

The Effect of Enriched Environment on Drug Seeking Behavior

Michael T. Bardo, PhD

**Professor of Psychology and Director
Center for Drug Abuse Research Translation (CDART)**



Question

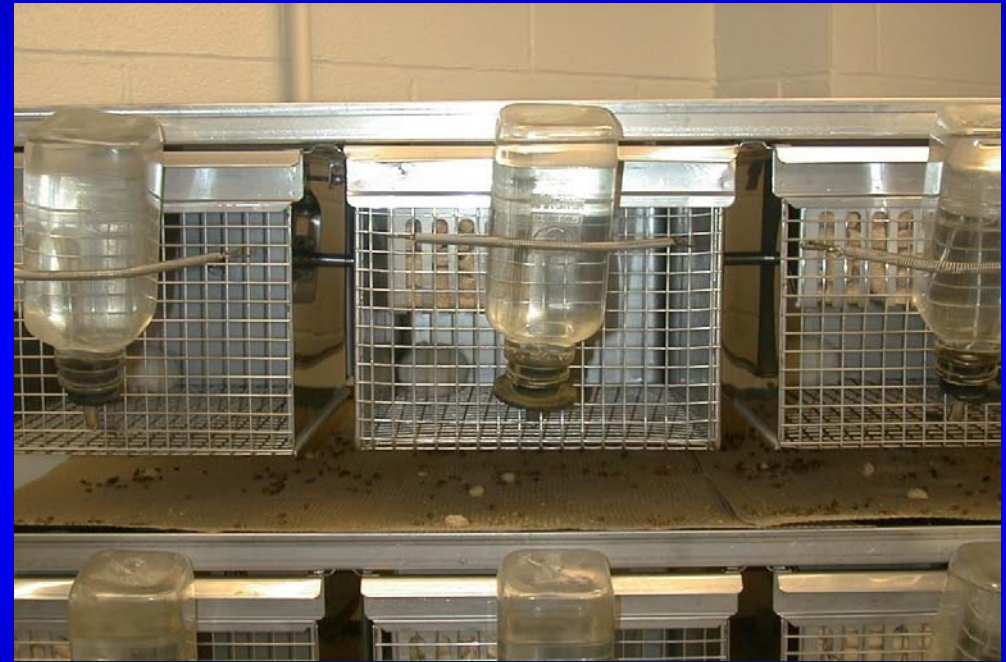
Can environmental enrichment (exercise) during development alter drug abuse vulnerability?

Housing Conditions During Development

Enriched Condition (EC)



Isolated Condition (IC)



ARE YOU ENRICHED?

Environmental Enrichment Decreases Body Weight and Increases Brain Weight

Group	N	Mean Body Weight (grams)	Mean Brain Weight (grams)
EC	11	258 ± 5*	1.69 ± 0.02*
SC	9	263 ± 5	1.67 ± 0.02
IC	11	280 ± 4	1.63 ± 0.02

