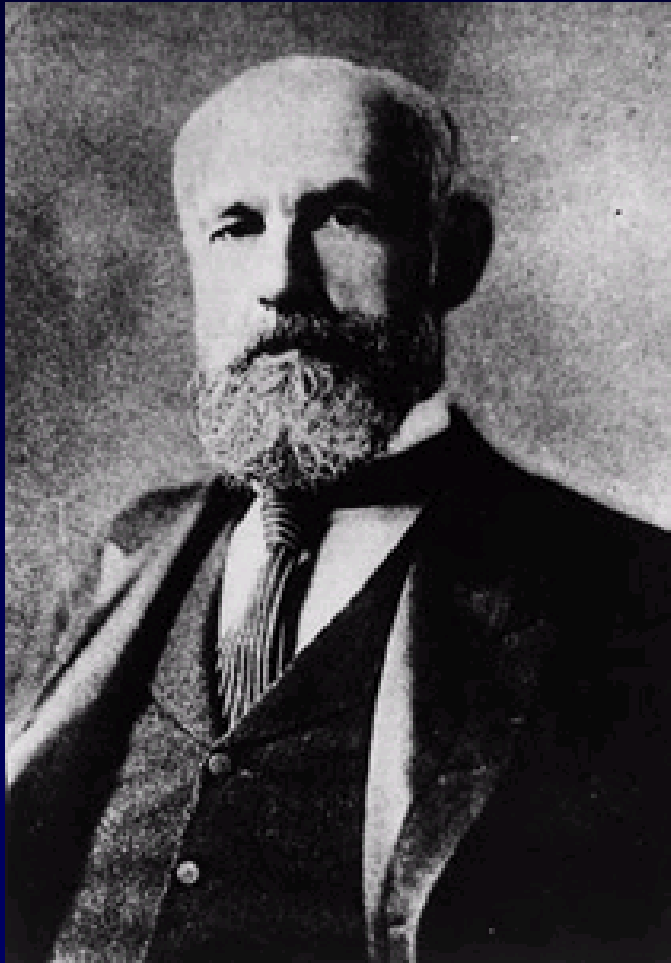


Adolescence and Stress:
Negative Outcomes in Adult Function
and Mental Health

Russell Romeo, Ph.D.

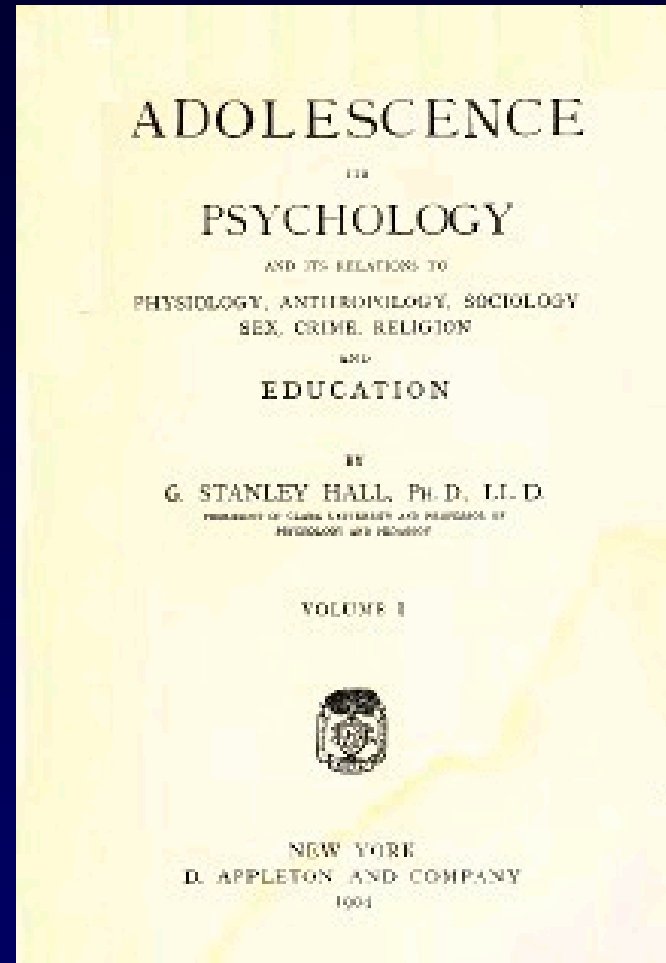
Rockefeller University
Laboratory of Neuroendocrinology

G. Stanley Hall



(1844-1924)

Adolescence, 1904



Youth are heated by Nature as drunken men by wine.
- Aristotle

The Health Paradox of Adolescence

By adolescence, individuals have matured beyond the frailties of childhood, yet have not begun any of declines associated with adult aging.

