

Measuring the Exposome in Bipolar Disorder

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Environmental Exposure in Bipolar Disorder

Kraepelin recognized “brain scars, infectious & gastrointestinal diseases, psychic influences” contribute to manic-depressive illness onset and relapse (Kraepelin, 1921)

Contemporary categorization:

- Obstetric complications, traumatic brain injury, substance use, life events
- Assessing impact of the exposure by life stage (perinatal, adolescence, adult, late life)
- Modifiable (i.e., diet and exercise), or non-modifiable (i.e., pollution, climate?)

More newly investigated environmental risk factors

- Air quality as strongest environmental predictor of BD (Kahn et al. 2019)
 - 6 components (CO, NO₂, O₃, PM₁₀, PM_{2.5}, SO₂)



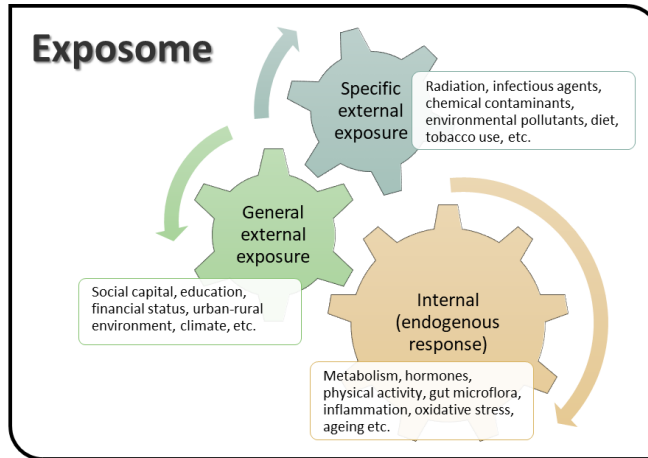
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Exposome Concept: Totality of exposure over life course



(Wild, 2012)



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Measuring the Exposome

A 'one-agent-at-a-time' approach ?

Genome – Possible to sequence the entire three billion DNA bases of the germline genome e.g., GWAS, Polygenic risk scores

Multi-omics approach with emerging technologies

- Large scale data, use of high-throughput technologies
- Collective characterization/quantification of toxicants, pollutants, nutrients, physical and psychological stressors (Niedzwiecki et al., 2019)
 - Transcriptomics (RNA expression), Proteomics, Metabolomics (<2,000 Da), Lipidomics...
 - High-resolution metabolomics (Jones, 2016)



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Measuring the Exposome

- Cumulative lifelong exposure to > 1 million or more commercial, occupational, and environmental chemicals (Hu, Jones, et al., 2021)
 - Blood exposome – small molecules and metals (Rappaport et al., 2014)
 - Endogenous metabolites or exogenous food chemicals, pollutant, drugs
 - 58% of small molecules are not human metabolites – need to go beyond endogenous metabolome
 - Combined express liquid extraction and gas chromatography high-resolution mass spectrometry (Hu, Jones et al., 2021)
 - A cost-effective and standardized approach for measuring exposome
 - Quantification of both known and unidentified environmental chemicals
- Hypothesis free **exposome-wide association studies (EWAS)**



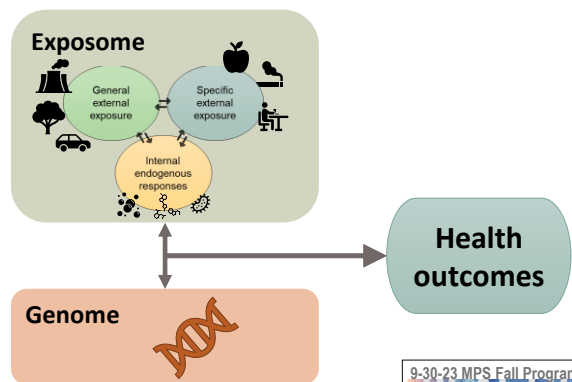
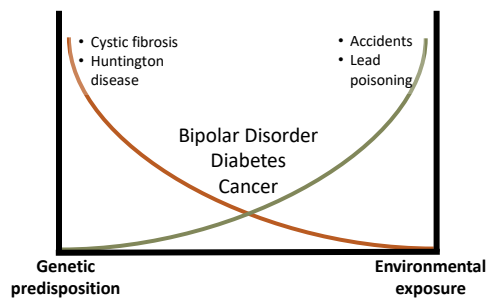
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Gene-Environment Interaction for Precision Medicine



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Thank you!



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