Introduction to biopsychology

1st ISBS Summer School

St. Petersburg, Russia

May 9th -15th,2008

The Kraepelinian Dichotomy

Emil Kraepelin (1856–1926), a German psychiatrist

• Freud (1856 to 1939) regarded psychiatric disorders as caused by psychological factors

• Kraepelin held that psychiatric diseases have biological and genetic substrates OR psychogenic substrates.

• False dichotomy of "mood vs. thought" or "brain vs. mind" , His theories were widely influential in the field of psychiatry

• Led to mischaracterizations of disorder etiology. E.g. interpersonal hypothesis of schizophrenia ("schizophrenogenic mother")

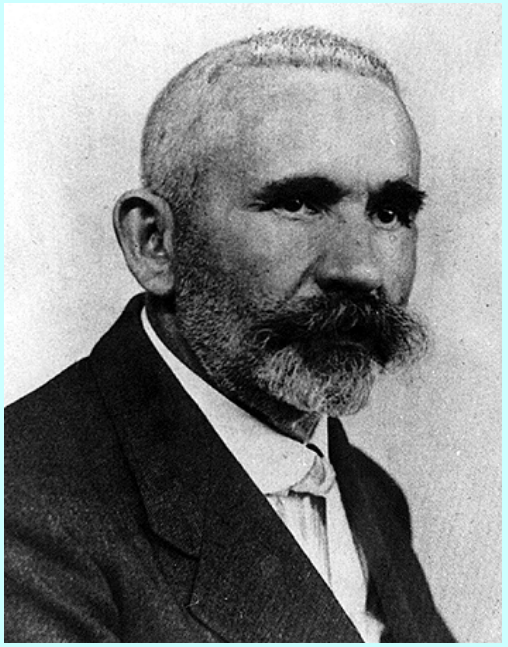


Table 1 - Classification of Mixed States according to Kraepelin, 1913, 1919

Types	Mood	Activity	Thought
Anxious or depressive mania	-	+	+
Agitated depression	-	+	-
Mania with thought inhibition	+	+	-
Manic stupor	+	-	-
Depression with flight of ideas	-	-	+
Inhibited mania	+	-	+

Emil Kraepelin

Received M.D. from the University of Würzburg (1878)

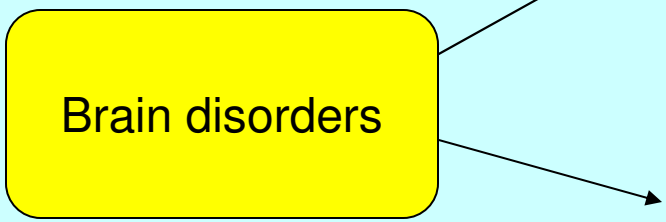
Continued his studies under several German neuroanatomists as well as with the experimental psychologist Wilhelm Wundt.

Wrote his *Compendium der Psychiatrie* (1883), in which he first presented his nosology, or classification of disorders.

Kraepelin divided mental illnesses into:
- **exogenous disorders**
- **endogenous disorders**

In 1880s: Professor at the Universities of Dorpat (Tartu, Estonia) and Heidelberg, continued to refine his classification, issuing several revisions of his psychiatry textbook (grew into several volumes)

Kraepelinian Dichotomy: 1983



Exogenous disorders

- **Caused by external conditions**
- **Treatable**

Endogenous disorders

- **Have biological causes (organic brain damage, metabolic dysfunctions, or hereditary factors)**
- **Incurable**