Stronger
Bigger
Faster
Increases in...
Reaction time
Reasoning abilities
Immune function
Withstand...
Cold
Heat
Injury

**Morbidity and mortality
rates *increase*
200%-300%
over the same interval of time**

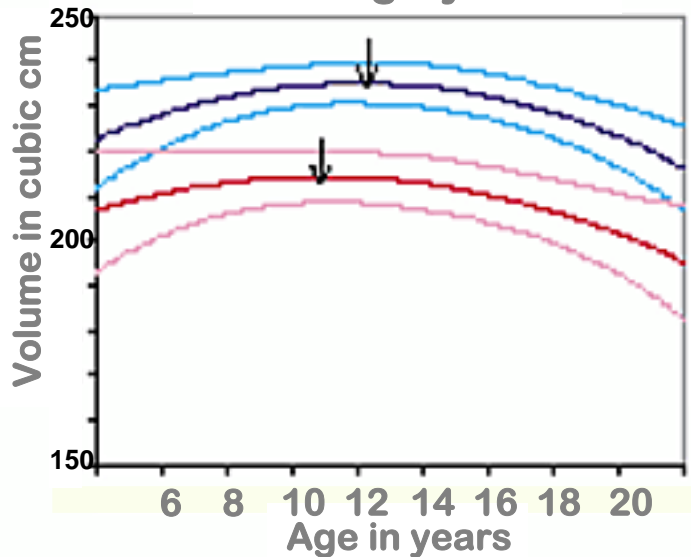
Puberty is a period of developmental vulnerability

- Emergence of psychopathologies
 - Anxiety Disorders
 - Depression
 - Schizophrenia
 - Eating Disorders
- Risky behavior
 - Drug use and abuse



