

THE HEREDITY HOAX

Challenging Flawed Genetic Theories of
Human Development



EDITED BY RICHARD M. LERNER AND GARY GREENBERG

“Genetics enjoy a high profile today in the minds of the intelligentsia and lay public alike. Fresh genetic results are often announced in newspapers with fanfare and draw immediate attention. No doubt they are “sexy,” and, undeniably, we are in part products of our inheritance – our nature. However, only in part, and the ultimate story genetic reductionism tells always turns out to be more nuanced and complex than originally touted. Vigilant academics who follow the literature have come to understand that precious few heralded genetic findings survive follow-up scrutiny or replication. Where’s the pushback? Well, here. In *The Heredity Hoax*, Richard Lerner and Gary Greenberg crystallize conceptual and methodological shortcomings of genetic reductionism in their own words as they expose problematic implications of genetic reductionist ideas for policy, programs, and social justice. Moreover, they skillfully marshal the words of proponents and critics to buttress their contentions. But, you ask, what perspective is left to supplant or, at least, supplement the genetic project? Lerner and Greenberg do not leave you in the lurch, but are persuasive that relational developmental systems – the coaction of nature and nurture – offer a more rational, productive, and optimistic framework for understanding human development. Want to be an intelligent consumer of the scientific literature in this grand debate of the 21st century? *The Heredity Hoax* is where to start.”

—**Marc H. Bornstein**, *President Emeritus, Society for Research in Child Development;*
Editor, Parenting: Science and Practice

“In this magnificent and timely volume Richard Lerner and Gary Greenberg have brought together a collection of chapters by the world’s leading authorities that address the fatal misconceptions of classical genetic accounts of human development. Just as quantum theory has upended our classical view of the physical world, the various chapters in this volume systematically challenge and replace the determinist view of genetic heritability with a dynamic Relational Developmental Systems metatheoretical framework that revolutionizes our understanding of human development and its potential. This reframing of the dynamic nature of the relations between genetics and development has profound and potentially positive implications for our approaches to education, parenting and broader issues of social justice.”

—**Larry Nucci**, *Professor, Graduate School of Education, University of California Berkeley*

“*The Heredity Hoax* is an important collection that battles genetic determinism on multiple fronts. Curated by two field leaders who have devoted their careers to this fight, this collection dismantles fallacies of simplistic reductionism in ethology, evolutionary biology, behavior genetics, and sociobiology. Not content with critique, Professors Lerner and Greenberg bring together perspectives to build a real and rigorous alternative framework that analyzes behavior as an emergent property of dynamic, relational, bio-social systems of organismal development. Connecting this new paradigm to policy frameworks, they show how bio-social science can take part in the optimistic cultivation of human flourishing and greater equality. This guide will be essential reading for newcomers to this field as well as experienced experts.”

—**Aaron Panofsky**, *Professor, UCLA Institute for Society and Genetics, Public Policy,*
and Sociology; Director, Institute for Society and Genetics



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THE HEREDITY HOAX

This innovative and thought-provoking book integrates both new, authored material and reprints of existing literature that, together, provide a compelling narrative that reveals the fatally flawed science associated with genetic reductionist accounts of human behavior and development.

Through an interdisciplinary lens, it illuminates the dynamic nature of human development, empowering readers to question established notions, and embrace the complexity of our potential. Across the book, the work of top-tier scientists, from developmental, comparative, educational, and biological science illuminates theory and research converging on the conclusion that the multiple egregiously flawed work of genetic reductionists should be expunged from research pertinent to human development. The book challenges the prevailing reductionist narratives and their application to social policies, programs, and uses in media. Theoretically based and empirically rigorous, this multidisciplinary approach to human development will shine a light on the inequities in individuals or groups that suggest that specific genes do not enable them to succeed in life.

The Heredity Hoax invites graduate programs and advanced undergraduate courses on human development, human potential, epigenetics, and more to delve into the intricate interplay between genes, environment, and personal growth. This book will also serve as an unimpeachable source of evidence for researchers, educators, and social policymakers.