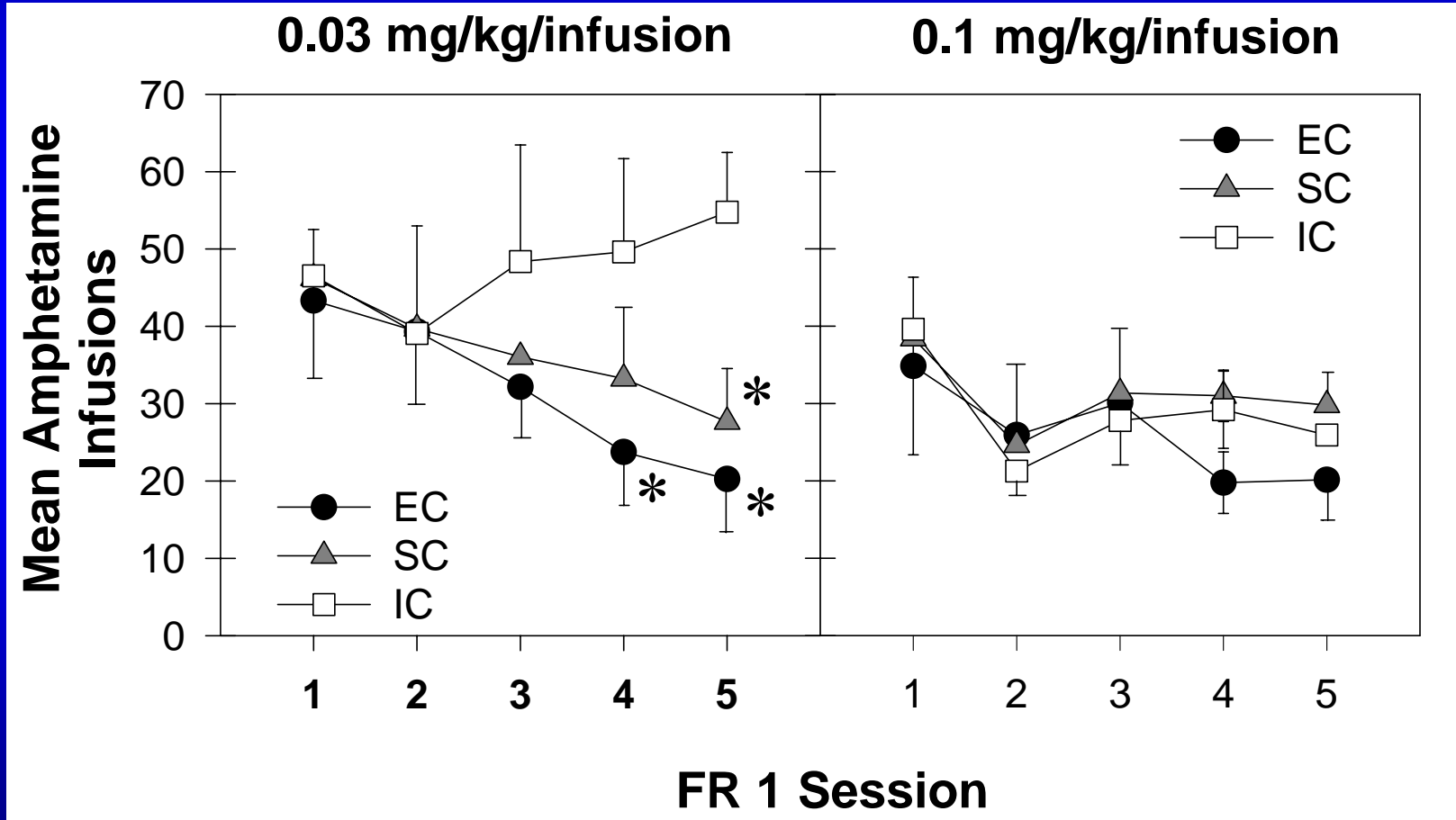
*Significant difference from IC group, $p < 0.05$.