Gray and white matter changes during pubertal development in humans

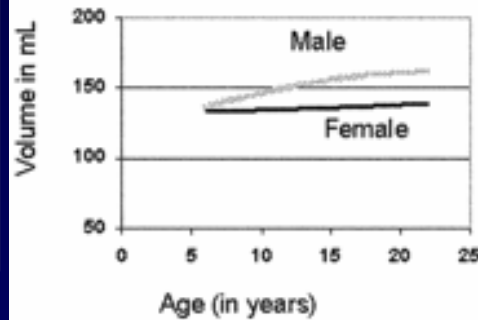
Frontal gray matter



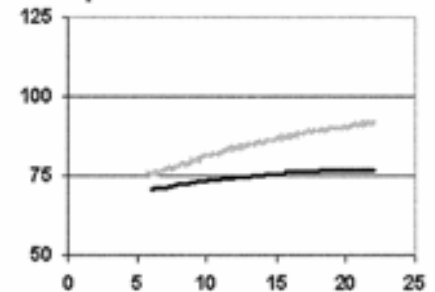
Giedd, 2004 *Ann NY Acad Sci*

Giedd *et al.* 1999 *Nature Neuroscience*

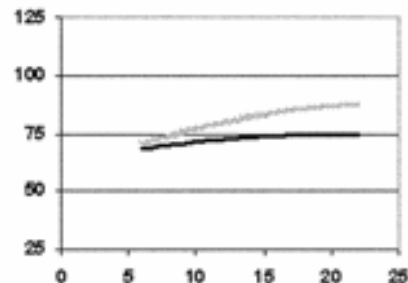
Frontal White Matter



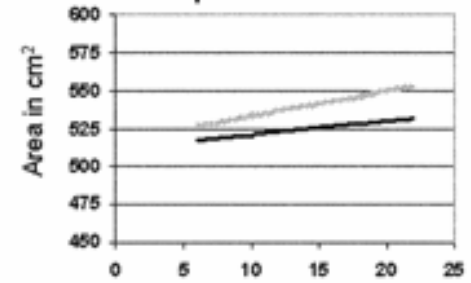
Temporal White Matter



Parietal White Matter

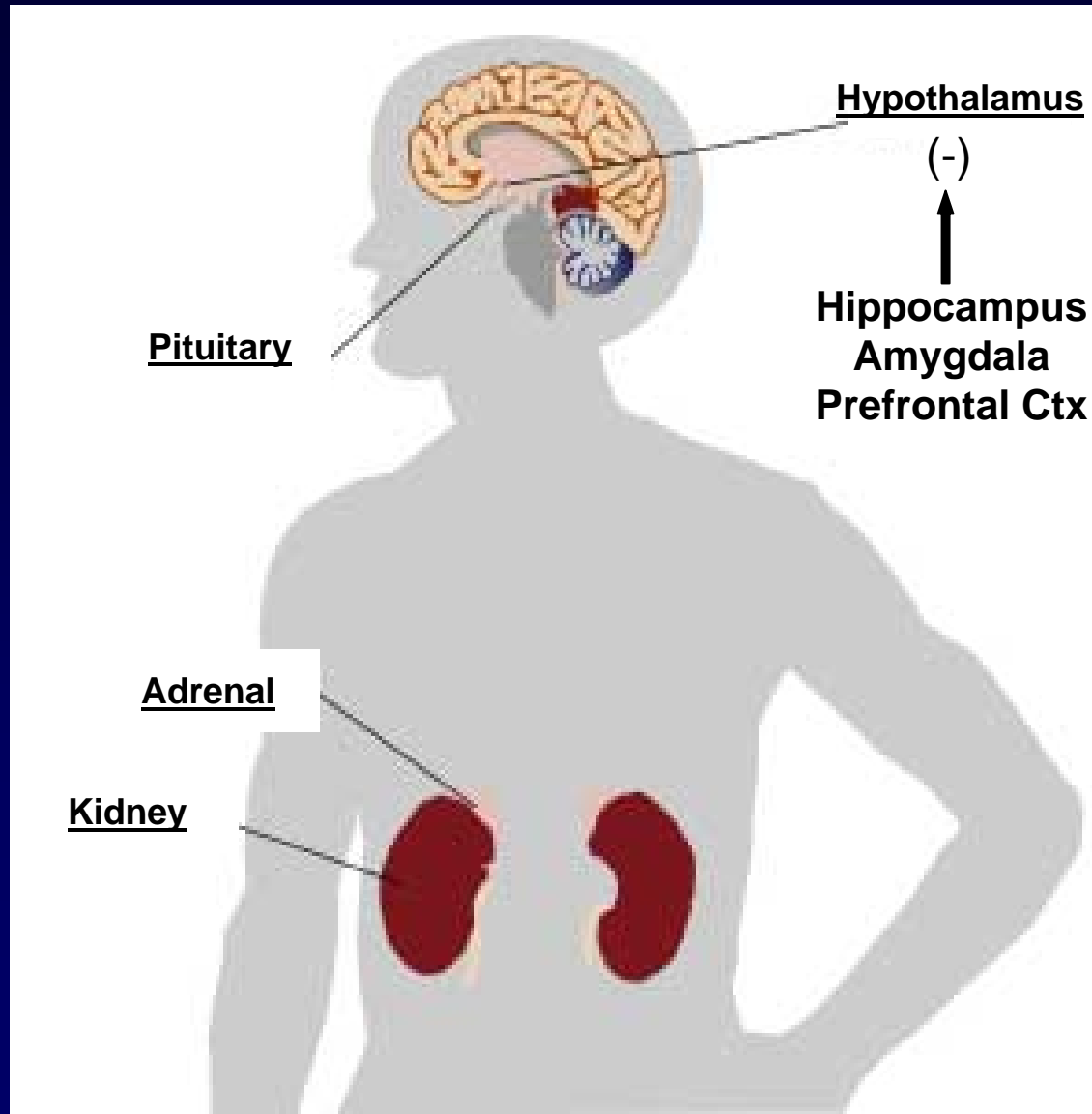


Corpus Callosum



Hypothalamic-Pituitary-Adrenal Axis

CRH
↓
ACTH
↓
CORT



(-)
↑
CORT

Adaptive responses to stress

- increase available energy
- increase oxygen intake
- decrease blood flow to digestion
- stimulate immune system
- inhibit reproduction
- enhance memory

Pathological responses to chronic stress

- increase available energy
- increase circulation
- decrease blood for digestion
- stimulate immune system
- inhibit reproduction
- enhance memory
- increased risk for diabetes
- high blood pressure
- chronic bowel syndrome
- inhibit immune system
- decrease libido and fertility
- impair memory
- neural damage/remodeling