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THE HEREDITY HOAX

CHALLENGING FLAWED
GENETIC THEORIES OF HUMAN
DEVELOPMENT

Edited by
RICHARD M. LERNER AND GARY GREENBERG

Designed cover image: Shutter2U via Getty Images

First published 2025

by Routledge

605 Third Avenue, New York, NY 10158

and by Routledge

4 Park Square, Milton Park, Abingdon, Oxon, OX14 4RN

Routledge is an imprint of the Taylor & Francis Group, an informa business

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ISBN: 9781032702933 (hbk)

ISBN: 9781032699578 (pbk)

ISBN: 9781032702988 (ebk)

DOI: [10.4324/9781032702988](https://doi.org/10.4324/9781032702988)

Typeset in Minion Pro

by KnowledgeWorks Global Ltd.

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PREFACE

At some point in the middle of the first decade of the 21st century, we began to talk with each other about the fact that genetic reductionist accounts of behavior and development continued to appear in prominent journals in several fields of study within psychology – for instance, cognitive, comparative, developmental, personality, and social – and within allied fields, such as economics, education, and sociology. Although there were several different instances of genetic reductionist ideas appearing in journals (behavioral genetics, sociobiology, evolutionary psychology, and evolutionary developmental psychology), all formulations “boil down to” (or “reduce to,” if we wish to be ironic instead of colloquial) one basic claim: The genes inherited by a person at the moment of conception provide an unmodifiable *blueprint* for life, behavior, and development across the life span.

In addition to this counterfactual assertion, the ideas of genetic reductionists were problematically complicated by media translations of these claims. These translations were presented in newspaper and magazine articles, television and radio stories, and in the then newly burgeoning online news and social network platforms. The information associated with genetic reductionism pertained to human behaviors, skills, and experiences as varied as intellectual abilities, parenting, sexuality, childbearing, morality, character, religiosity, personality attributes, temperament, educational attainment, criminality, experiencing rape, male infidelity, having children out-of-wedlock, living in poverty, or even the proclivity to watch television.

In none of the genetic reductionist papers gaining peer-reviewed publication was there any specification of the specific gene or genes purported to cause these behaviors or experiences, and there was never any evidence of how the possession of these unidentified genes participated in a developmental process from conception to behavioral enactments or contextual experiences. In turn, in the public dissemination of this information it was a relative rarity to find reports of the conceptual and methodological criticism by scientists with a broad range of expertise pertinent to the claims of genetic reductionists. These critiques of genetic reductionist publications were presented by, in particular:

1. Cell biologists, geneticists, epigeneticists, evolutionary biologists, paleontologists, physical and evolutionary anthropologists, and mammologists (e.g., Lester Aronson, American Museum of Natural History; Sir Patrick Bateson, University of Cambridge and President of the Zoological Society of London; Steve Cole, University of California, Los Angeles; Marcus Feldman, Stanford University; Stephen Jay Gould, Harvard University; Mae-Wan Ho, Institute of Science and Society, London; Ruth Hubbard, Harvard University; Eva Jablonka, Massachusetts Institute of

Technology and Tel Aviv University; Donald Johanson, Arizona State University; Evelyn Fox Keller, Massachusetts Institute of Technology; Richard Lewontin, Harvard University; Owen Lovejoy, Kent State University; Benno Müller-Hill, University of Cologne; Denis Nobel, University of Oxford; T. C. Schneirla, American Museum of Natural History; and Ethel Tobach, American Museum of Natural History); and

2. Scholars from the physical sciences, mathematics, and economics who have provided incontrovertible logical, mathematical, and statistical proofs that the data generated from the research, and the interpretations derived from these data, by genetic reductionists were egregiously and irreconcilably flawed (e.g., P. W. Anderson, Bell Laboratories; Arthur Goldberger, University of Wisconsin; Nobel Laureate James Heckman, University of Chicago; David Layzer, Harvard University; Peter C. M. Molenaar, Penn State University; and Peter S. Saunders, King's College London).

Yet, the critiques continued to be largely ignored by genetic reductionists and the media continued to disseminate counterfactual information to the public. And we continued to be perplexed about how and why bad science continued to have a foothold in scientific journals and public dissemination.

By 2008, we concluded that the storylines told by genetic reductionists – whether labeling themselves as behavior geneticists, sociobiologists, evolutionary psychologists, or evolutionary developmental psychologists – and by segments of “the media” amounted to perpetrating a hoax in both science and society. We believed that the continuation of the hoax could eventuate in the weight of bad science compromising opportunities for engaging in good science and, as well, wreaking havoc on public policies and programs that sought a scientifically credible evidence base for a host of educational, physical and mental health, and social initiatives that could improve the lives of all youth, families, and communities.

