

INDEX

- academic achievement, 8. *See also* heritability
of academic achievement; intellectual disabilities; learning disorders (LD); literacy; noncognitive factors in gene-environment transactions; numeracy; reading-based SLD
genetic information in education
and, 322–23
home learning and classroom environment
and, 203–05
noncognitive factors in, 136–39
as politically and socially charged issue, 309
quantitative genetics and, 206–10
socio-economic status and, 203, 211
- acute stress response, 8
adaptive values of vs. maladaptive effects, 87
cortisol as measurement of, 87–88
different types of stress and, 89
DNA methylation and, 92–97
early childhood policies and programs
and, 99–100
ethical considerations for, 99
health outcomes from maternal stress
during pregnancy, 89–91
low socio economic status (SES) and, 88–89
need for future research on, 97–99
stress physiology, 87–88
- adoptees
search for biological parents and genetic identity and, 16–18
- adoption studies
design of, 25–27
estimates of concordance and heritability
and, 28
on reading ability and disability, 164
- American College of Medical Genetics, 297
- animal studies, 315
on learning and memory in
Drosophila melanogaster, 310–11
on maternal stress, 93–94
- anticipatory guidance
defined, 195
- Aristotle, 20
- Armstrong, Thomas, 367–69
- Army Beta Test, 22
- Asbury, K., 211, 217
- Attention Deficit/Hyperactivity Disorder (ADHD)
learning disabilities and, 167
- autism spectrum disorder (ASD), 213
defined, 29
in Diagnostic and Statistical Manual for Mental Health Disorders, 34–35
educationally related maladaptive behaviors
in, 191
as example of heritability, 29–34
gene-environment correlations and, 35–36
heritability estimates of, 29, 36
increase in prevalence of, 35
looping and, 36–37
next generation whole-genome sequencing
study of, 59
polygenic transmission of, 29
relative recurrence risk (RRR) and, 36
twin studies on, 35
twin studies on (Hallmayer study), 29–34
variability in criteria and methods for diagnosis, 34–35
- Babies by Design, The Ethics of Genetic Choice* (Green), 359
- Battelle Memorial Institute, 284

- behavioral genetic approaches. *See* quantitative genetics
- behavioral phenotypes and intellectual disabilities, 183–84. *See also* intellectual disabilities; quantitative genetics
- anticipatory guidance for special education teachers and, 195
- behavioral phenotypes defined, 184
- cognitive-linguistic functioning in Down syndrome, 188–89
- educationally related maladaptive behaviors in, 191
- etiology-related interventions and, 193–94
- influence on educational practices and, 187, 196
- knowledge about as leading to appropriate referrals, 194
- knowledge about as predicting later interpersonal or individual problems, 194–95
- multiple behavioral and non-behavioral domains that change over development and, 186–87
- parental interactions with the school system and, 192
- personality and vulnerability in Williams syndrome, 189–91
- special education teachers lack of knowledge about, 192–93
- total specificity and partial specificity and, 185
- within-syndrome variability and, 185–86
- Berkeley (University of California)
attempt of to introduce genetic testing into college curriculum, 243, 258, 259
- Bettelheim, Bruno, 37
- California Autism Twins Study, 32
- Cattell, R.B., 137
- cerebrodiversity, 369–71
cautionary message on, 371
- Charcot-Marie-Tooth syndrome, 52
- China
commercial genetic testing in, 300
- Chinese initiative for identifying DNA prodigies, 107–08
- prematurity of, 125
- chromatin modifications, 92
- CLIA. *See* Clinical Laboratory Improvement Amendments of 1988 (CLIA)
- clinical epigenetics, 8, 87, 91–92, 329
- chromatin modifications, 92
- DNA methylation and, 92–97
- early childhood policies and programs and, 99–100
- evidence of influence of early maternal care in animals on, 93–94
- evidence of influence of early maternal care in humans on, 94–97
- need for future research on, 97–99
- Clinical Laboratory Improvement Amendments of 1988 (CLIA), 243
- regulations of on DTCGT, 258–59
- CNN, 107–08, 125
- cognitive development, 8
- Cohen, Eric, 15
- Collins, Francis, 67
- commercial genetics industry, 10, 284, 301–2.