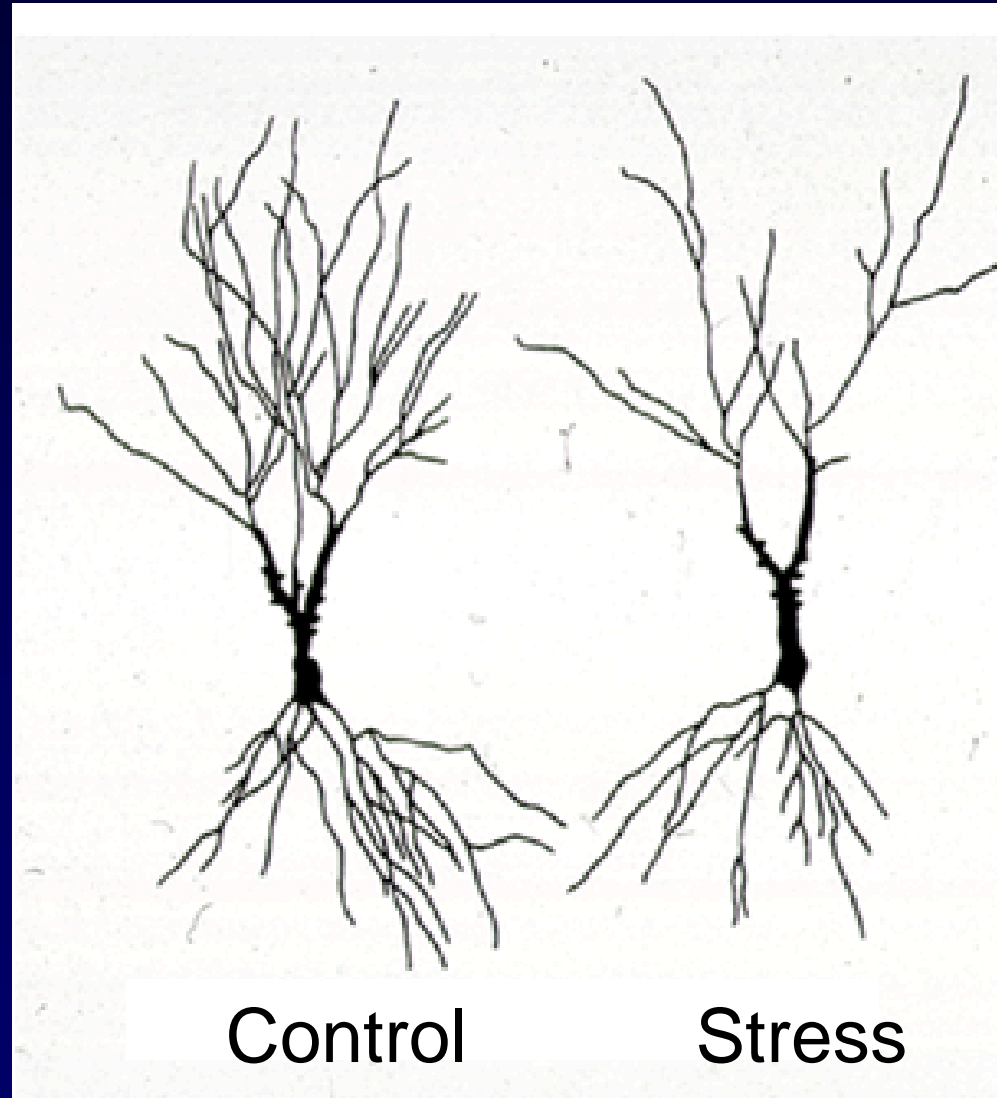
Stress-induced dendritic remodeling in adults

Hippocampus ↓

Prefrontal Cortex ↓

Amygdala ↑

**CONTINUE TO
MATURE DURING
ADOLESCENCE!!!**



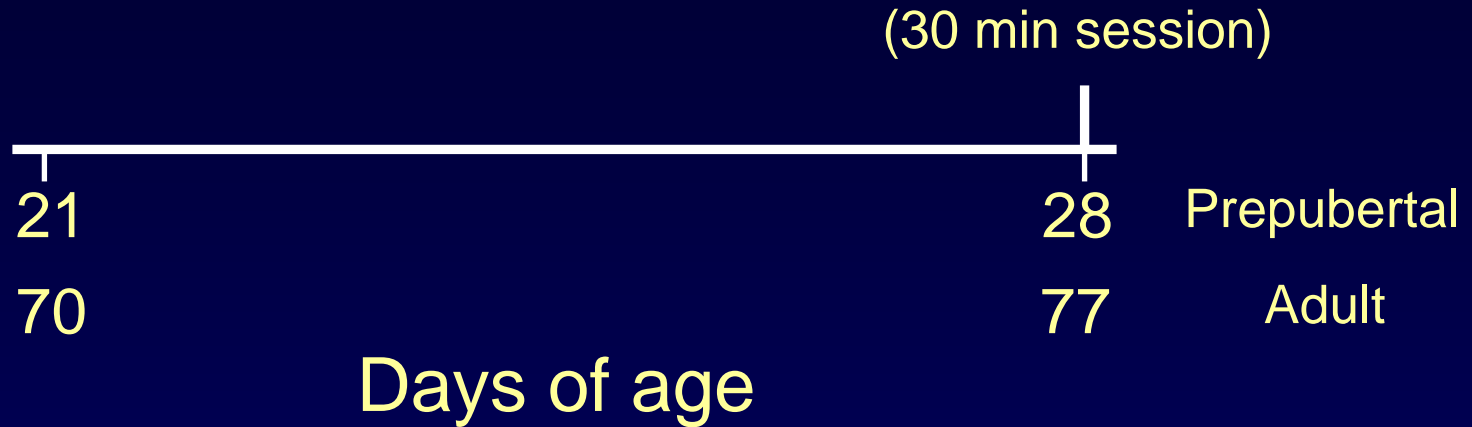
Stress Burden and the Lifetime Incidence of Psychiatric Disorders in Young Adults

R. Jay Turner, Ph.D. and Donald A. Lloyd, Ph.D.
Archives of General Psychiatry (2004); **61**:481-488

Stress burden during adolescence was strongly correlated with subsequent onset of depressive and/or anxiety disorders in adulthood.



