibility to learn those concepts and use those tools that allow them to best play this role, including modern genetics and genomics. Perhaps recognizing this, the American Psychological Association has recently convened a Working Group on Genetic Research Issues to explore ways for psychological scientists to be active participants in the genetics revolution.

REFERENCE

Patenaude, A. F., Guttmacher, A. E., & Collins, F. S. (2002). Genetic testing and psychology: New roles, new responsibilities. *American Psychologist, 57,* 271–282.

Vol. 58, No. 4, 318–320

Correspondence concerning this comment should be addressed to Hill Goldsmith, Department of Psychology, University of Wisconsin—Madison, 1202 West Johnson Street, Madison, WI 53706. E-mail: hhgoldsm@wiscmail.wisc.edu

DOI: 10.1037/0003-066X.58.4.319a

Genetics, Psychology, and Determinism

Szabolcs Kéri
University of Szeged and Karolinska Institute

In their interesting contribution, Patenaude, Guttmacher, and Collins (April 2002) overviewed the potential effects of genetic revolution on the everyday practice of health care professionals, with a special reference to the role of clinical psychologists. This article raises a related and important issue, namely, that adequate interventions may provide some benefit for individuals with genetic predispositions for mental disorders to cope with vulnerability and possibly help reduce the risk of the development of serious psychopathology. However, I think the concretization of such interventions is premature, and several scientific, ethical, and practical issues must be clarified.

Although a large amount of information has accumulated during the past years about the genetic bases of human behavior, many critical questions remain to be answered. The first is how specific genetic patterns relate to the complex and flexible patterns of human behavior. Cloninger (1994) claimed a revolutionary yet oversimplified concept of novelty seeking, reward dependence, and harm avoidance as basic elements of personality, which provided a psychologically and neurobiologically testable framework. Despite a promising beginning, genetic studies based on this framework remain conflicting and nonconclusive. A similar problem seems to be critical in relation to genetic studies for several psychiatric disorders, including schizophrenia, mood disorders, and substance abuse, even when one tries to investigate these complex disorders at the level of more elementary phenotypes such as working memory, decision making, theory of mind, or even Cloninger's traits. The main conclusion can be that normal and pathological human behavior is influenced by multiple genes with individually small and poorly understood effects and undetermined interactions (Weinberger et al., 2001). Human personality is an extremely complex construct with biological, interpersonal, and cultural foundations. At this time, it is unclear how genetic factors contribute to the biological foundations of personality, not to mention the unknown interaction of gene effects with interpersonal and cultural influences.

For example, recent studies seemed to reveal a strong and specific genetic background for suicide behavior (see, e.g., Du, Faludi, Palkovits, Bakish, & Hrdina, 2001). Now, it turns out that these genetic mechanisms may be related to impulsivity rather then suicidality itself, which is associated with limited coping strategies and consequent self-destructive tendencies. In Hungary, the suicide rate is markedly high, which recently promoted extensive preventive efforts (Rihmer, 2001). One may hypothesize that some genetic relatedness stands behind this phenomenon. However, if one considers a simplified view that a geographically circumscribed population is characterized by a specific genetic pattern and that this pattern results in a certain collective personality constellation and attitude, during decades and centuries this will manifest itself in the cultural microuniverse, including social norms, arts, religion, and politics. These traditions also transfer from generation to generation through learning and identification, interacting with the biological substrate. Consider an example, which is intentionally simplified to illustrate some relevant features. The Hungarian national anthem is often considered to be a nationwide manifestation of pessimism and latent self-destructive tendencies. Although this point of view can be criticized, the national anthem is perhaps the most well-known artistic work in the population as a traditional and historical representative of many generations' attitudes, beliefs, feelings, and desires. Recently, it has been shown that the imagination of the text of the national anthem activates brain regions closely related to emotional processing (Gulyas, 2001). Neurochemical mechanisms in related brain areas, at the same time, are regulated by genetic factors. For example, a specific variant of an enzyme is related to decreased working memory capacity, which may limit the flexibility of effective problem solving and coping, further increasing the risk of hopelessness and self-destruction (Weinberger et al., 2001). Despite these mechanisms, the cultural microuniverse clearly represents many compensatory mechanisms that may act against disadvantageous biological traits, and in turn, adaptive personality traits may compensate for potentially destructive environmental factors. Indeed, although biological evolution is a slow process, cultural evolution shows a rapid pace with which it can adapt to changing circumstances, paradoxically often creating new frameworks that exceed the natural capacity of biologically determined foundations.

The complexity of the question can be seen from the above-described considerations. It is apparent that targeted psychological preventions for genetically vulnerable populations require a better understanding of gene–behavior–culture relationships. In addition, the potential risk of a disorder developing as a probabilistic effect of multiple genes must be clearly defined, together with well-established and empirically tested preventive methods. Without these, psychological intervention for genetically vulnerable individuals is at risk of becoming a source of limited personal autonomy, determinism, and stigmatization.

REFERENCES

Cloninger, C. R. (1994). Temperament and personality. *Current Opinion in Neurobiology, 4,* 266–273.

Du, L., Faludi, G., Palkovits, M., Bakish, D., & Hrdina, P. D. (2001). Serotonergic genes and suicidality. *Crisis, 22,* 54–60.

Gulyas, B. (2001). Neural networks for internal reading and visual imagery of reading: A PET study. *Brain Research Bulletin, 54,* 319–328.

Patenaude, A. F., Guttmacher, A. E., & Collins, F. S. (2002). Genetic testing and psychology: New roles, new responsibilities. *American Psychologist, 57,* 271–282.

Rihmer, Z. (2001). Can better recognition and treatment of depression reduce suicide rates? A brief review. *European Psychiatry, 16,* 406–409.

Weinberger, D. R., Egan, M. F., Bertolino, A., Callicott, J. H., Mattay, V. S., Lipska, B. K., et al. (2001). Prefrontal neurons and the genetics of schizophrenia. *Biological Psychiatry, 50,* 825–844.

Correspondence concerning this comment should be addressed to Szabolcs Kéri, Department of Clinical Neuroscience, Psychiatry Section, Karolinska Institute, Stockholm 17176, Sweden. E-mail: szkeri@phys.szote.u-szeged.hu

DOI: 10.1037/0003-066X.58.4.319b

Psychologists' Contributions to the Genetic Revolution

Andrea Farkas Patenaude
Dana-Farber Cancer Institute

Alan E. Guttmacher and Francis S. Collins
National Human Genome Research Institute

We are delighted with the thoughtful and informative responses of Goldsmith et al. (2003, this issue) and Kéri (2003, this issue) to our article, "Genetic Testing and Psychology: New Roles, New Responsibilities" (Patenaude, Guttmacher, & Collins, April 2002). Both comments enlarge the discussion of the important roles psychologists will continue