We wondered what we could do to address the misinformation involved in the heredity hoax and thereby contribute something to preventing or at least diminishing the chances of bad science being used to create policies and programs. Being academics, it is certainly not surprising that we came up with the idea of producing a book, one that would be entitled “The Heredity Hoax.”

Our next step was to decide what sort of book we would produce. Would it be a trade book, a co-authored scholarly book, an edited book that contained chapters written by some of the experts we have noted above, or a book of reprinted examples of the best science we knew of to counter the false claims and flawed methods of genetic reductionists? We started and then stopped several instances of all of these pathways forward because none of them seemed to be the right choice for us. Pauses between these attempted paths forward were occasionally short, but many were fairly long.

Time passed. One of us retired from his professorial position. We both grew old ...

Then, merely 15 years after we had the initial ideas for *The Heredity Hoax*, we finally – in 2023 – hit upon a path that seemed right. It was a hybrid path, one that combined several of the paths we had considered: first, we could build on our past writings¹ about the significant and substantial conceptual and methodological problems with all of the above-noted instantiations of genetic reductionism. This task alone represented challenges because, in combination across the careers of both of us, our past writing extends more than 100 years! We nevertheless sought to extract from what we had written ideas that could be meshed with our present understanding of the shortcomings of all versions of genetic reductionism. Second, we could include in the book reprints of curated articles that reflect some of the best scientific work countering all of the instantiations of genetic reductionism that have been prominent across both the 20th century and now, the first quarter of the 21st century.

This two-pronged approach is what readers will encounter in *The Heredity Hoax: Promoting Social Justice Through Eliminating Genetic Reductionism from Science*. The presence of the two prongs of

contributions to this book illustrates that the scholarship we present is substantially beyond the work of your two editors. In addition, this book exists because of the efforts of both students and colleagues. As we will illustrate, some of the individuals who started to work with us when they were in the first group became distinguished members of the second one by the time we undertook completing the book that readers of this preface are now encountering.

For instance, in 2008, when we began to first work on this project, we called upon three new doctoral students (working in the lab of RML) to help us generate all the articles we could find that we thought pertinent to our goals: Kristina Callina, Megan Mueller, and Christopher Napolitano. Because this effort occurred before Google Scholar or other major scholarly search engines existed, the work involved in this process was quite formidable. Today, Drs. Callina, Mueller, and Napolitano are successful scholars. At this writing they are, respectively, co-leading a research and evaluation consulting organization in the Greater Boston area, working as a professor in the Cummings School of Veterinary Medicine at Tufts University, and working as a professor in the Department of Educational Psychology of the College of Education at the University of Illinois, Urbana-Champaign. We are grateful for the great start they gave us in working on this book, and we hope that it will be helpful as they continue to pursue their scholarly career.

As we were completing the book, additional doctoral students (again in the lab of RML) provided significant assistance. Margaret Mackin and Kirsten Olander provided careful reference checking, making certain that anything cited in the text of a portion of the book appeared correctly in the accompanying References and, in turn, checking that any citation appearing in the Reference list was cited within the text. Natasha Keces reviewed every word on every line of the entire manuscript and made certain that there were no substantive or grammatical oddities present in the manuscript and that the publication style of the publisher was assiduously followed. If there remain any shortcomings in the book after these stellar students made these contributions to the manuscript, the fault lies with us and not with these early career scholars. We are in their debt.

We are in debt as well to many other people. Most significantly, we acknowledge our debt to the scholars who advised us about the content of this book, many of whom were also generous in allowing us to include their work in the sections of the book. We express our gratitude to these scientists, whose collective contributions to addressing the shortcomings of genetic reductionism operationalize the enactment of good science that advances scholarship and contributes to the use of science to optimize social justice and equity in the development of all people. These scholars include Mark S. Blumberg, Marc H. Bornstein, Pamela Cantor, Steve W. Cole, Mary Helen Immordino-Yang, Jay Joseph, Michael E. Lamb, Jacqueline V. Lerner, Robert Lickliter, George M. Michel, David S. Moore, David Osher, Willis F. Overton, Douglass Walsten, and David Witherington.