Emil Kraepelin

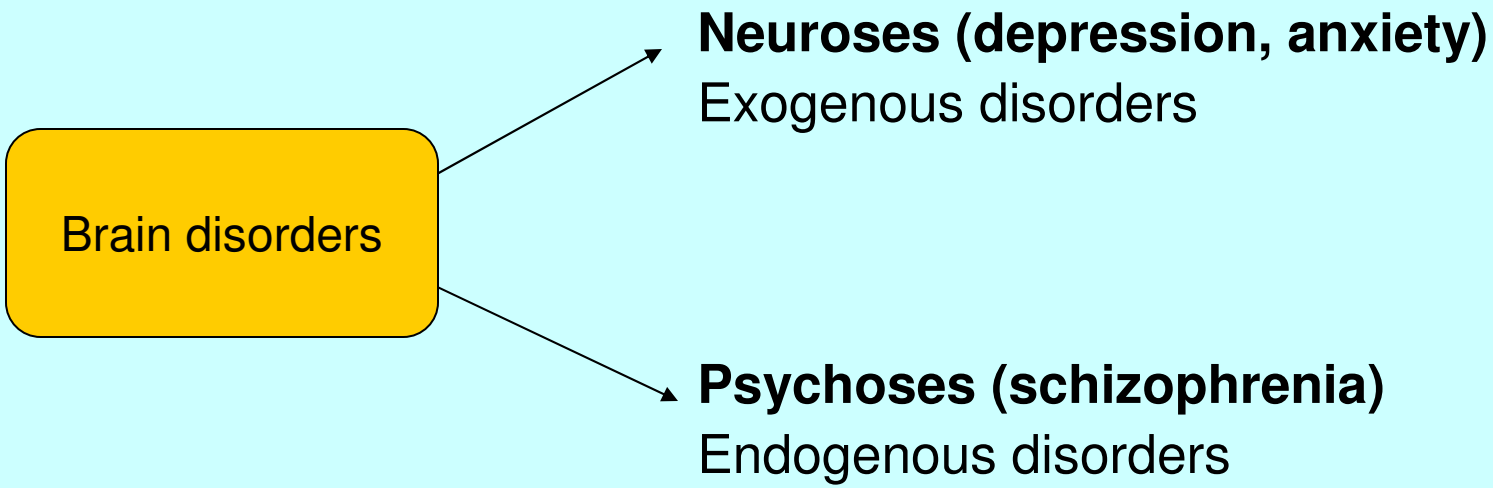
In the sixth edition (1899), he first made the distinction between manic-depressive psychosis and dementia praecox, now called schizophrenia

Believed that manic-depressive disorders and melancholia (depression) were exogenous and thus were treatable, while dementia praecox fell among the endogenous, incurable illnesses (attributed to organic changes in the brain)

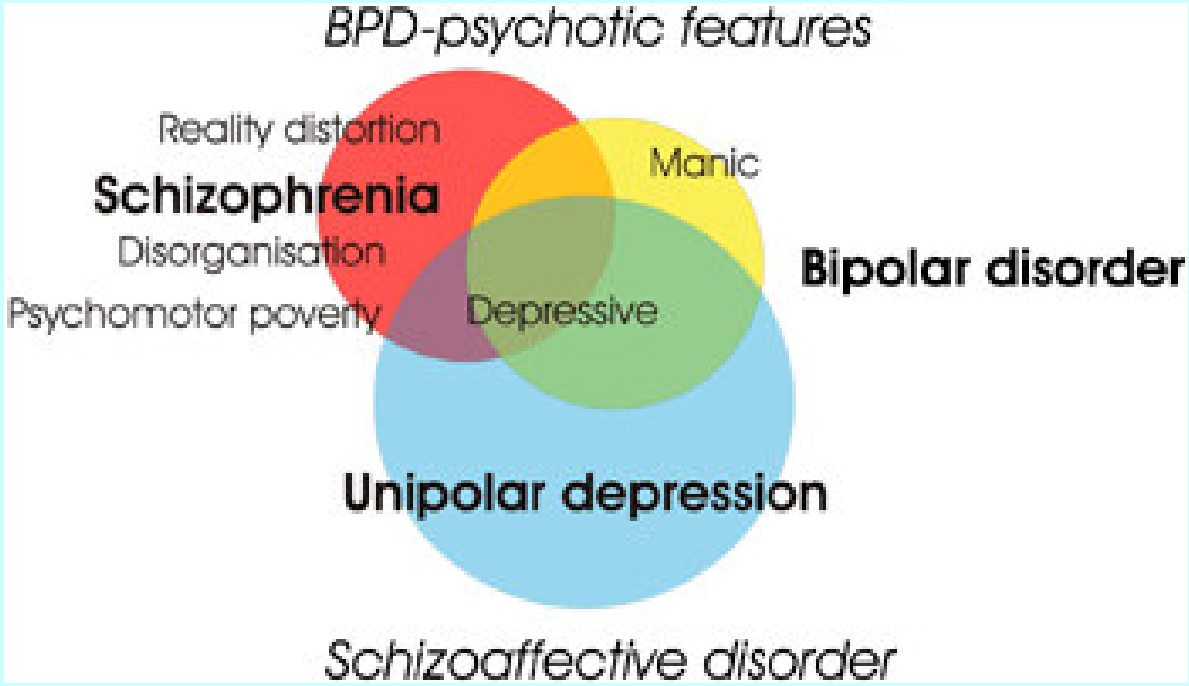
Kraepelin moved to the University of Munich in 1903 and remained there until 1922, when he became director of the Research Institute of Psychiatry in the same city