Drug Self-Administration Method

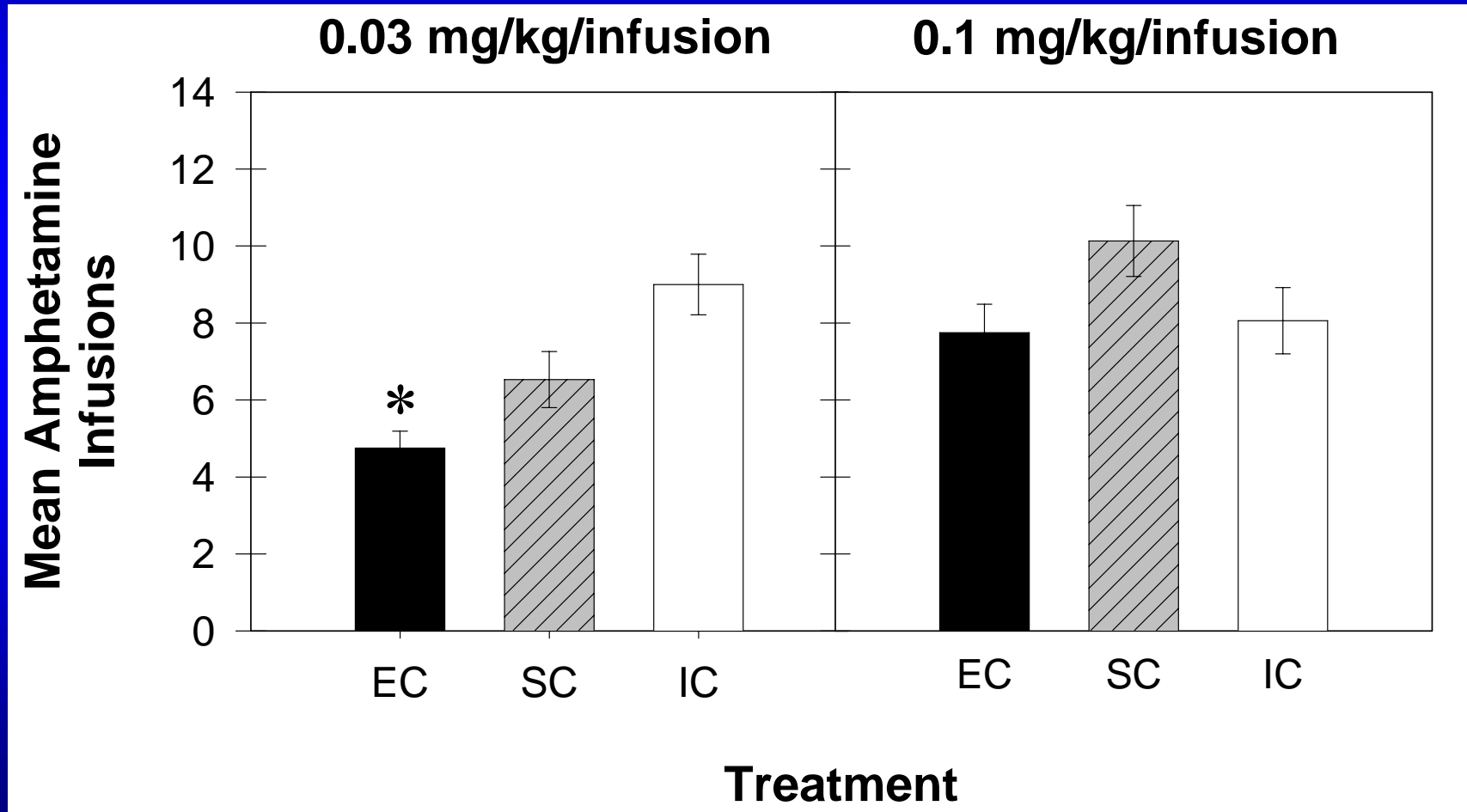
- Male Sprague-Dawley rats, 250-350 g.
- Food restriction to 85% normal body weight
- Shape to lever press for sucrose pellet
- Free feed for one week
- Implant jugular catheter
- One week recovery
- Initiate drug self-administration