See also DTCGT
- in China, 300
- commercial genetic testing, 288–90
- comparison of services in, 294–95
- data-driven business models
post-HGP, 286–88
- DTC whole genome sequencing, 295–96
- effect of financial crisis of 2008 on, 296
- genetic ancestry testing (GAT) and, 291
- governmental scrutiny of, 297–300
- health information and, 292–94
- nutritional genomics and, 292
- outside of U.S., 300–01
- common disease / rare variant (CDRV)
hypothesis, 53
- computers in classroom instruction, 212
- concordance
defined, 21
- four aspects of, 28
- consent, 321
child consent in genetic and genomic research, 266–68
- genetic literacy and, 10
- informed consent laws, 7, 248–50
- copy number variants (CNVs), 51–52, 59
in genome-wide association studies, 55–56
- cortisol, in acute stress response, 87–88
- creativity, heritability of, 337
- Cystic Fibrosis, 288
- Darwin, Charles, 20
- Decade of the Brain, 1
- Designer Baby Era, 374–75, 378
- developmental origins of health and disease (DOHaD) hypothesis, 90

- Diagnostic and Statistical Manual for Mental Health Disorders (DSM-V, APA, 2013)
- autism diagnosis and, 34–35
 - differential sensitivity intervention research, 264
 - direct-to-consumer (DTC) genotyping
 - industry. *See* commercial genetics industry; DTCGT
 - direct-to-consumer genetic/genomic testing. *See* DTCGT
 - disabilities, 8. *See also* intellectual disabilities; learning disabilities
 - DNA, 15, 45–47. *See also* molecular genetics
 - chromatin modifications, 92
 - clinical epigenetics and, 91–92
 - copy number variants (CNVs) and, 51–52, 55–56, 59
 - DNA methylation and, 92–97
 - DNA sequencing, 57–59, 66
 - gene expression studies, 56–57
 - next-generation whole-exome sequencing (WES), 58–59
 - Polymerase Chain Reaction (PCR), 285
 - structural genetic variants and, 50–51
 - DNA sequencing
 - direct to consumer whole genome sequencing, 295–96
 - next-generation whole-genome sequencing (WGS) and, 58–59
 - Down syndrome, 69, 212
 - age of mothers of and effect of on parental-school interactions, 192
 - cognitive-linguistic functioning in, 188–89
 - educational interventions based on knowledge of genetic etiologies, 193
 - special education teachers lack of knowledge about, 192
 - Drosophila melanogaster*
 - studies on learning and memory and, 310–11
 - DTCGT, 2–4, 290–91. *See also* commercial genetics industry
 - CLIA regulations on, 258–59
 - comparisons of services in, 294–95
 - effect of financial crisis of 2008 on, 296
 - FDA regulations on, 252–58
 - genetic ancestry testing (GAT) and, 291
 - genetic identity and inheritance and, 18–19
 - governmental scrutiny of, 9, 297–300
 - health information and, 292–94
 - nutritional genomics and, 292
 - whole genome sequencing and, 295–96
 - Dutch Hunger Winter, 94
 - Dweck, C.S., 147
 - dyslexia, 311
 - cerebrodiversity and, 369–71
 - educational decision-making, 10, 63. *See also* genetic information in education; genetic testing in school; personalization of education along genetic lines
 - risks of using DNA in, 68
 - Einstein, Albert, 373
 - electrophysiological measures, of intelligence, 114–15
 - ethics, 8, 9, 10, 16, 211, 212
 - child consent in genetic and genomic research, 266–68
 - on Chinese initiative to identify DNA prodigies, 107
 - data storage of genetic information and, 268–69
 - determining when to disclose genetic information to guardians, 272–73
 - of disclosing genetic risk to parents, 269–71
 - of genetic information in education, 212–15, 309
 - genetic testing as restraining autonomy through potential stigma and low expectations, 319–20
 - guardian permission and genetic literacy in genetic and genomic research, 265–67
 - Human Genome Project and, 6
 - justice of access to genetic testing and services, 317–19
 - OGOD model and, 213
 - privacy issues and rights and, 320–21
 - protection of children's rights and privacy in longitudinal studies and, 267–68
 - of public dissemination of genetic research findings, 275–76