Throughout his career, he continued to refine his classification and was working on the ninth edition of his textbook when he died

Kraepelinian Dichotomy: 1899



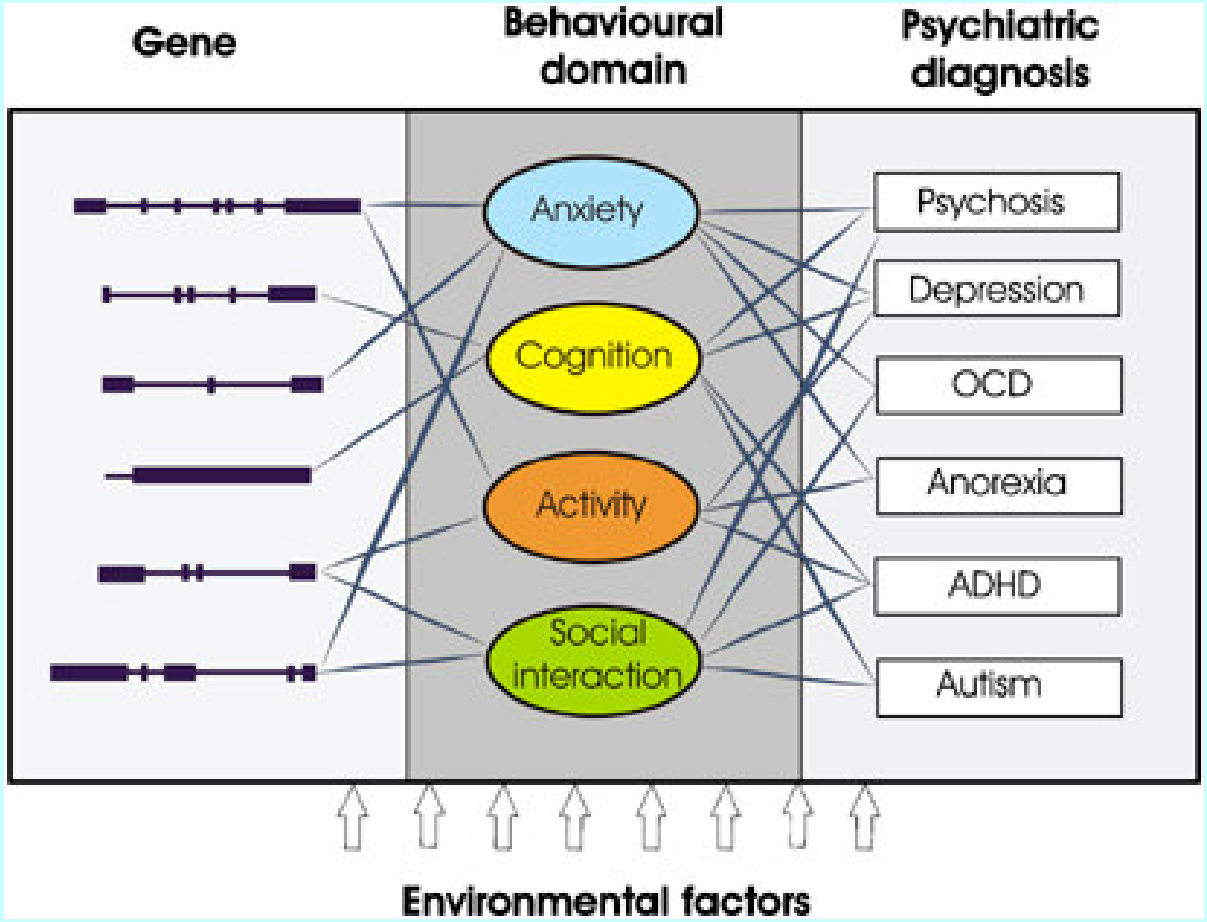
Overlap between neuroses and psychoses



BPD = bipolar disorder

Kas et al., 2008

The behavioural domain concept across psychiatric diagnosis



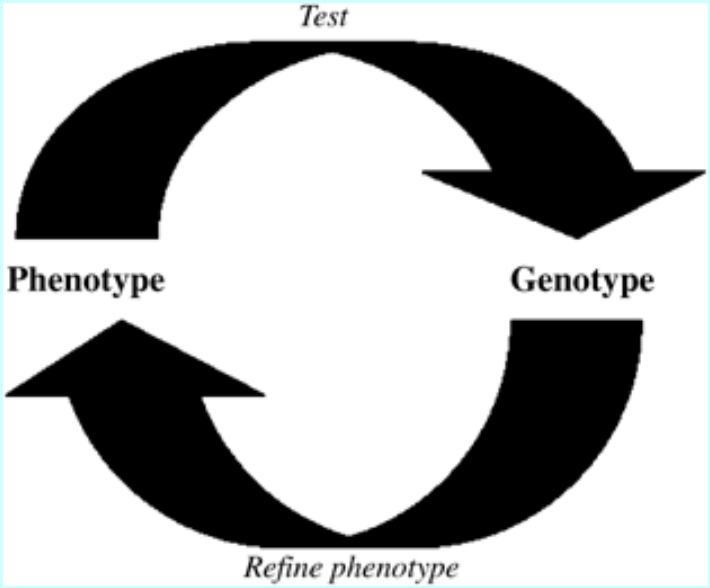
Kas et al., 2008

Trans-species genetics of specific endophenotypes

Domain	*Endophenotype*	*Rodents*	*Human*	*Psychiatric diagnosis*
Cognitive function	Attentional set shifting/perceptual rigidity	Food burying, multidimensional visual stimuli	WCST, CatBat task, Haptic Illusion task; intra-extra dimensional set-shifting	Eating disorders, schizophrenia
	Episodic or 'episodic-like' memory	Delayed matching to place; three trial object exploration task	Weschler memory scale, Rey verbal learning tests	Schizophrenia
	Working memory	Morris water maze, radial arm maze	N-back, reverse digit span	Schizophrenia
	Attention/(impulsivity)	5-choice serial reaction time task, delayed-reinforcement paradigms	Barrett impulsivity scale, sensation-seeking scales, Go/No-Go task; delay discounting task; Stroop colour word test	Eating disorders, ADHD
	Sustained attention	5-choice serial reaction time task	Continuous performance test; rapid visual information processing	Schizophrenia, ADHD
Activity	Baseline physical activity	Home cage monitoring	Acti-watches, observation, questionnaire measures	ADHD, anorexia nervosa
Appetitive motivation	Food anticipation activity	Starvation-induced hyperactivity	Behavioral approach (BAS) and behavioral inhibition (BIS) scales, Motivational Trait Questionnaire, Chapman Social and Physical Anhedonia Questionnaire	Depression, eating disorders