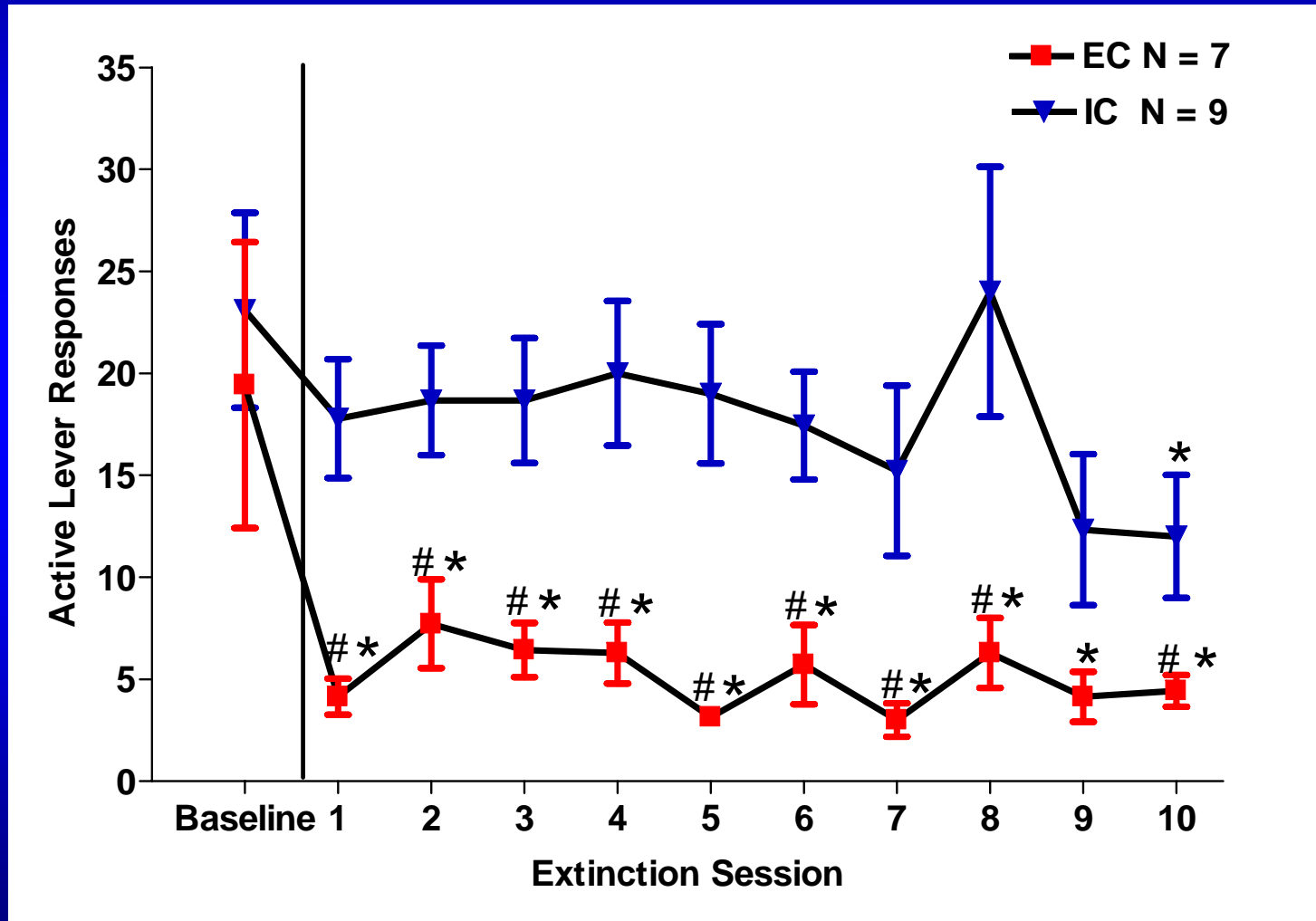
EC Rats Self-Administer Less Amphetamine than IC Rats on FR 1 Schedule