 - question of untested students and, 320
 - race and social justice in genetic research, 273–75
 - race and social justice in genetic testing under IDEA, 251–52
 - of reproductive-genetic technologies, 352–58
 - right not to know results of genetic tests and genetic risk, 271–72
 - sociobehavioral, 273
 - U.S. Presidential Commission for the Study of Bioethical Issues, 375
 - executive function, 117–18
 - defined, 117
 - heritability estimates for intelligence and, 117–18

- expectations and educational outcomes
 - expectancies defined, 148
 - experiment on high and low expectations and, 214–15
 - experience-producing drive theory (EPD), 137–38
 - Eyal, G., 36
 - Family Educational Rights and Privacy Act (FERPA), 320, 321
 - family studies
 - on autism spectrum disorders, 36
 - familial transmission of characteristics of intellectual functioning, 109
 - on intellectual disabilities, 110
 - financial crisis of 2008
 - effect on commercial genetics industry, 296
 - Fisher, Ronald, 20
 - Florida Twin Project on Reading, 208
 - Food and Drug Administrations (FDA)
 - FDA regulations on DTCGT and, 252–58
 - fragile X syndrome, 212
 - educational interventions based on knowledge of genetic etiologies, 193
 - educationally related maladaptive behaviors in, 191
 - shyness in carrier mothers and parental-school interactions, 191
 - special education teachers lack of knowledge about, 193
 - fruit fly. *See Drosophila melanogaster*
 - Galton, Sir Francis, 22, 37, 108
 - gene association studies, 54–55, 57, 110
 - gene expression studies, 56–57
 - gene x environment interactions (GxE), 76–80, 210
 - defined, 73, 76
 - GeneEd (Genetics, Education, Discovery), 59
 - gene-environment correlations, 36, 210.
 - See also* noncognitive factors in gene-environment transactions
 - autism spectrum disorder and, 35–36
 - defined, 209
 - heritability estimates for intelligence and, 112–13
 - teacher's perspective on, 328–32
 - transactional models of, 134–36
 - within the family environment, 263
- Generalist Genes Hypothesis, 64
 - genetic ancestry testing (GAT), 291
 - genetic and genomic education, 59, 227–28, 229, 230, 231. *See also* genetic and genomic literacy
 - Mendelian genetics, 310
 - online resources for, 59
 - genetic and genomic literacy, 9, 221–22, 310, 319. *See also* genetic and genomic education
 - definitions of, 223, 266
 - future directions for research in, 231–35
 - guardian permission for genetic research participation and, 265–67
 - informed consent practices and, 10
 - literacy skills and print and oral communication of genetic information, 228–30
 - numeracy and communication of medical risk, 230–31
 - public knowledge on, 224–28
 - race and ethnicity and, 225
 - Rapid Estimate of Adult Literacy in Genetics (REAL-G) measure of, 229
 - teacher's need to have, 345
 - genetic and genomic research
 - actions critical for successful translation of into everyday human practice, 1
 - cautions in public dissemination of, 275–76
 - child consent and, 266–68
 - genetic literacy and guardian permission and, 265–67
 - limitations of applying to real world behavior, 314–16
 - methodological developments in, 66–67
 - Missing Heritability Paradox in, 65
 - protection of children's right and privacy in longitudinal studies and, 267–68
 - race and social justice and, 273–75
 - genetic data storage, ethics of, 268–69
 - genetic engineering
 - four steppingstones for plan for, 375–78
 - genetic identity and inheritance, 15–16
 - adoptees search for biological parents and, 16–18
 - Darwin and Mendel and, 20
 - direct-to-consumer genetic testing and, 18–19
 - Pythagoras and Aristotle and, 20
 - genetic information in education, 4–6, 9, 10, 309–10. *See also* genetic testing in schools; personalization of education along genetic lines

- academic achievement and, 322–23
- benefit of earlier identification of disabilities and, 312–13
