Genes, Environment, & Gene-Environment Interplay

The Future of Mental Health Treatment?

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 Biology of Mental Health
 Environmental Effects on Mental Health
 Gene-Environment Interplay
 Mental Health Treatment Implications

The Biology of Mental Health
Central Dogma of Molecular Biology

- DNA
- RNA
- Protein
- What is a gene?
Mutations


What causes changes in the DNA sequence?

- Spontaneous changes of bases
- Reactive metabolites
- Environmental chemicals
- UV radiation
- Recombination

Genetic mutations and dysfunctional cellular signaling play some role in the etiology of disorders
- Schizophrenia
- ADHD
- Mood disorders
- Anxiety disorders & PTSD

The genetic and signaling components of mental health often overlap, including multiple genes and signaling pathways.

Environmental Effects on Mental Health
Gene-Environment Interplay
What exactly is gene-environment interplay?

- Three categories (Brendgen et al., 2009; Rutter, Moffitt, & Caspi, 2006)
  - Interaction between specific genes and environment (GXE)
  - Epigenetics
  - Gene-environment correlations (rGE)
Gene-Environment Interactions

- Works via three mechanisms (Brendgen et al., 2009)
  - Diathesis-stress
  - Compensation
  - Control

- Evidence/Examples
  - Anxiety and depressive disorders (Petersen et al., 2012)
  - Schizophrenia (van Winkel et al., 2010)
Epigenetics

- DNA → RNA → Protein
- Regulations above the level of genetic code lead to alterations in gene expression
- Exposure to certain environments can change the regulation (Champagne & Mashoodh, 2009)

Epigenetics (Ctd)

1. Transcriptional Control
2. RNA Processing Control
3. RNA Transport & Localization Control
4. Translation Control
5. mRNA Degradation Control
6. Protein Activity Control
Gene-Environment Correlations (rGE)

Three types:
- Passive, Active, & Evocative (Rutter, Moffitt, & Caspi, 2006)
Different types of gene-environment interplay can occur at the same time.

Example

Peer acceptance/rejection and depressive behavior (Brendgen et al., 2009)
Resilience

- Genetics
- Environment
- Gene-environment interplay

http://cognitive-edge.com/blog/entry/5873/cynefin-strategy-building-resilience/
Implications for Counseling/Mental Health Treatment
Implications for Treatment

- Main clinical benefit will likely be from an understanding of the biological pathways of the interactions (Rutter, 2010).
  - Once understood, drug treatments could be used for environmentally insensitive individuals and psychotherapy used for environmentally sensitive individuals (Rutter, 2010).

- Understanding the form of gene-environment interplay at work in a disorder could help pick prevention and intervention strategies (Jaffee & Price, 2007).

- Overall, will help to further tailor the treatment to each individual.

Ethical Considerations

- Fatalism
- Privacy and confidentiality
- Environmental conditions
Epigenetics is not “all or none.”

Depends on many factors, including cell type, differentiation, etc.

Changeable

http://www.proginosko.com/2013/01/the-most-important-question/
Changes in Classification

- NIMH Research Domain Criteria Project
- “facilitate translation of modern molecular biology, neuroscience, and behavioral approaches toward explicating the pathophysiology of disorders (Cuthbert & Insel, p. 1062)”

Conclusions
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- Both genes and the environment play an important role in mental health.
- One mechanism by which this may take place is gene-environment interplay.
- Interplay can occur in different forms that may often be at work together.
- Learning more about these interactions could lead to the development of tailored treatment options.