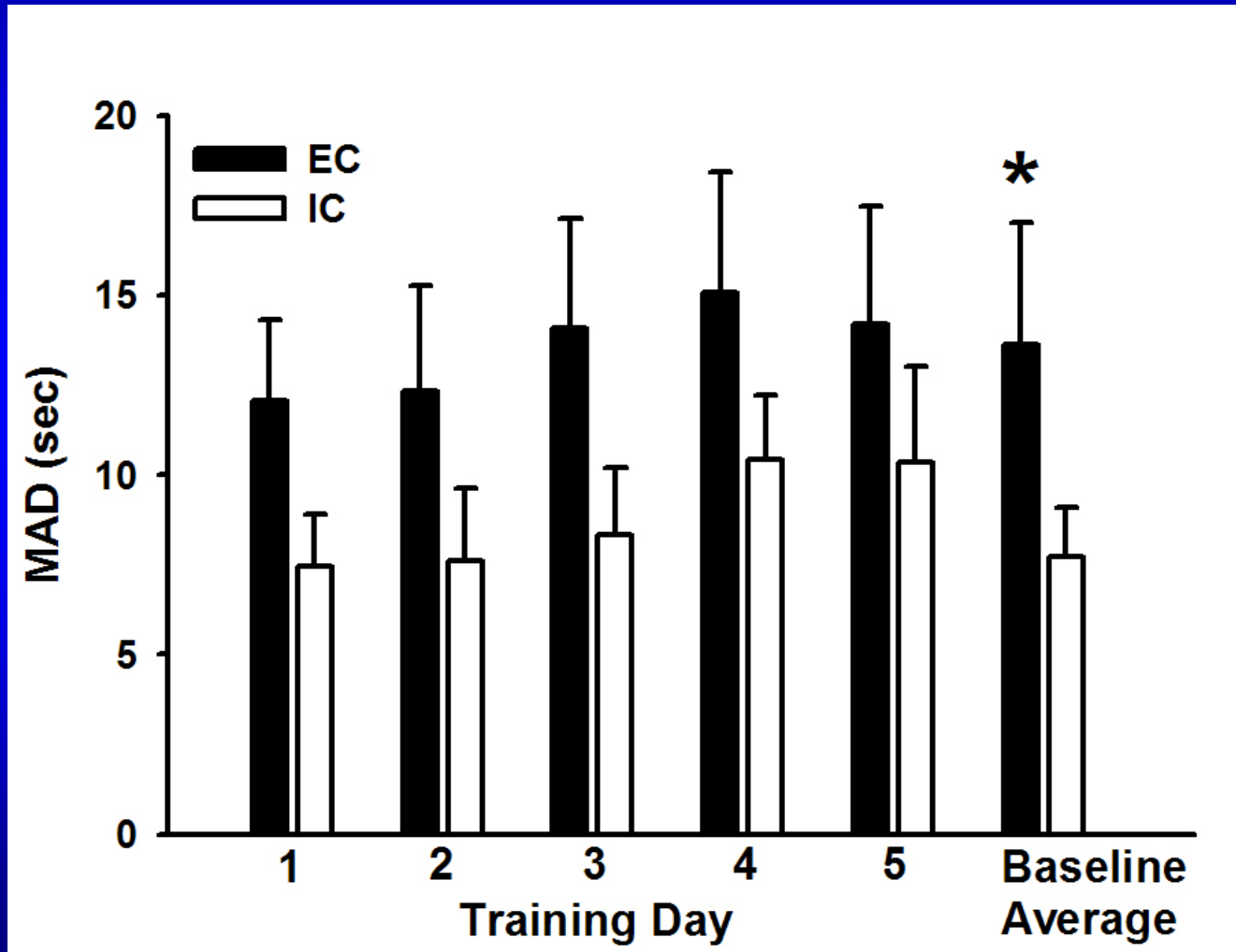
EC Rats Self-Administer Less Amphetamine than IC Rats on PR Schedule