- benefit of earlier identification of learning styles and, 313–14
- benefit of reduced special education spending through earlier identification of disabilities, 313
- debate on adequacy of current standards for protection of, 321
- DTCGT and, 2–4
- early childhood policies and programs and, 99–100
- environmental factors as modulating impact of, 315, 322
- ethics of, 212–15
- guiding principles for, 215–18
- heritability estimates for academic achievement and, 2
- justice of access to genetic testing and services, 317–19
- lack of cost effectiveness of, 322
- lack of studies on, 2
- limitations of applying research on real world behavior, 314–16
- negatives of, 212–15
- positives of, 210–12, 312–14
- privacy issues and rights in, 320–21
- responsible approach to probable inevitability of use of, 2, 67–68, 327
- restraint of autonomy through potential stigma and low expectations, 319–20
- teacher misconceptions about, 327
- Genetic Information Nondiscrimination Act of 2008 (GINA), 7, 320
- genetic inheritance
 - transmission of, 48
- genetic risk ratios, 109
 - as behavioral data based, 109
- genetic testing, 57
 - Chinese initiative for identifying DNA prodigies, 107–08, 125
 - commercial genetic testing, 288–90
 - study on public knowledge and attitudes toward, 19
- genetic testing in schools, 9, 10. *See also*
 - genetic information in education;
 - personalization of education along genetic lines
- CLIA regulations on DTCGT and, 258–59
- constitutional concerns and, 244–48
- FDA regulations on DTCGT and, 252–58
- Individuals with Disabilities Education Act (IDEA) and, 250–52
- informed consent laws and, 248–50
- justice issues in access to and services provided due to, 317–19
- privacy issues and rights in, 320–21
- question of untested students and, 320
- racial disparities in, 251–52
- restraint of autonomy through potential stigma and low expectations, 319–20
- state law and, 244
- UC Berkeley's attempt to introduce into college curriculum, 243, 258, 259
- genetic variations, 48–49
- genetics, defined, 326
- genome association studies
 - CNVs in genome-wide association studies, 55–56
 - genome-wide association studies (GWAS) and, 55
- genome-wide association studies (GWAS), 55, 66, 311
 - learning disabilities and, 170
- genome-wide complex trait analysis (GCTA), 210
- genomic health literacy
 - defined, 223
- genomics, defined, 1, 326
- genotype-environment correlations (r_{GE}), 73–76, 80
 - defined, 73
- g -factor, 111, 116, 117, 118
- Goldsmith, L., 18
- golem effect, 72
- governmental scrutiny, of commercial genetics industry, 297–300
- Green, Ronald, 359
- grit, 138
 - defined, 145
- GxE. *See* gene x environment interactions (GxE)
- Hacking, Ian, 36
- Hallmayer study on autism spectrum disorder, 29–34
- Hayes, B., 137, 138
- health decision-making, 9, 223, 227, 228, 229
 - health literacy and, 223
 - numeracy and, 230
- Health Insurance Portability and Accountability Act (HIPAA), 320

- health literacy, 226
 defined, 223
 future directions for research in, 231–35
 literacy skills and print and oral
 communication of genetic
 information, 228–30
 numeracy and communication of medical
 risk and, 230–31
 Rapid Estimate of Adult Literacy in
 Medicine test and, 228
- height, as example of heritability, 28–29
- heritability, 8. *See also* adoption studies;
 heritability of academic achievement;
 heritability estimates; heritability
 estimates for intelligence; quantitative
 studies; twin studies
- autism spectrum disorder as example
 of, 29–34
 of creativity, 337
 defined, 21, 108, 206
 four aspects of, 28
 height as example of, 28–29
 of IQ, 111, 119–25
 $P = A + C + E$ model of, 21
 of reading-based SLD, 164
- heritability estimates
 for academic achievement, 2
 of academic achievement in low-income
 areas, 211
 of autism spectrum disorder, 29, 36
 as behavioral data based, 109
 for intellectual disabilities, 109
 for intelligence, 109
- heritability estimates for intelligence.
