

Genetics and Peer Relations

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Mechanisms of Gene-(Peer)Environment Interplay



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- ◆ Gene-Environment Correlations (rGE)
- ◆ Gene-Environment Interactions (GxE)

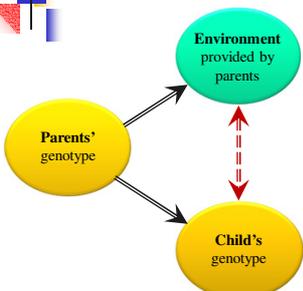


Mechanisms of Gene-(Peer)Environment Interplay

- ◆ Gene-Environment Correlations (rGE)



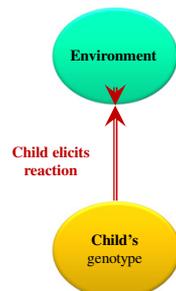
PASSIVE rGE



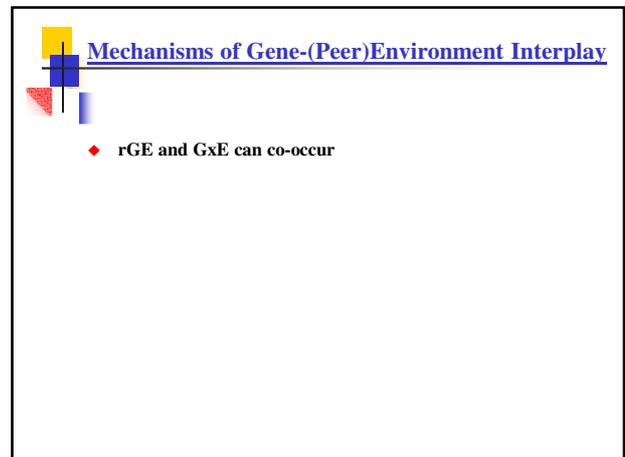
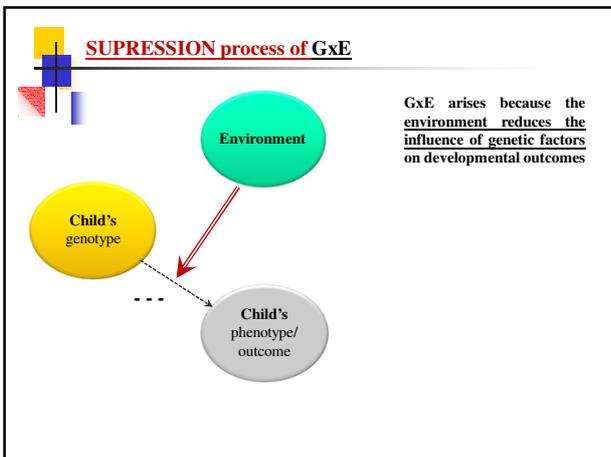
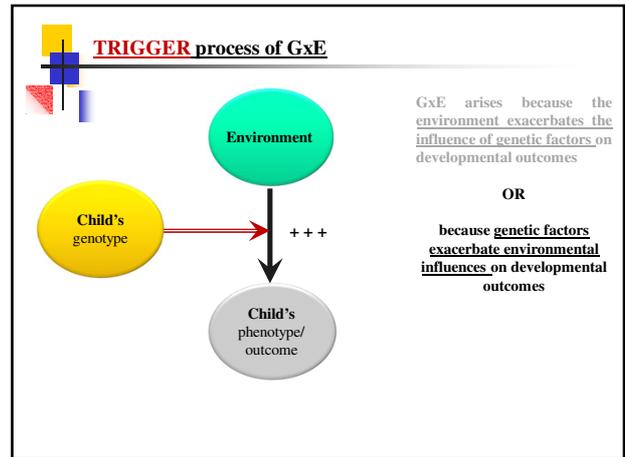
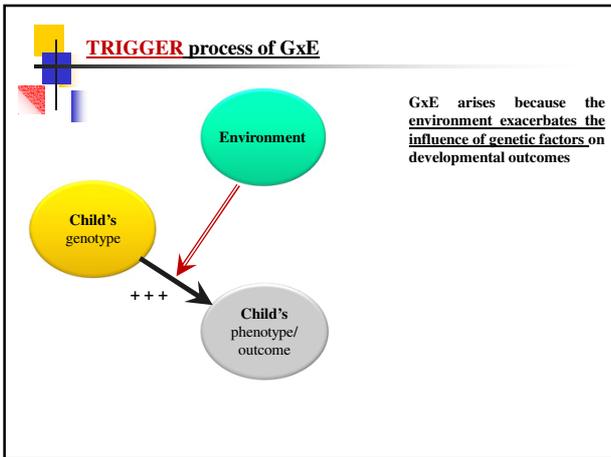
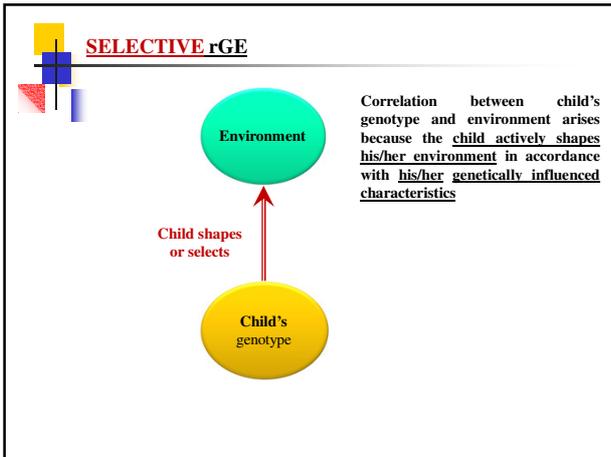
Correlation between child's genotype and environment arises as a by-product because both are influenced by parents' genotype