We also want to recognize the extraordinary contributions made by Jarrett M. Lerner, the Managing Editor at the Institute for Applied Research in Youth Development at Tufts University. His editorial acumen, knowledge, wisdom, and skills in addressing effectively and with excellence the challenges of undertaking and completing the sort of hybrid book we have produced are incomparable. We cannot imagine completing this work without his expert editorial assistance. We are deeply grateful to him. We are also grateful to our editor at Taylor and Francis, Molly Selby, and to her Editorial Assistant, Shivranjani Singh. Their support, guidance, and collaboration were essential contributions to this book, from its inception to its completion. We appreciate enormously all that they have done.

In recounting the long history but short past of this book, two people stood with us throughout the long projects, that is, our wives Jacqueline V. Lerner and Patricia Greenberg, respectively. Fifteen years is a very long time to continue to hear that one's spouse continues to try to complete a project. Their unflagging support and generosity of spirit were essential to keep us moving forward. We owe them endless thanks.

A final note of thanks is due to the person whose intellectual abilities and leadership, integrity, and commitment to social justice provided a model of scholarly excellence for both of us while, at the same time, being a generous mentor, motivator, and friend. She was the person who brought us together and catalyzed a friendship and collaboration between us that has spanned, at this writing, almost half a century: Ethel Tobach, the late Curator *Emerita* of the American Museum of Natural History. With gratitude and love, we dedicate this book to her.

RML
Medford, MA

GG
Chicago, IL
February, 2024

Note

1. For instance, see [Lerner \(1976, 1986, 1992, 2002, 2015, 2018, 2021\)](#) and [Greenberg \(1981, 1982, 2004, 2006, 2011, 2013, 2015; Greenberg & Partridge, 2010\)](#).

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SECTION I

FRAMING THE CHOICE

The Pseudo-evidence and pessimism of genetic reductions vs. the evidence and optimism derived from research framed by dynamic, relational development systems-based concepts



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EDITORS' INTRODUCTION

Developmental science seeks to *describe* (depict or represent), *explain* (account for), and *optimize* (maximize the probability of health and thriving) changes within an individual (*intraindividual change*) and of differences between people (*interindividual differences*) *across the life span* (Baltes et al., 1977; Lerner, 2018). However, what sorts of changes characterize an individual as he or she develops across the lifespan? Where do these changes come from? Do all of these changes pertain to the development of the person? Questions such as these are inevitably involved in all theoretical ideas about human development (Lerner, 2018; Raeff, 2016).

All scientific theories are derived from specific instances of philosophies. Philosophy has two general areas of concern: *Ontology*, or philosophical statements about what exists; and philosophical conceptions of how what exists can be known, or *epistemology*. *Paradigms* are philosophical ideas that combine ideas about what exists with ideas about how the things that exist can be known (Kuhn, 1962, 1970).

Paradigms are similar to what philosopher Stephen Pepper (1942) termed *world views*, that is conceptions that involve both ontological and epistemological statements and can be understood by considering what Pepper termed *root metaphors*. These metaphors are analogies that are used to illuminate the basic ideas that are involved in a specific worldview of paradigm.

An example that pertains to the major scientific paradigm across the past three centuries is the root metaphor of a *machine*. In what is typically referred to as the *mechanistic paradigm* (e.g., Overton, 2015; Overton & Reese, 1973; Reese & Overton, 1970), the ontological statement is that the natural world exists as a machine and a scientist can know how the world (the machine) works by understanding each of the parts of the machine and then additively combining this knowledge.

For instance, a car is a machine, and to understand the “nature” of a car, a researcher would need to discover how and when the parts of the car (the carburetor, the engine, the transmission, the battery, etc.) are known and then this knowledge is put together, the attributes of the car are revealed. Similarly, if a human can be ontologically regarded as machine-like, then the epistemological route to fully understanding what it means to be such a machine would be to reduce the whole – the human – to the parts comprising the human. The pursuit of such knowledge might start with understanding the different functions of the machine, that is, respiration, circulation, digestion, reproduction, sensory and motor functioning, etc.

However, what explains these functions? The epistemology ruling the mechanistic paradigm would lead a scientist to then *reduce* each function to organs, then to tissues, then to cells, and finally to the

chemicals comprising the cell and to the physical laws governing the combination of the chemicals. Ultimately, then, the mechanistic paradigm would see that at their root, each human is a machine that can be known by the laws of chemistry and physics. As well, all living creatures could be treated as machines that are knowable by reducing these structure and function to chemistry and physics and, as well, inanimate objects that exist in the natural world are also at their root composed of chemicals that function in accordance with the physical laws of the universe. As such, all science can be reduced to the same constituent phenomena, and these phenomena can be known by reducing the complexity of humans, or all flora and fauna, and in fact all of what exists in the universe to the laws of chemistry and physics.

