Introduction to the Special Issue on Genes and Education

Elena L. Grigorenko and Robert Plomin

An agenda of sharing the specialized knowledge that has rapidly accumulated in the fields of genetics and genomics with a broader range of professionals working in psychology, education, and educational psychology has been the focus of many activities of the International Mind, Brain, and Education Society (IMBES). This special issue is one of the many outcomes of that agenda. In this brief introduction, we share our thoughts on why such an agenda is important and briefly point out the contribution of each of the issue's articles to the fulfillment of this agenda.

First, this agenda is important in a time of translational research, that is, research that attempts to link the frontiers of life science with the everyday practice of medical, educational, and social-work professionals. Although most attention in scientific journals and in mass media discussion is given to medical translational sciences, the link between genetic research and the noisy and chaotic environment of the classroom is no less important. Thus, just as medical professionals consume modern knowledge coming out of academic research environments, educational professionals are interested in consuming relevant knowledge and translating it into their everyday practices.

Second, this agenda is critical to avoiding the buildup of misinformation. When specialized knowledge is not systematically translated to lay consumers in an organized fashion, misconceptions often arise, and nowhere is this more the case than in the field of genetics. We are thankful to the editors of *Mind, Brain, and Behavior* for providing us with an opportunity to be part of such a systematic educational campaign as the one being led by the IMBES.

Third, as the field of genetics unfolds and grows into a family of *-omics* (*genomics*: structural and functional studies of the entire human genome; *transcriptomics*: studies of the transcribed portions of the human genome; *proteomics*: studies of proteins generated by the transciptome; *neuronomics*: the dynamic system of actions of the genes expressed and proteins functioning in the brain; and *phenomics*: complex behaviors controlled, at least partially, by the genome), it is important for educational audiences not only to appreciate the horizons of the modern science but also to understand its limitations and the complex ethical issues surrounding modern scientific discoveries.

Fourth, as various genomic tests enter the reality of everyday life, it is possible that, in the near future, parents might attempt to use the results of these tests to understand the complex genetic foundations of individual differences between children and to argue, as they are meant to do, for the best match between educational practices and the genetic profiles of their children. It is important for the community of educators at least to be ready for such an interaction with informed (or misinformed) parents.

In sum, the IMBES agenda to promote and support understanding of the latest findings in the *-omics* sciences rests on philosophical, educational, and practical considerations and is a conscientious effort to enhance the two-way street of communication between practitioners and scientists, just as prescribed by the movement of translational science.

The five articles forming this special issue, individually and collectively, contribute to the educational mission of the IMBES. The issue opens with a contribution from Stephen Petrill and Laura Justice, who provide a concise and informed summary of the traditional and modern links between behavioral (or quantitative) and molecular genetics and education. The subsequent contribution, by Gerd Schulte-Körne, Kerstin Ludwig, Jennifer el Sharkawy, Markus Nöthen, Bertram Müller-Myhsok, and Per Hoffmann, exemplifies the general discourse delivered in the previous article by focusing on studies of reading abilities and disabilities, drawing a thread from classical to modern studies of both, stressing the importance of capitalization on psychological theories of abilities and achievement, explaining the relevance of neuroscience studies of reading, and discussing potential applications of quantitative and molecular genetic studies of reading ability and disability for education. The excitement within the field captured in the article by Gerd Schulte-Körne and his colleagues is dampened, at least a bit, by the contribution from Claire Haworth, Emma Meaburn, Nicole Harlaar, and Robert Plomin. While sharing the general appreciation of the findings in the field of genetics of reading and reading disabilities, these researchers remind the field of how far we are from true understanding of the genetic texture of reading and how much work there is yet to do to twine together small contributions of multiple genes in understanding this texture. The complex nature of the issues the field is currently

dealing with is further illustrated by the article from Erik Willcutt, Rebecca Betjemann, Bruce Pennington, Richard Olson, John DeFries, and Sally Wadsworth. These researchers remind us that childhood developmental disorders often co-occur, and the authors discuss the presentation and etiology of this co-occurrence using reading disabilities and attention-deficit/hyperactivity disorder as examples. This idea of copresentation of multiple deficits is further developed in the article by Elena Grigorenko. This contribution revisits a number of themes discussed in other articles of the issue (e.g., specificity and generalizability of genetic mechanisms, the role of replication in genetic sciences); offers a discussion of causality in the context of links among genetics, psychology, and education; and underlines the important roles of psychology and educational practices in the formation of questions for genetic studies.

It is our firm belief that educators and education policy makers are the ultimate end users of scientific research, including genetic research. It is also our firm belief that lively and dynamic classroom environments are the best source of questions that need to be studied by researchers. Translational science assumes a two-directional movement between the questions of essence to educators/practitioners and the latest discoveries in the life sciences. The IMBES attempt to facilitate such a movement, exemplified in this issue, is one more stone laid in the construction of such a two-way street.