EC Rats have Superior Performance on Extinction of Drug Seeking Compared to IC Rats



EC Rats Display Greater Behavioral Inhibition in a Delay Discounting Task

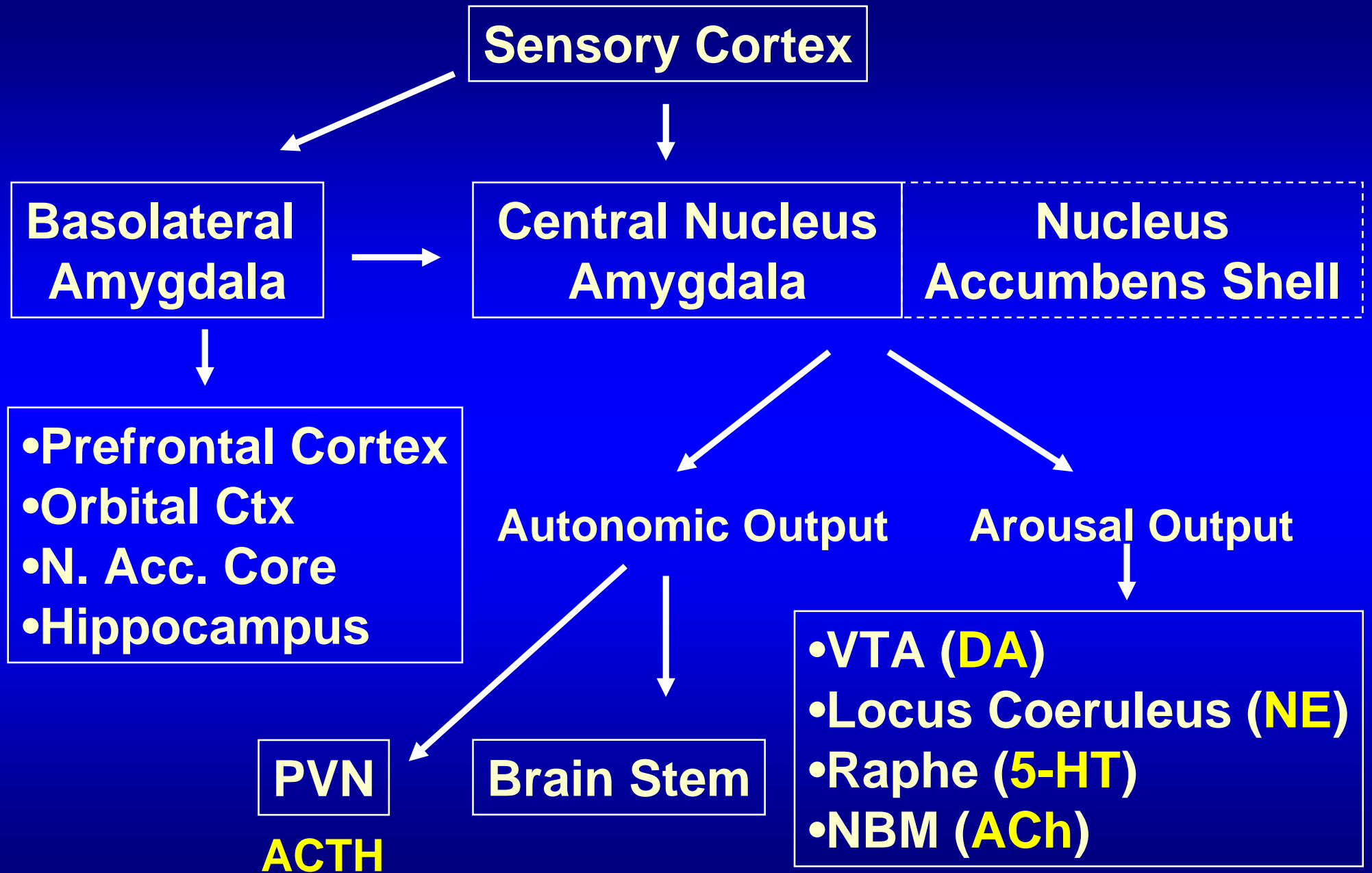


Summary of Behavioral Findings

- Environmental enrichment decreases acquisition and maintenance of amphetamine self-administration.
- Environmental enrichment decreases the reinforcing effect of amphetamine measured using a PR schedule.
- Environment enrichment accelerates the rate of extinction of drug seeking and blunts drug-induced reinstatement.
- Environmental enrichment enhances behavioral inhibition in a impulsive choice task
- Thus, these results suggest that environmental enrichment protects against stimulant abuse vulnerability.

Question

What are the neurobiological mechanisms associated with the protective effect of environmental enrichment on drug abuse vulnerability?