One more philosophical tool is needed to move from the ideas within a paradigm to a scientifically useful (i.e., an empirically useful) set of ideas that can be productively used for research and discovery. This idea is termed a *metatheory*, which is a theory about theories (Lerner, 2018; Overton, 2015). A scientific metatheory is derived from a paradigm, and it is simply a set of ideas that define the components of a theory that would be consistent with a specific paradigm. A theory in science is a set of statements that integrates existing observations (empirically established “facts”) and leads to the generation of additional facts.

In science, a theory is not something that is judged as either true or false. It is judged in regard to its empirical usefulness. Some criteria for determining usefulness are precision, scope, and deployability. Theories are more precise when they can integrate more specific findings and generate hypotheses that can predict more specific findings than other theories. Theories have greater scope when they can integrate more areas of research pertinent to a topic than is the case for other theories. Theories have great deployability when they can be used to explain observations with less use of additional ideas or assumptions than is the case with other theories (this criterion may be understood as a version of Occam’s razor, which is the idea that explanations that are constructed with the smallest set of elements are better explanations; this idea is also known as the law of parsimony).

Many different theories can be derived from a paradigm. However, a metatheory of a paradigm indicates what ideas any theory associated with a specific paradigm must include or exclude. The metatheory for a mechanistic paradigm specifies that any theory derived from it should specify the machine-like nature of the to-be-explained entity that exists and then must specify the basic elements of explanation that need to be invoked to explain the entity. That is, what are the *essential* components of the machine, the foundational components that build all superordinate structures and functions of the parts of the machine?

In the example, we have noted that chemistry and physics are the essential elements to which the human machine could be reduced. Whereas mechanistically oriented scientists who study human behavior and development would not deny the ultimate importance of this level of reduction, less molecular referents have often been used in different theories. Examples are reduction to the elements of classically conditioned or operantly conditioned stimulus-response relations (e.g., Bijou & Baer, 1961; Skinner, 1938) or reduction to the genes received at conception (e.g., Buss, 2019; Dawkins, 1976; Plomin, 2018; Rushton, 2000).

Mechanistic Ideas in the Study of Human Development

Ideas associated with the mechanistic paradigm have been used to derive scientific theories and methods that have resulted in important advances in knowledge and useful translations of this knowledge into

applications that have contributed positively to advances in human health and well-being. Of course, there are also well-known instances of scientific ideas and their applications being misused in regard to human welfare (e.g., Carmack et al., 2008; Clarke, 2021; Elliott, 2017; Rabuy, 2014).

Arguably, however, the major instance of the enactment of bad science and of its translation into applications to policies, social programs, and even discriminatory (or even worse) actions toward millions of human has occurred in regard to ideas, research, and actions taken on the basis of claims about the role of genes in human behavior and development (Gould, 1976; Greenberg, 2015; Hirsch, 1981; Lerner, 1992; Lifton, 1986; Moore, 2002, 2015b; Müller-Hill, 1988; Panofsky, 2014; Proctor, 1988).

Several different genetic reductionist conceptions of human behavior and development have been forwarded. Prominent examples that, at this writing, continue to be used to provide mechanistic accounts of human behavior and development include Behavior Genetics (e.g., Harden, 2021; Plomin, 2018), Sociobiology (e.g., Dawkins, 1976; Wilson, 1975; Wilson & Wilson, 2007), Evolutionary Psychology (Buss, 2019; Buss & von Hippel, 2018), and Evolutionary Developmental Psychology (e.g., Bjorklund, 2015, 2016; Bjorklund & Ellis, 2005).

The first of the two goals of this book is to critically discuss genetic reductionist models of the role of genes in humans' lives. All of these models have a common set of problems: (1) Overinterpretation of empirical findings, that is, making claims about the meaning or significance of their findings that go beyond what the data actually indicate; (2) Misinterpretation of empirical findings, that is, asserting that the data they present have one meaning (e.g., that provides evidence that differences between people on a score from a measure or analysis indicate that heredity has largely or wholly been a cause of the score or the results of an analysis when the sort of scoring they used or analysis they conducted cannot be used to determine causality); (3) Making claims about the role of genes that are counterfactual, that is, asserting that genes work in a specific way that, if true, would indicate that heredity plays the most significant role in one, some, or all of human behavior and development when, in fact, genes do not function as portrayed by the statements of genetic reductionists; and (4) Applying overinterpreted, misinterpreted, and counterfactual statements to policies and programs that affect education, training, health, reproductive rights, human rights, equity and social justice, and even the very lives of some people.