EVOCATIVE rGE



Correlation between child's genotype and environment arises because the child's genetically influenced characteristics elicit a reaction from the environment



Methods of Testing Gene-Environment Interplay

- ◆ **Quantitative Genetic Studies**
 - overall genetic and environmental influences are not explicitly measured, but estimated based on comparisons of siblings with varying genetic relatedness (e.g., twins, adoptive siblings)
- ◆ **Molecular Genetic Studies**
 - attempt to identify specific measured gene variants related to a behavior or other trait

Our Research

- ◆ Classical Twin Design based on an ongoing longitudinal study (Quebec Newborn Twin Study)

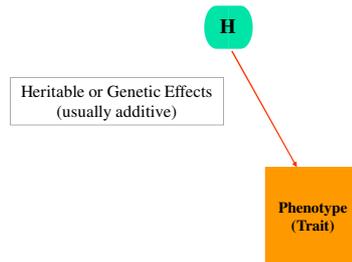


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The Quebec Newborn Twin Study

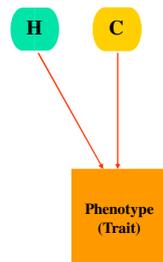
- ◆ Random sample of all twin births in Quebec between 1996 and 1998 (3 annual cohorts)
- ◆ 648 MZ and DZ twin pairs followed longitudinally every year from birth to grade 1, and since then bi-annually
- ◆ Starting in kindergarten:
 Multi-source assessments with teacher-, peer-, and self-reports on various aspects of development, including *peer relations* and *psychopathology*

Logic of Quantitative Genetic Models Based on Twins



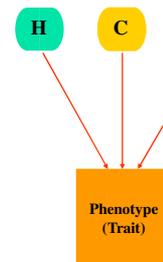
Logic of Quantitative Genetic Models Based on Twins

Common or Shared Environmental Effects



Logic of Quantitative Genetic Models Based on Twins

Unique or NonShared Environmental Effects



Our Research Objective

To examine possible gene-environment correlation (**rGE**) and gene-environment interaction (**GxE**) in the link between **negative experiences with peers** and **externalizing and internalizing problems** in youth

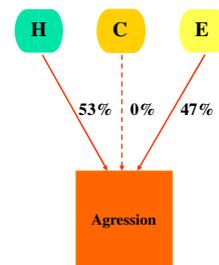
Why Peer Relation Difficulties?