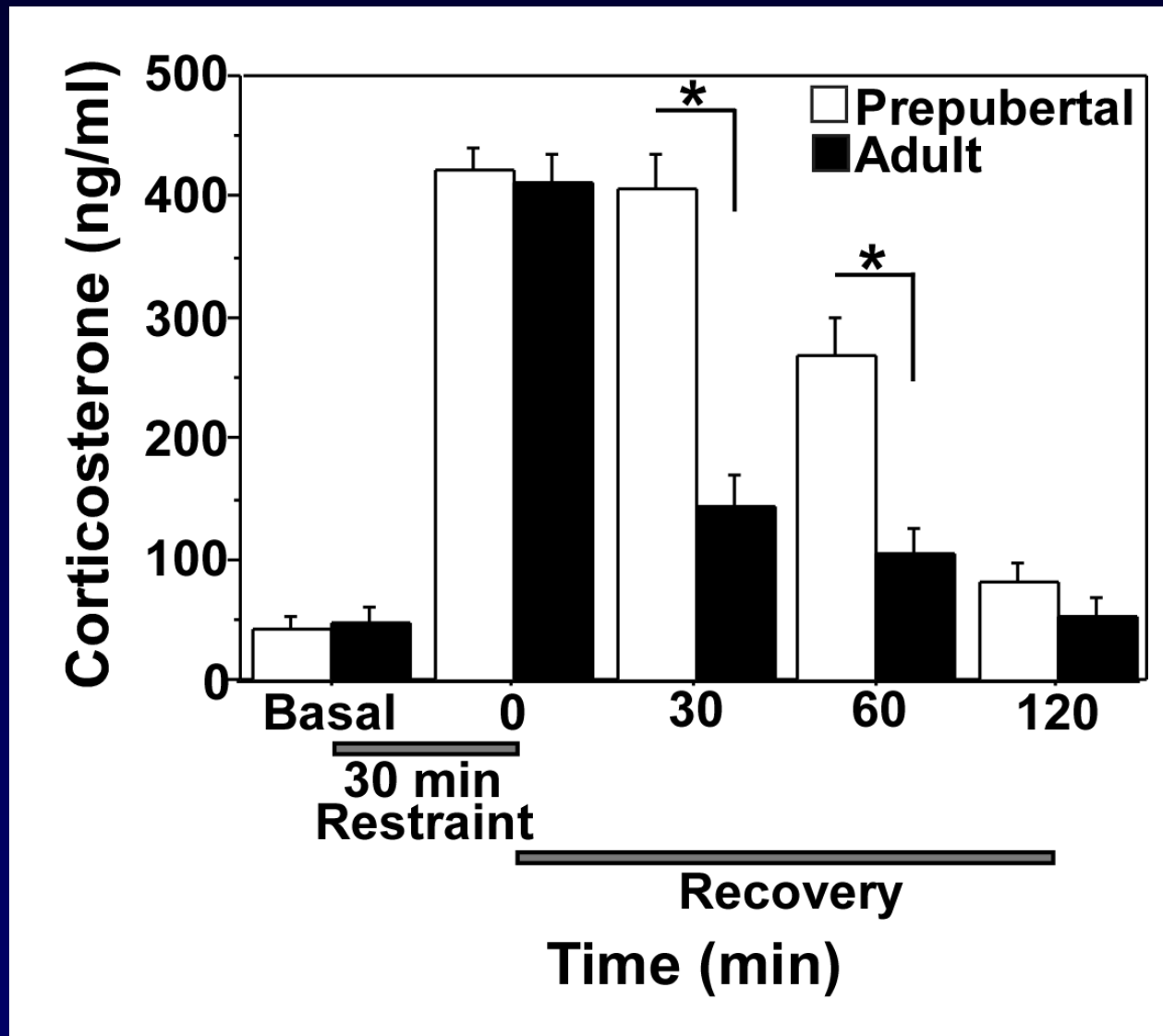
Are prepubertal and adult stress responses different?