Together, these problems with genetic reductionist accounts of human behavior and development create egregious misconceptions about scientific facts about heredity and, specifically, of how genes play a part in our lives from conception through death (Moore, 2002, 2015a, 2015b). This misinformation has a pernicious effect on both science and society and, as such, is why we have entitled this book *The Heredity Hoax*. Our interest in countering the misinformation and mischief associated with the problems of genetic reductionism rationalizes the second goal of this book, which is challenging flawed genetic theories of human development (as reflected in the book's subtitle).

Science is a community endeavor. One instance of the role of the scientific community is represented by the standard of peer review. Scientific work cannot become archival knowledge until peers have evaluated the scholarly products of scientists. Such review makes science self-correcting and its knowledge cumulative across time and place. However, another instance of the community nature of science is to strive to supersede the faults and problems with a given approach to science with a better approach. This transcendence involves the second goal of this book. The scholarship that we present in this book to challenge models of genetic reductionism is associated with a metatheory derived from a different scientific paradigm. We discuss this paradigm and metatheory in the next section.

Concepts from Dynamic, Relational Developmental Systems (RDS) Metatheory

There are more things in heaven and earth, Horatio,
Than are dreamt of in your philosophy.

(Shakespeare, 1604/1605, *Hamlet*, Act 1,
Scene 5, Lines 167–168)

Over the course of the first quarter of the 21st century, the scholarly field that has been termed *developmental science* (e.g., Bornstein & Lamb, 2015) experienced a shift in the philosophy of science framing discourse (e.g., Overton, 2006, 2010, 2015). Increasingly, dynamic systems ideas have emerged as a focal lens for understanding human development across the life course (e.g., Cantor et al., 2021; Lerner, 2018; Mascolo & Bidell, 2020; Witherington & Lickliter, 2016). This emergence has been coupled with the broad rejection of ideas using reductionist notions in theoretical models of intraindividual change pathways across the life span.

Instead, theoretical models of human development have emerged to reflect the interest in the dynamic, that is, mutually influential, relations within an open, living system. These individual $\leftrightarrow$ context relations have been conceptualized as the basic process of human development. A dynamic metatheory, termed relational developmental systems (RDS), and the *process-relational* paradigm within which it is embedded have emerged within this scholarly context (Lerner, 2018, 2021; Lerner & Lerner, 2019; Overton, 2015).

Paradigm, Metatheory, and Epistemology in Human Development

We have explained that a metatheory is an ontological statement derived from a superordinate paradigm, that is, a metatheory specifies the concepts that must be included in any theory reflecting the paradigm of origin. By implication of what must exist within the ontological parameters of a specific metatheory (e.g., human behavior and development are composed of *dynamic* – that is, *mutually influential* – *coactions* across time and place among all variables for all levels of being, biological through sociocultural, existing within a system of relations constituting the ecology of human life), a metatheory also indicates what concepts cannot exist in a theory derived from the metatheory (e.g., a structurally or functionally meaningful construct that is not related to, for instance, or moderate in its action with, any other construct cannot be a part of a dynamic, relational system).

A concrete example of this point can be found in regard to the concept of a *gene*. Within a mechanistic metatheory, a biological construct such as a gene or a set of genes may be used to account for energizing and directing the function of the machine or, in the characterization used by Dawkins (1976) of a human, of the Lumbering Robot. In this account reduction to the specific gene or specific set of genes located within the robot could explain its behavior and, critically, the direction it takes to reproduce itself in future robots. In turn, within a metamodel that emphasized that dynamic coactions among constructs within the systems comprising an individual, a gene is no more or no less a part of the system than any other construct existing in the system. Within such a metamodel, a gene or a set of genes functions *only* through moderation by other facets of the system. As such, to understand the structure and function of the system, reductionism is eschewed as counterfactual, and dynamic relations within the coacting system must be studied.