See also intellectual disabilities;
 intelligence; IQ
 changes in across the life span, 112
 Chinese initiative for identifying DNA
 prodigies and, 107–08, 125
 covariance with indicators of academic
 achievement and, 118–19
 differentiating between, 111–13
 gene-environment interactions
 in, 112–13
 information processing speed as indicator
 of, 116–17
 socio-economic status and, 113
- heritability of academic achievement, 2,
 8, 9, 206
 covariance with indicators of intelligence
 and, 118–19
 Generalist Genes Hypothesis and, 64
 implications for genetic information in
 education and, 2
 Missing Heritability Paradox and, 213
 relationships between environmental factors
 and, 63
 studies confirming, 63
 twin studies on, 71–72
- Human Genome Project (HGP), 1, 6, 57,
 263, 284
 data-driven business models and, 286–88
 ethical issues and, 6
 Sanger DNA sequencing and, 58
- human traits
 etiology of complex, 19–21
 Mendelian (simple) traits, 52
 Mendelian vs. common disorders
 and, 52–53
- Individualized Education Plan (IEP), 4, 312
- Individuals with Disabilities Education Act
 (IDEA), 4
 defined, 160
- Individuals with Disabilities Education
 Improvement Act (IDEIA), 4, 312, 313
- Inheritance* (Moalem), 325
- intellectual disabilities, 8. *See also* behavioral
 phenotypes and intellectual disabilities
 benefits of early detection through genetic
 testing, 312–13
 etiology of severe vs. mild, 110
 evidence of genome as major source of
 variations in individual, 110
 five common features of 300 monogenetic
 disorders of, 110
 heritability estimates for, 109
 One-Gene-One Disorder (OGOD)
 hypothesis and, 212
 question of etiological bases of individual
 differences in as distributed in general
 population, 110
 twin and sibling studies on, 110
- intelligence. *See also* heritability estimates for
 intelligence; intellectual disabilities; IQ
 electrophysiological measures of, 114–15
 etiology of, 107–08
 evidence of genome as major source of
 variations in individual, 110
 explanations for correlations among diverse
 cognitive abilities and, 111
 familial transmission of, 109
 g-factor as explanation for correlations
 among diverse cognitive abilities, 111

- heritability estimates for, 109
 - information processing speed as indicator of, 116–17
 - investment theory and, 137
 - lack of single assessment for measurement of, 111
 - lack of single definition of, 111
 - large number of assessments for measurement of, 111
 - question of etiological bases of individual differences in as distributed in general population, 110
 - relative risk statistics and, 109
 - twin studies and, 22
- International Longitudinal Twin Study, 208
- intervention responsivity studies, 116–17
- investment theory, 137
- IQ
 - experiment on high and low expectations and, 214–15
 - heritability of, 111, 119–25
 - IQ discrepancy model of reading-based SLD, 163
- Kanner, Leo, 37
- labeling, 215
- learning and memory
 - environmental variables in, 315
 - studies on *Drosophila melanogaster* (fruit fly) and, 310–11
- learning disabilities (LD), 8, 160, 311.