Blood Sampling Time Point

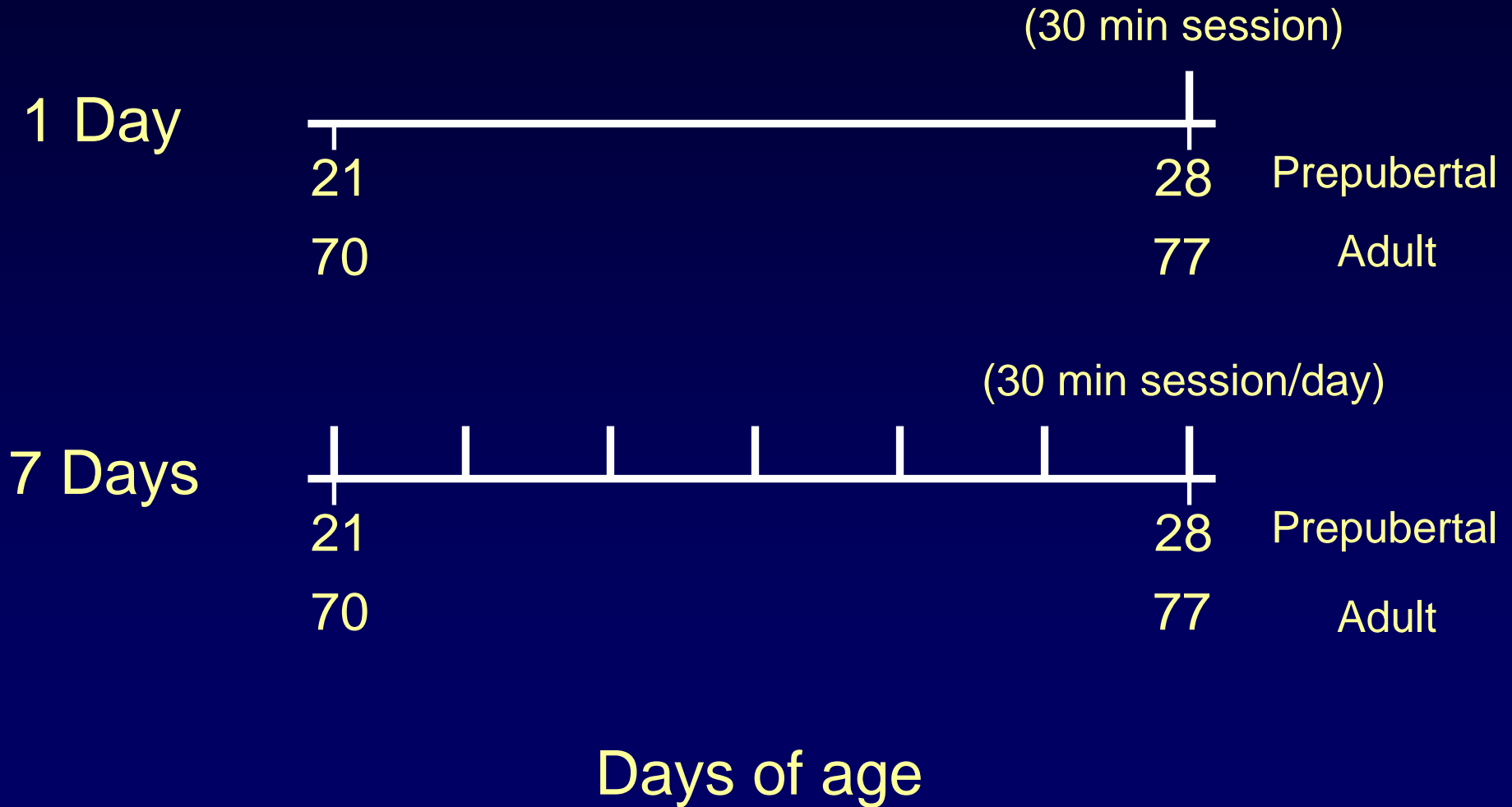
Basal, 0 min, 30 min, 60 min, 120 min

Prepubertal animals do not shut off stress response

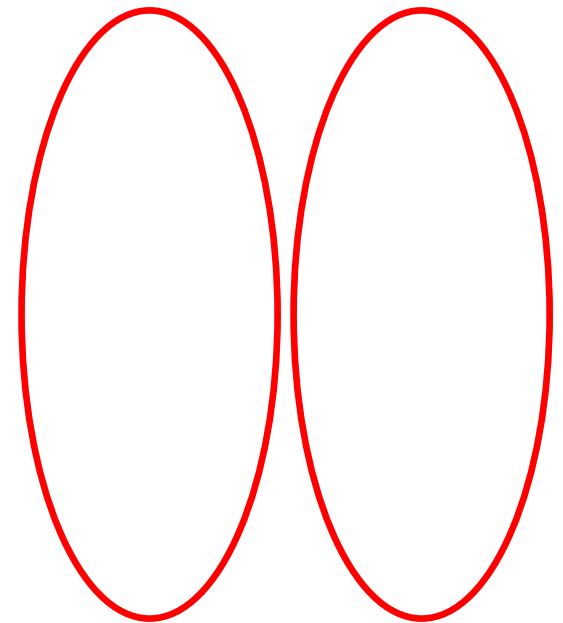