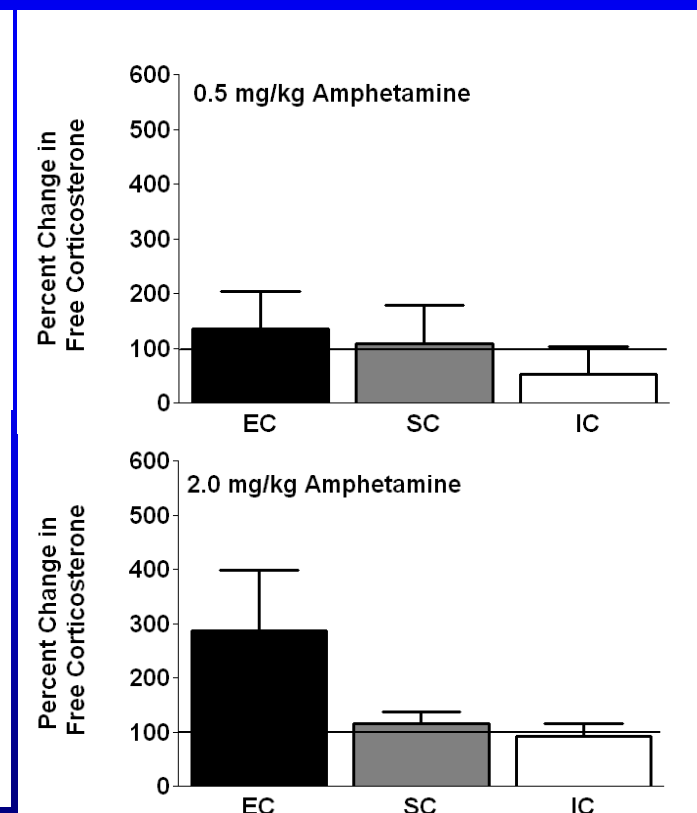
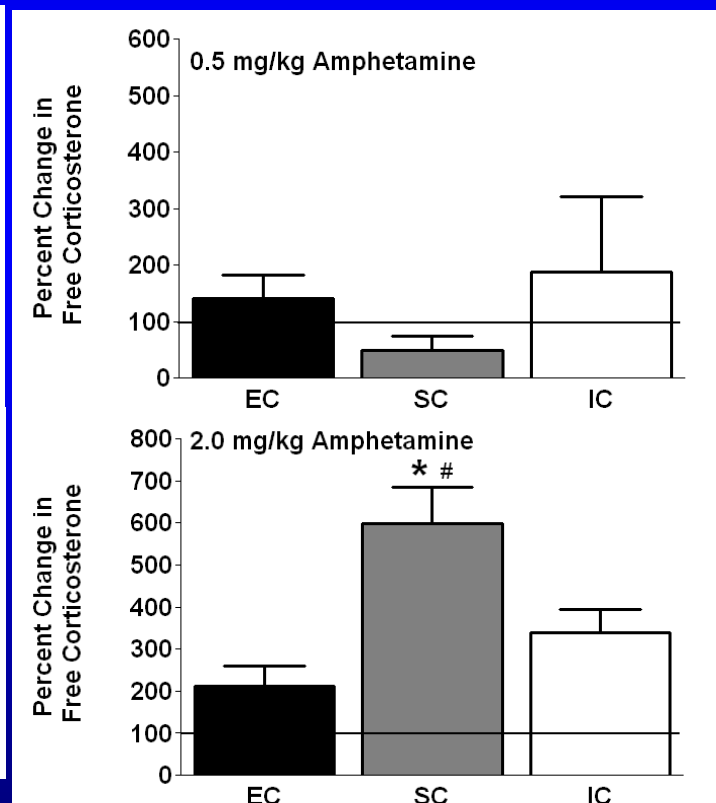
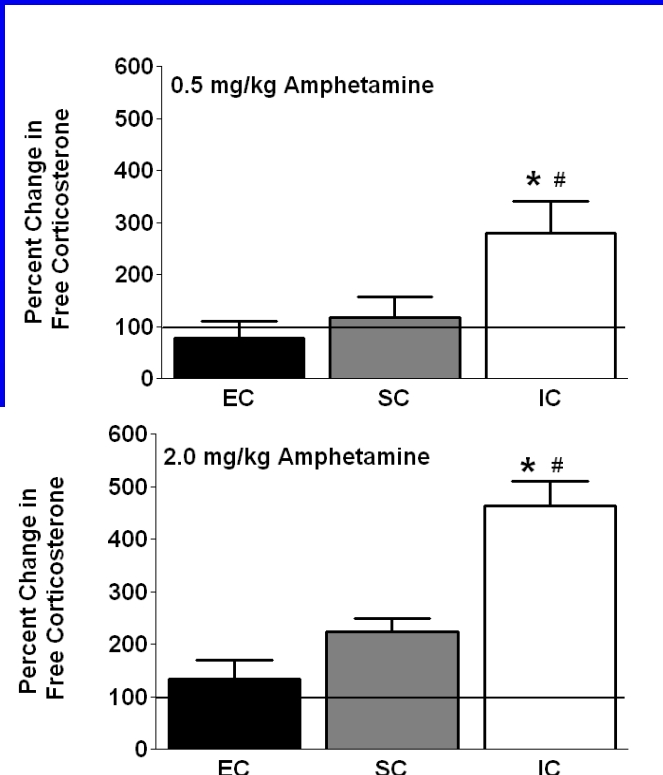


Amphetamine-induced Increase in Plasma Corticosterone is Blunted in EC Rats

15 min

60 min

180 min



Mandyam, Wee, Eisch, Richardson and Koob (2007) *J Neurosci*
27:11442-11450.

**Voluntary exercise for 14 days in rats increases glioneogenesis
(astrocytes and oligodendrocytes) in mPFC.**

Why would exercise/enrichment decrease drug abuse vulnerability?

- **Neurobiological level of analysis:** Both exercise/enrichment and drugs activate a common reward substrate.
- **Behavioral level of analysis:** Exercise/enrichment and drug use involve competing responses.
- **Social-cognitive level of analysis:** Cause of positive mood may be attributed to exercise/enrichment rather than ingested drug.