This example provides a transition to a focus on the dynamic, relational development systems (RDS) metamodel and its place within a paradigm focused on dynamic systems (von Bertalanffy, 1933, 1968) and on the relations within such systems. As explained by Overton (2015), a burgeoning interest

in dynamic, relational processes in human development has resulted in the emergence of a *dynamic, relational process paradigm*. This paradigm has superseded paradigms focusing either on mechanist and reductionist concepts or on organismic concepts (e.g., the fixed stages of development, Erikson, 1950, 1959; Freud, 1923, 1954; Kohlberg, 1978; Piaget, 1970); these latter concepts did not adequately treat the dynamics of coactions with time and place in creating intraindividual change or interindividual differences in intraindividual change, that is, changes that instantiate the potential specificity of each person's history of individual $\leftrightarrow$ context relations (Molenaar, 2004; Molenaar & Nesselroade, 2014, 2015; Rose, 2016). As discussed by von Bertalanffy (1933, 1968), a system is a complex, open organization of coacting variables that are also coacting with their contexts, which of course includes all other variables within the system. These coactions enable qualitatively new features of the system to emerge across time and place, and, therefore, the dynamics of the system create its continual evolution (e.g., Jablonka & Lamb, 2005) of agentic and autopoietic feedback processes.

Thus, the ideas in this paradigm focus on process (systematic changes in the developmental system), becoming (moving from potential to actuality; a developmental process with a past, present, and future; Whitehead, 1929/1978), holism (the meanings of entities and events derive from the temporally and ecologically textured context in which they are embedded; Bronfenbrenner & Morris, 2006; Cantor et al., 2021; Elder et al., 2015), and relational analysis (assessment of mutually influential relations in the developmental system). In sum, in this dynamic, relational process paradigm, the human is seen as inherently active, self-creating, self-organizing (autopoietic), self-regulating (agentic), nonlinear and complex, adaptive, and at least relatively plastic; that is, the person possesses the potential for systematic change through dynamic coactions with the context (Overton, 2015).

RDS metatheory includes ideas from this paradigm. Because of holism, RDS metatheory emphasizes the integration of different levels of organization, including biology, physiology, culture, physical ecology, and history, as involved in creating human life, behavior, and development over the life span (Lerner, 2018; Overton, 2015). In addition, because of the individual's agency, and in the service of adapting to the specific features of the specific settings within which the individual lives and develops, the individual acts on the world that is acting on the individual. Therefore, *each* person's life is structured by the experience of specific mutually influential coactions between levels of organization within the dynamic developmental system. These coactions vary across place (e.g., community, country, or culture) and across time (Bronfenbrenner & Morris, 2006; Elder, 1998; Elder et al., 2015). Because no two people, even monozygotic twins, experience the same system of individual $\leftrightarrow$ context coactions across ontogeny, the singularity, the specificity, of each human, is assured. As Rose (2016) puts it, each of us walks the road less traveled.

The "arrow of time," or temporality, is history, which is the broadest level within the ecology of human development. History imbues all other levels with change. Such change may be stochastic (e.g., nonnormative life or nonnormative historical events; Baltes et al., 2006) or systematic (e.g., history- or age-graded changes). The potential for systematic change constitutes a potential for *relative* plasticity (i.e., for malleability, the potential for systematic change in structure or function; Lerner, 1984, 2018) across the life course for individuals, families, and the broader ecology of human development. Such plasticity is regarded as a fundamental strength of humans.

Plasticity provides a basis for optimism that the course of development for all individuals may be enhanced (Lerner, 1984, 2018). If there is plasticity in every individual's developmental pathway, then policies and programs can be aimed at capitalizing on this plasticity to decrease social, educational, economic, and health disparities and to enhance the quality of life of all individuals. This implication of dynamic, RDS-based ideas enables developmental scientists to view with optimism the possibility of

promoting individual $\Leftrightarrow$ context relations that engender positive development, that is, a developmental pathway wherein an individual possessing positive attributes may strive to contribute in beneficial ways positively to the physical and social world that at the same time is supporting the well-being of the individual. Because there is plasticity in human development, there can also therefore be an intentionality around promoting social justice (Lerner & Overton, 2008).

However, in order to enhance the chances that this implication of RDS metatheory is instantiated through evidence derived from theoretically predicated research, it is important to be more specific about the concepts within RDS metatheory that should be used to frame theoretical models of human development. At the beginning of this section of the book, we noted that there are key questions that may be asked about human development, such as: What sorts of changes characterize an individual as he or she develops across the life span? Where do these changes come from? Do all of these changes pertain to the development of the person? Theories of development using ideas from RDS metatheory have specific answers to such questions.