 - See also* specific learning disorder (SLD)
 - benefits of early detection through genetic testing, 312–13
 - One-Gene-One Disorder (OGOD) hypothesis and, 212
 - socio-economic status and, 168
- learning styles
 - benefits of early detection of through genetic testing, 313–14
- legal issues in genetic testing, 259
 - CLIA regulations on DTCGT and, 258–59
 - constitutional concerns and, 244–48
 - FDA regulations on DTCGT and, 252–58
 - Individuals with Disabilities Education Act (IDEA) and, 250–52
 - informed consent laws, 248–50
 - racial disparities and, 251–52
- Lesch-Nyhan syndrome, 185, 212
- linkage studies, 53–54, 57, 109
 - learning disabilities and, 170
 - linkage analysis defined, 53
- literacy
 - communication on genetic information and, 228–30
 - home learning and classroom environment and, 203–05
 - socio-economic status and, 210
- looping, autism spectrum disorder and, 36–37
- maternal stress
 - evidence in animals on early care's influence on, 93–94
- Mendel, Gregor, 20, 52–53, 58, 310
- Merriman, C., 22, 24
- Minnesota Study of Twins Reared Apart, 27
- Missing Heritability Paradox, 65, 213
 - defined, 213
- Moalem, Sharon, 325
- molecular genetics, 8. *See also* DNA
 - clinical epigenetics and, 91–92
 - copy number variants (CNVs) and, 51–52, 55–56
 - DNA and, 45–47
 - gene association studies, 54–55
 - gene expression studies and, 56–57
 - genetic variations and, 48–49
 - learning disabilities and, 170
 - reading disabilities and, 164
 - single nucleotide polymorphisms (SNPs) and, 49–50
 - structural genetic variants and, 50–51
- Mullis, Kary, 285
- National Human Genome Research Institute (NHGRI), 59, 223, 234, 291, 344, 359
- National Intelligence Test, 22
- National Longitudinal Transition Study, 183
- Navon, D., 36
- Netherlands Twin Registry, 207
- neurodiversity, 367–69
 - cautionary message on, 371
- Neurodiversity, Discovering the Extraordinary Gifts of Autism, ADHD, Dyslexia, and Other Brain Differences* (Armstrong), 367
- neuroscience, 1
 - educational neuroscience, 172
 - growth of, 1
- newborn screening, 67
- next-generation whole-genome sequencing (WGS), 58–59

- noncognitive factors in gene-environment transactions. *See also* gene-environment correlations
- academic interest and, 144
- achievement goal orientation and, 146–47
- Big Five personality traits and, 141–43
- criteria supporting academically relevant, 139–41
- defined, 134
- as driving force in academics, 136–39
- Expectancy-Value model and, 148–49
- experience-producing drive theory (EPD) and, 137–38
- future research suggestions for, 149–53
- grit and, 145
- intellectual interest and curiosity and, 143–44
- intelligence mindsets and, 147
- investment theory and, 137
- noncognitive skills defined, 8, 134
- self-control and, 146
- self-perceived ability and, 144–45
- summary of research on, 149, 151
- numeracy
- defined, 230
- genetic literacy and communication of medical risk, 230–31
- health decision-making and, 230
- home learning and classroom environment and, 203–05
- nutritional genomics, 292
- Olmstead v. United States*, 320
- One-Gene-One Disorder (OGOD)
- hypothesis, 212
- ethics of, 213
- Penrose, Lionel, 110
- personal genomics, 10
- personality
- Big Five personality traits, 141–43
- personalization of education along genetic lines, 2, 110, 338. *See also* genetic information in education; genetic testing in schools
- computers as method in, 211
- current impossibility of due to lack of current knowledge on, 64, 65, 67
- gene x environment interactions (GxE) and, 76–80
- genotype-environment correlations (rGE) and, 73–76, 80
- ideal scenario for and possible benefits of, 68–70
- personalized learning defined, 211
- potential problems with, 71–73
- question of possibility of, 63–68
- responsible approach to probable inevitability of, 67–68
- personalized medicine approach, 8
- to specific learning disorder, 160, 171–74
- Phonological Core Deficit Model, 162
- Phonological-Core Variable-Difference Model, 162
- Plomin, R., 211, 217
- Polymerase Chain Reaction (PCR), 285
- positive stress, 89. *See also* acute stress response
- poverty. *See* socio-economic status (SES)
- Prader-Willi syndrome, 69, 185
- educational interventions based on knowledge of genetic etiologies, 193
- educationally related maladaptive behaviors in, 191
- Precision Education approach, 8
- specific learning disorder (SLD) and, 160, 171–74
- Precision Medicine Initiative, 159
- privacy rights, 7, 10, 267–68, 320–21, 344