- Externalizing and internalizing behaviors have been found to predict rejection and victimization by peers
 - **potential rGE**
- Negative peer experiences (rejection, victimization) have been linked to increased externalizing and internalizing behavior
 - **potential GxE**

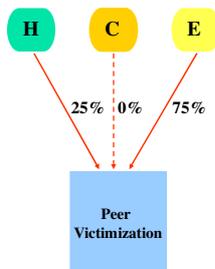
From:

Brendgen, M., Boivin, M., Barker, E. D., Girard, A., Vitaro, F., Dionne, G., Tremblay, R. E., & Pérusse, D. (2011). **Gene-Environment Processes Linking Aggression, Peer Victimization, and the Teacher-Child Relationship.** *Child Development, 82* (6), pp. 2021-2036.

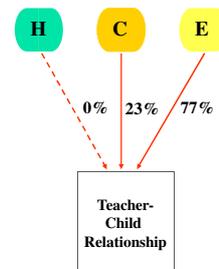
Univariate Analysis: Aggression

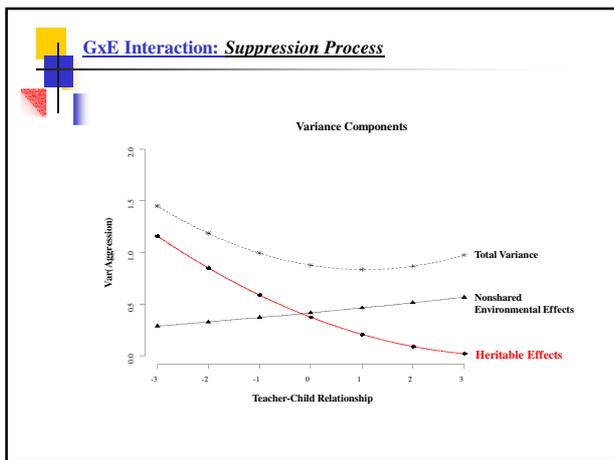
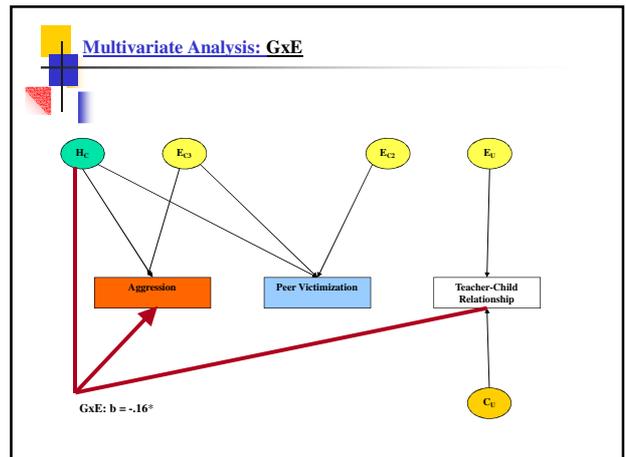
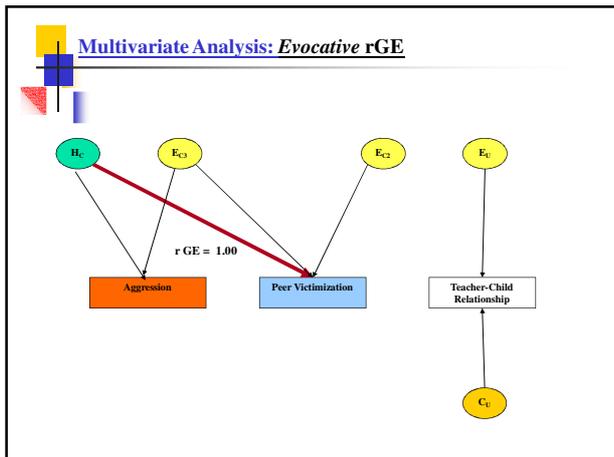