Essentially, RDS metatheory-based ideas or, more simply, (for ease of exposition) RDS-based ideas, involve the view that human beings are active rather than passive and that humans are part of an integrated system of relations involving the individual and the ecology (the context) of human development; and it is this system of relations that is the source of the course of development across life (Raeff, 2016; Witherington & Lickliter, 2016). The integrated (relational) developmental system provides the necessary and sufficient conditions to account for the structure and function of development across the life course. As such, humans are self-constructors of their development; they are *autopoietic* (Lerner, 1982, 1984, 2012; Lerner & Busch-Rossnagel, 1981; Lerner & Callina, 2014; Lerner & Walls, 1999; Overton, 2015; Witherington & Lickliter, 2016).

RDS-based ideas therefore also emphasize that the world around the developing person – both the physical and the social ecology of human life – is active and changing. According to all RDS-based models of human development (see Overton & Molenaar, 2015, for examples), the basic process of development involves, then, the integration or fusion of actions within the relational development systems (Tobach & Greenberg, 1984). Specifically, then, in RDS-based models, there is an integration of variables across all levels of organization within the system; this integration involves (a) the actions of people in and on their world, and (b) the actions of the world on people. We use a bidirectional arrow – $\Leftrightarrow$ – to represent these integrative and mutually influential relations. Integrated actions shape the quality and course of human behavioral, psychological, social, and cultural structure and function across the life span (Brandtstädter, 1998, 1999; Brandtstädter & Lerner, 1999; Lerner & Busch-Rossnagel, 1981; Mascolo & Fischer, 2015; Raeff, 2016; Witherington & Lickliter, 2016).

Sources of Action in Human Development

But, where do the actions that propel human development come from? Consistent with its conceptualization of the character of human life – of focusing on the integration of levels of organization (Aronson, 1984) – RDS-based ideas emphasize that the source of the actions involved in human development is derived from the mutually influential relations within the relational developmental system, for instance, between the individual and his or her context, represented as individual $\Leftrightarrow$ context relations.

These dynamic (mutually influential) changes may involve both quantitative and qualitative changes in the processes of development. For instance, processes involved with a person's perceptual, motivational, or cognitive development undergo changes in kind or type (quality), and in amount, frequency, magnitude, or duration (quantity). This conception of change does not deny that there are some aspects

of a person that remain the same throughout life; rather, it asserts that human development is a synthesis between processes that promote change and processes that promote constancy (Brim & Kagan, 1980; Lerner, 1985; Overton, 2015).

In other words, due to the integration of the organizational levels of human life, ranging from biology, through the individual and social relationships, to the community, institutional, cultural, and historical, RDS-based models indicate that the laws that govern the functioning of both constancy and change are relational ones; they pertain to processes of interrelated relations across all levels of organization within the developmental system. No one level, and no one variable within a level (e.g., genes), is privileged as the key to these integrated relations (Noble, 2015). *The process of development, therefore, cannot be reduced to one level or variable.* This rejection of reductionism, and more specifically, of genetic reductionism, is the key difference between models derived from RDS and genetic reductionist models associated with human development (e.g., behavioral genetics, sociobiology, or evolutionary developmental psychology).

An Overview of the Contributions to This Section

In the two selections included in this section of the book, the implications of this key difference between dynamic, RDS-based models of human development and genetic reductionist models are discussed in greater details. Lerner and Greenberg discuss implication for both the conduct of science and, as well, implications of the application of science to social policies and programs, both in formal and informal educational settings, and in regard to opportunities to live in a socially just and democratic world wherein there are equitable resources available for health, personal fulfillment, and family and community well-being on a habitable and safe planet.

In turn, Greenberg discusses the fallacies and failures of genetic reductionism. He provides an historical review of lessons learned, and this discussion illuminates why the heredity hoax has worked against the positive implications of RDS-based science discussed by Lerner and Greenberg. He offers ideas about dynamic RDS-based science which can counter the pernicious impact of counterfactual genetic-reductionist claims and, as such, demonstrates the wisdom in Kurt Lewin's famous statement, that there is nothing so practical as a good theory.

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Behavioral Epigenetics

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Rejecting Genetic Reductionism and Embracing Relationism and the Complexity of Dynamic Systems

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