- debate on adequacy of current standards for educational records, 321
- Fact Sheet on, 321
- federal regulations protecting, 320
- Program for International Student Assessment (PISA), 70
- psychopathology, 191
- stress diathesis model of, 86
- Pygmalion effect, 72
- Pythagoras, 19
- quantitative genetics, 8, 19–21. *See also*
- behavioral phenotypes and intellectual disabilities
- academic achievement and, 206–10
- adoption studies design and, 25–27
- combination twin and adoption studies and, 27–28
- defined, 20, 206
- emergence of, 20
- $P = A + C + E$ model of, 21
- reading disabilities and, 164
- twin studies design and, 22–25
- Quintilian, 325

- race
 - racial disparities in genetic testing and special education, 251–52
 - social justice in genetic research and, 273–75
- Rapid Estimate of Adult Literacy in Genetics (REAL-G), 229
- Rapid Estimate of Adult Literacy in Medicine test, for health literacy, 228
- reading-based SLD
 - heritability of, 164
 - indicators of, 165–66
 - indicators of (brain-based risk), 168
 - indicators of (cognitive and cognitive-behavioral factors), 166–67
 - indicators of (environmental risks), 168
 - indicators of (family based risk), 168–70
 - indicators of (previous classroom performance), 167
 - indicators of (sex-differences in diagnosis), 166
 - indicators of (socio-economic status), 168
 - indicators of (specific gene variant risks), 170–71
- IQ discrepancy model of, 163
- limitations in proposed definitions of, 161–65
- Phonological Core Deficit Model and, 162
- Phonological-Core Variable-Difference Model and, 162
- Precision Education approach to, 171–74
- prevalence and negative consequences of, 161
- Response to Intervention (RTI) model and, 163–64
- twin and adoption studies on, 164
- refrigerator mother, 37
- regulations, 320
- relative recurrence risk (RRR), 36
- relative risk statistic, 109
- reproductive-genetic technologies, 352–58
- Response to Intervention (RTI), 163–64
- r*GE. *See* genotype-environment correlations (*r*GE)
- segregation analyses, 109
 - as behavioral data based, 109
- self-control
 - defined, 146
- self-fulfilling prophecies, 214, 215, 320, 326, 327
- Sherman, Gordon, 369–71
- single nucleotide polymorphisms (SNPs), 49–50, 66, 91, 210
- sleep deprivation, learning and, 315
- Smith-Magenis syndrome, 185
- socio-economic status (SES)
 - academic achievement and, 168, 203, 211
 - adverse health and developmental effects across lifespan from low SES, 88–89
 - heritability estimates for intelligence and, 113
 - learning disabilities and, 168
 - literacy and, 210
 - stress and, 86
- soft skills. *See* noncognitive factors
- special education
 - anticipatory guidance on etiology-relevant information for teachers and, 195
 - knowledge on etiology-related genetic conditions for targeted interventions and, 193–94
 - reduced spending through earlier identification of disabilities via genetic testing, 313
 - teachers lack of knowledge about behavioral phenotypes and intellectual disabilities, 192–93
- specific learning disorder (SLD).
 - See also* reading-based SLD; learning disabilities (LD)
 - vs. biomedical disease, 159–60
 - defined, 159
 - long-term consequences of, 160
 - Precision Education approach to, 171–74
- Stanford-Binet Test of Intelligence, 22
- stress. *See* acute stress response
- structural genetic variants, 50–51
- susceptibility theory, 264
- Theis, S.V.S., 22
- tolerable stress, 89. *See also* acute stress response
- toxic stress, 89, 97, 98. *See also* acute stress response
- traits. *See* human traits
- transactional models
 - of gene-environment correlations, 134–36
- twin studies, 332
 - on autism spectrum disorder (Hallmayer study), 29–34
 - California Autism Twins Study, 32
 - combined with adoption studies, 27–28
 - design of, 22–25
 - estimates of concordance and heritability, 28

twin studies (<i>cont.</i>)	values
on heritability of autism spectrum disorder, 35	defined, 148
on intellectual disabilities, 110	VCF syndrome, 191
intelligence and, 22, 113	
Minnesota Study of Twins Reared Apart, 27	Watson, Dr. John, 108
on reading ability and disability, 164	Western Reserve Reading and Math Project, 208
UK study on General Certificate of Secondary Education and, 71–72	whole-exome sequencing (WES), 58–59
Twins Early Development Study, 207, 208	Williams syndrome, 52, 69
	educational interventions
	based on knowledge of genetic etiologies, 193
U.S. Presidential Commission for the Study of Bioethical Issues, 375	personality and vulnerability in, 189–91