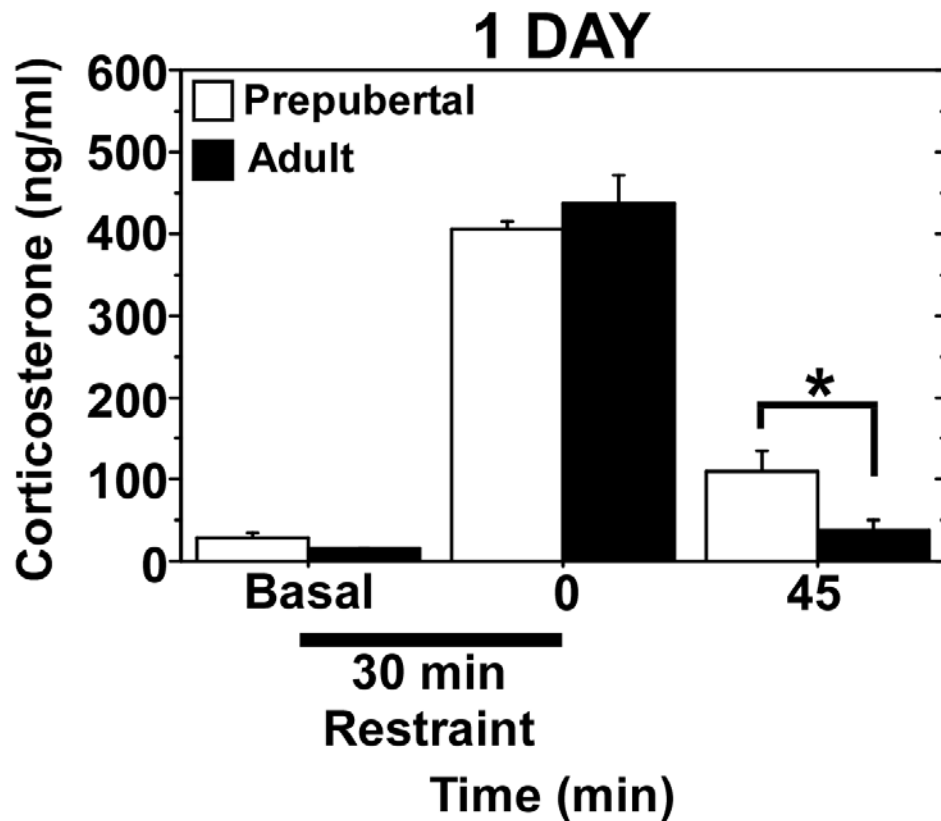




Do experience and development interact?



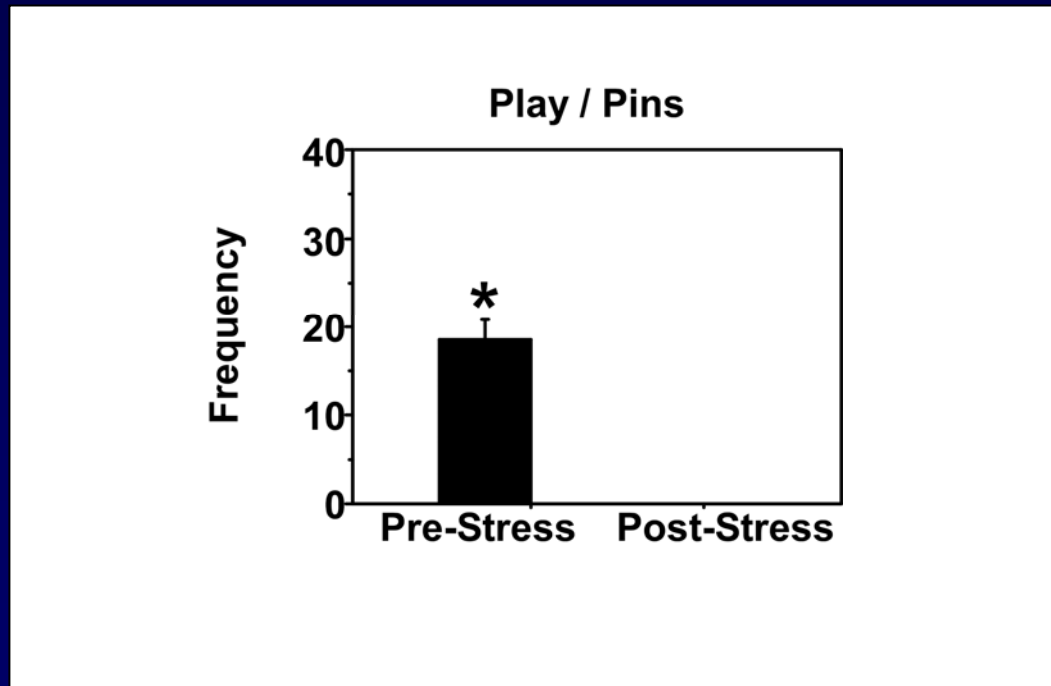
HPA Plasticity: Experience and development interact to affect stress responsiveness



Does stress affect behavior?