Some Future Directions

- **When is the optimal time to implement exercise... before, during and/or after drug experimentation?**
- **More basic research in controlled laboratory setting and translation to the field.**

“Enrichment” in the Laboratory



Daily Schedule

8:00 Intake Assessment

8:15 Meal

8:30 Session

9:00 Dose

Activities

9:50 Session

Activities

10:50 Session

Activities

11:50 Session

12:20 Discharge Assessment

Activities

Watching video-taped movies

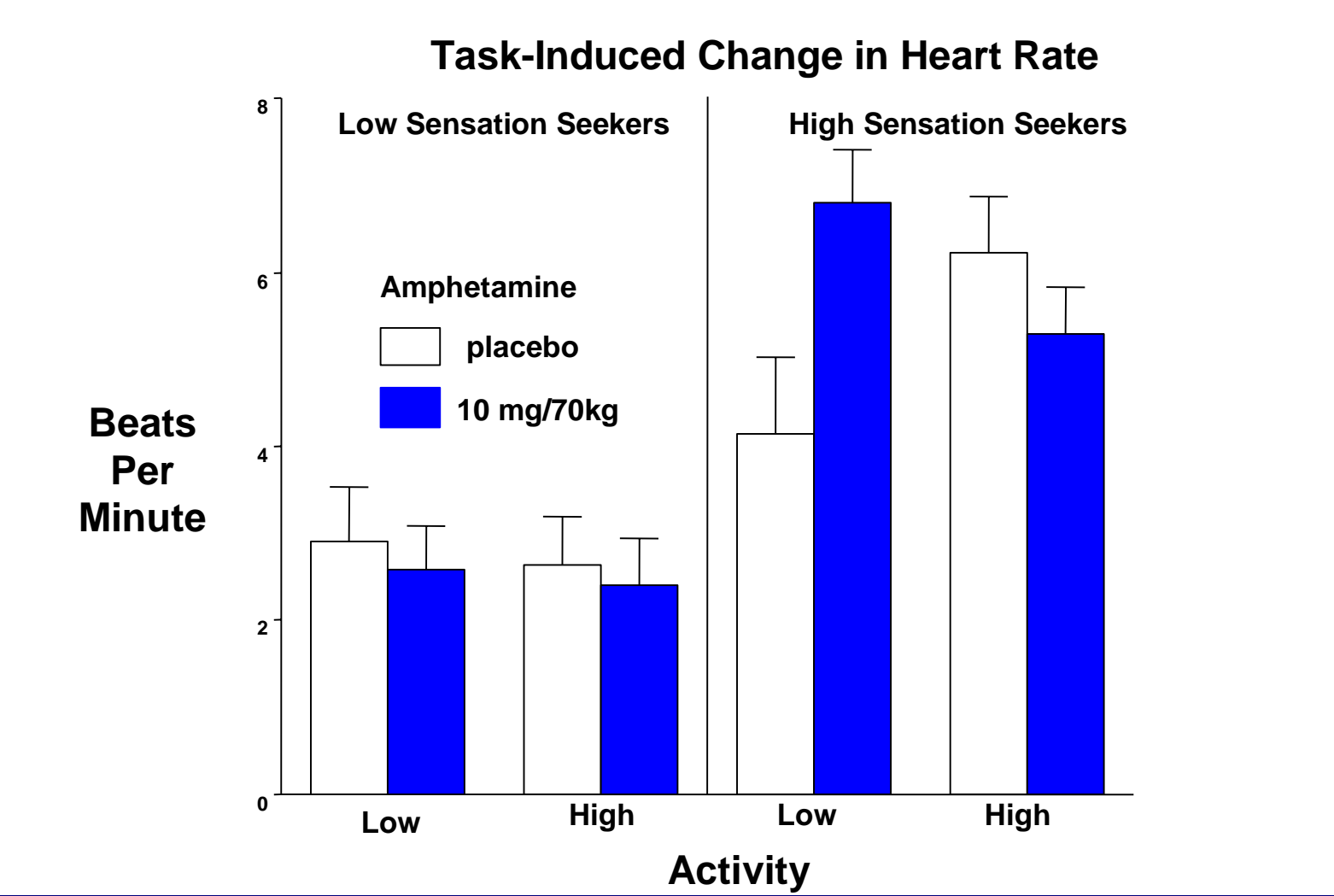
Listening to music

Playing computer games

Reading

High and low sensation activity levels determined through focus group discussions prior to the study

High Sensation Nondrug Stimulus Activities Reduce the Effect of Amphetamine in High Sensation Seekers



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