Modeling Addiction Vulnerability with a Rat Risky Decision-making task
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Introduction
- Excessive Risky Decision-Making is a hallmark of addiction.
- The Risky Decision Making Task (RDT) reveals individual variability in risky decision-making. 1
- Risk-taking rats in the RDT show characteristics common in addiction.
  • Increased cocaine seeking – Mitchell 2014
  • Increased Nucleus Accumbens shell (NAcc) D1 receptor expression 2
  • Diminished Dorsal Striatum D2 receptor expression 3
- This experiment examined differences in NAccs dopamine release and nicotine sensitivity through two questions:
  • Does the risk-taking subpopulation demonstrate sensitivity in psychostimulants?
  • Does dopamine release and availability in the NAccs differ as a function of risk-taking?
- Long-Term Aims:
  • To understand the behavioral and biological bases of addiction vulnerability to identify at-risk individuals
  • To facilitate therapeutic intervention prior to the onset of addiction.

Experiment 1 Results

Experiment 1 Risk Mean

Experiment 1 Risk Individual Differences

Risk-taking Predicts Nicotine Sensitivity

Risk-taking rats were less sensitive to psychostimulant effects of nicotine, but more sensitive to withdrawal.

Experiment 1
Risk taking and Nicotine Sensitization

1st 2nd 3rd 4th 5th 6th day break 7th 8th 9th 10th

After being characterized in the RDT, the rats' sensitivity to nicotine was measured using a behavioral sensitization protocol in an open field chamber.

Experiment 2 Results

Experiment 2 Risk Mean

Experiment 2 Risk Individual Differences

A

B

C

Risky rats showed increased stimulation-evoked dopamine release, greater dopamine supply, and longer dopamine half-lives

Experiment 2
Amperometry

After being characterized in the RDT, the release of dopamine in the Nucleus Accumbens shell was measured in risk-taking and risk-averse rats.

Conclusions

- The increased severity of nicotine withdrawal may mean that risk taking individuals are more susceptible to addiction due to the greater negative side effects of cessation of drug intake.
- The decreased sensitivity to nicotine in risk-taking rats may imply that risk taking individuals require more of a psychostimulant to experience the same effects as non-risk-taking individuals.
- Risk taking rats exhibit increased NAccs dopamine transmission, suggesting hypersensitivity to reward.

These data suggest that risk taking rats identified in the RDT may be more vulnerable to addiction formation than the general population.

References

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