Record	Stress	Record
30 min	30 min	30 min

Play behavior is inhibited after exposure to stress



Conclusions

- Adolescence is associated with dramatic changes in hormonal stress reactivity, and can be modulated by stress history of the animal.
- Stress profoundly affects social behaviors in adolescent animals.
- Though there appears to be a link between pubertal exposure to stress and later psychological dysfunction, the mechanisms that mediated this relationship remain elusive.

“What you know is nothing, little man; what you need to learn, immense.”

-Charles Dickens



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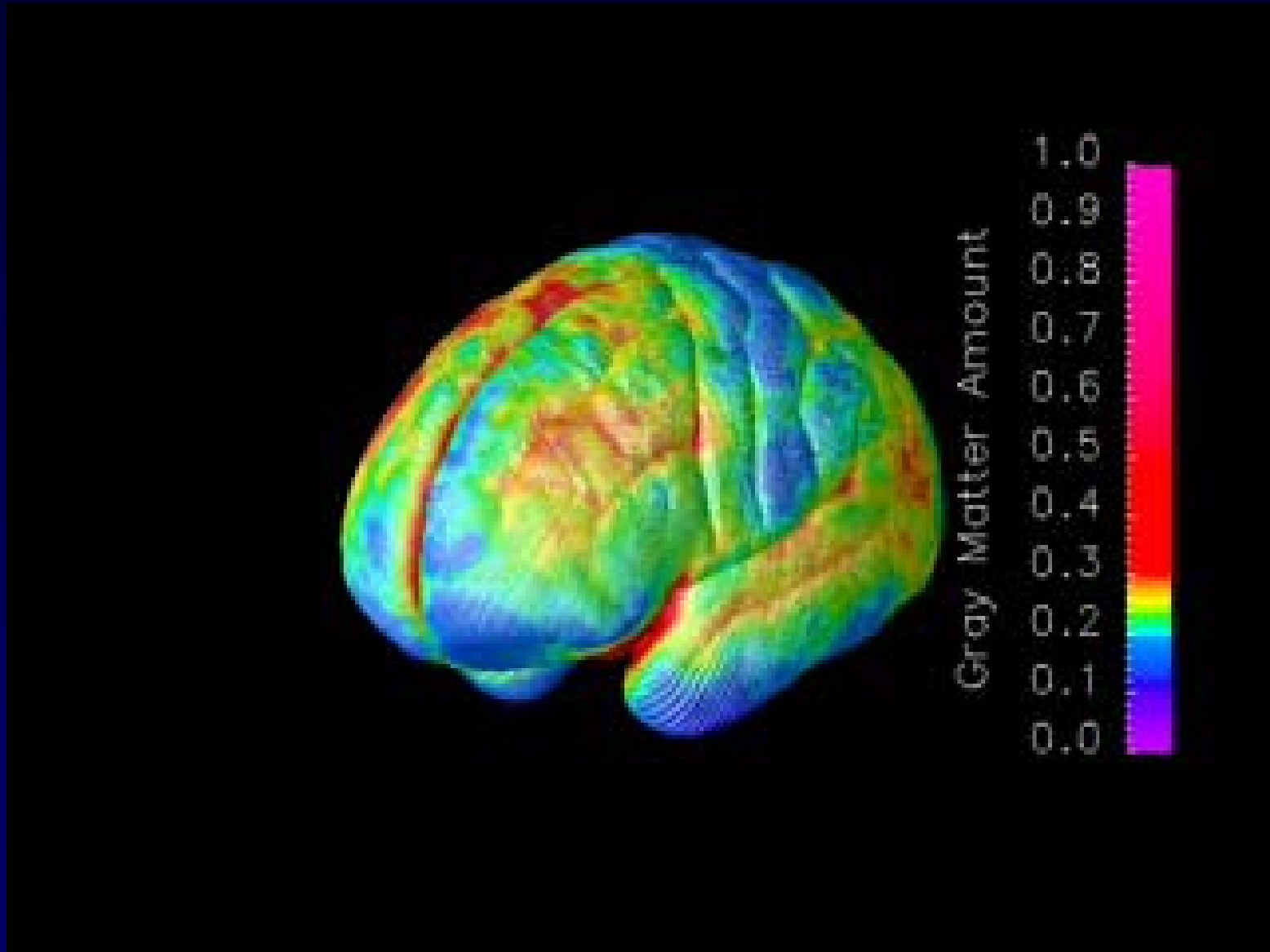
Barnard College

Mary Vernov

Barnard College

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- **National Science Foundation**
- **Borderline Personality Research Foundation**

Cortical maturation during adolescence



Open Field Test



- Dependent variables are low
high reactivity of anxiety in
adults

Pubertal Changes in Emotionality