Univariate Analysis: Peer Victimization → possible rGE

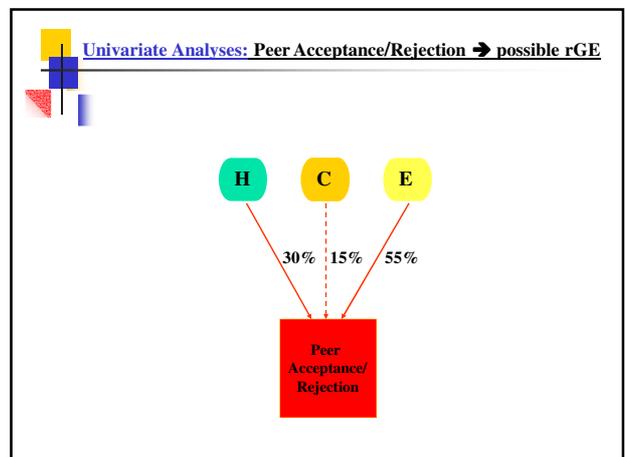
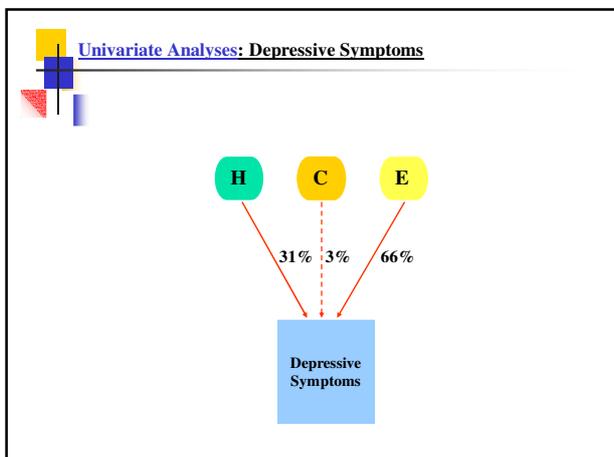


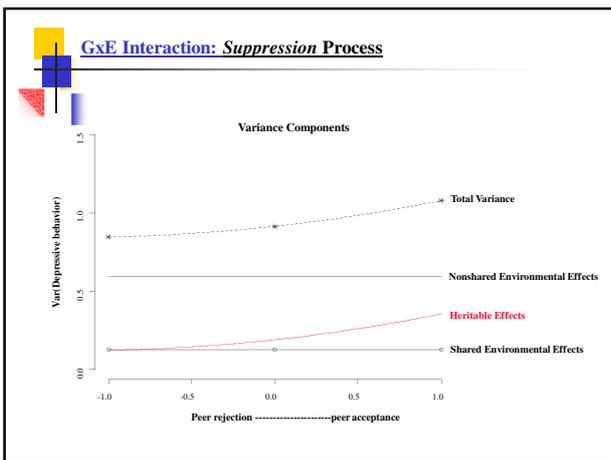
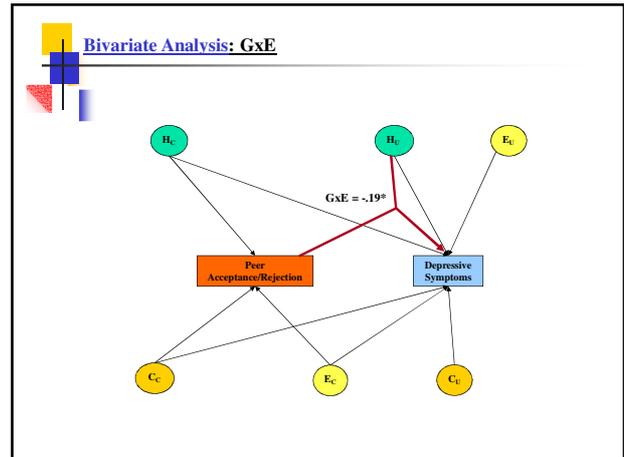
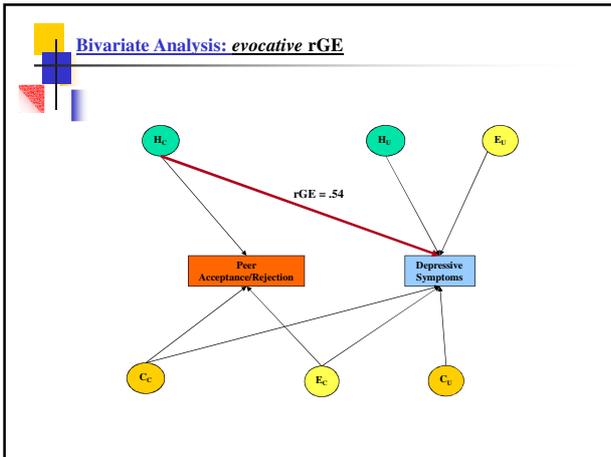
Univariate Analysis: Teacher-Child Relationship → no rGE





From:
 Brendgen, Vitaro, Boivin, Girard, Bukowski, Dionne, Tremblay, & Pérusse (2009). **Gene-Environment Linkages Between Peer Rejection and Depressive Symptoms in Children.** *Journal of Child Psychology and Psychiatry*, 50 (8), 1009-1017.





- ### Limitations of Quantitative Genetic Studies
- ◆ Inform about the ways genetic factors as a whole may work together with the (peer) environment to shape behavior or other traits (Johnson, Penke, & Spinath, 2011)
 - ◆ Heritability estimates do not reflect the effect of genes per se, but rather overall genetic influences that also include any existing nonmeasured gene-environment correlations and gene-environment interactions as well as epigenetic processes
 - ◆ Cannot inform about specific genes involved in the different forms of gene-environment interplay

- ### Molecular Genetic Studies
- ◆ E.g.: Association studies using large population samples:
 - examine whether natural and relatively frequently occurring variations (= polymorphic alleles) of a hypothesized candidate gene are related to interindividual differences in a behavior or trait
 - **Candidate gene is chosen a priori** based on its biological relevance to the trait

From:
 Burt, S. A. (2008). Genes and popularity: Evidence of an evocative gene-environment correlation. *Psychological Science*, 19(2), 112-113.



- ◆ Examined the association between **-G1438A** (an allele within the promoter region of the 5-HT2A serotonin receptor gene) and **peer popularity**



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- ◆ Previously unacquainted late-adolescent boys participated in a group-based interaction paradigm and were then asked to rate how much they liked each of their group members
- ◆ **Carriers of the G-allele were significantly more liked than those with the A-allele** (rGE ranging between $r = .20$ and $.22$ in the two samples)



Limitations of Molecular Genetic Studies

- ◆ Difficult to find specific genes that contribute to phenotypic variance, even in traits that are known to be highly heritable (e.g., height)
- ◆ Few genetic markers associated with social behaviors or traits have so far withstood replication
- ◆ Genes are likely to interact with each other in addition to interacting with environmental influences, with each effect explaining only a very small portion of the overall variance



Possible Avenues for Future Research

1. Incorporating **endophenotypes** (e.g. neuro-physiological measures derived from fMRI, event-related potentials, endocrine system functioning)
 - ➔ Provides information about the pathways through which specific genes may be related to a given outcome



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2. Study of the **epigenotype** rather than the genotype
 - ◆ Epigenotype = the pattern of gene activation



Epigenetics

- ◆ The **epigenetic code** is laid down during the development of the embryo, but **can be modified by environmental influences**
- ◆ Unlike genetic mechanisms of change (e.g., mutations), which modify the gene sequence (DNA) itself, epigenetic changes involve **environmentally induced chemical and physical processes that affect the selective activation or deactivation of genes**

Epigenetics

Environmentally triggered epigenetic changes in humans are **not restricted to the prenatal or early childhood period**

- ◆ Fraga et al. (2005) – studying a sample of 3 to 74 year-old identical (MZ) twins:
- ◆ **Epigenetic differences between the two members of a twin pair increased with increasing age**, especially when the two co-twins had differential life experiences.

→ **Epigenetic processes** of gene-environment interplay likely implicated in a multitude of environmental effects over the life course – including **effects of peer relations**

Conclusion: Genetics in Peer Research

- ◆ Essential for understanding development
- ◆ Allows testing theoretical models that link peer relations to development, e.g.:
- ◆ Test of “child effects” on peer relations, such as peer rejection or deviant peer affiliation (rGE)
- ◆ Test of a diathesis-stress model of disease, linking peer experiences with psychopathology (GxE)
- ◆ Genetically informed research is a “useful addition to the toolkit for testing environmental causation” (Moffitt, 2005)

Thank You!

Research Team:

- Mara Brendgen (Université du Québec à Montréal)
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