Social interaction	Social recognition/social discrimination	Resident mice versus social intruder	Social responsiveness/communication, theory of mind, facial recognition	Autism, schizophrenia

Kas et al., 2008

An iterative approach to psychiatric genetics



Some starting clinical phenotype must be chosen (e.g., a DSMIV category)

Positive genetic association signals can be used to define the optimal phenotype, which can be used in studies of independent samples

The procedure can be repeated to refine the genotype–phenotype relationship and identify biologically valid phenotypic sets

Craddock et al., 2006

Intrinsic vs. extrinsic motivation

- **Intrinsic motivation** occurs when people are internally motivated to do something because it either brings them pleasure, they think it is important, or they feel that what they are learning is significant.

- **Extrinsic motivation** comes into play when a student is compelled to do something or act a certain way because of factors external to him or her (like money or good grades).

Motivation definitions

- internal state or condition that activates behavior and gives it direction
- desire or want that energizes and directs goal-oriented behavior
- influence of needs and desires on the intensity and direction of behavior
- Franken (1994) provides an additional component in his definition: the arousal, direction, and persistence of behavior

Huitt, 2001

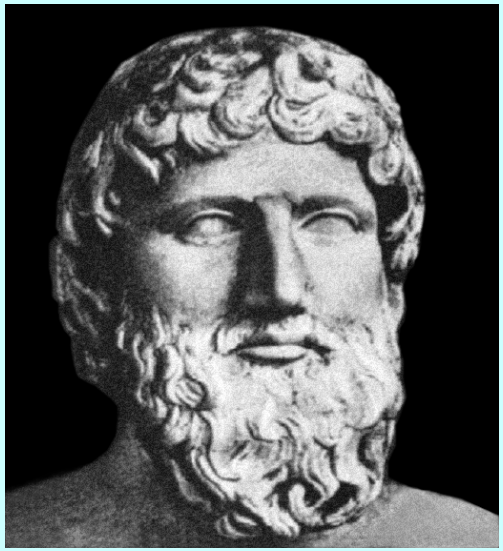
Examples of drives

Psychobiology of drives
- Instincts
- Drive theory
- Appetite and thirst
- Sex
- Sleep

Regulation of behavior
- Rewards and incentives
- Punishment
- Aggression
- Stress
- Exercise

Social and self-regulation
- Affiliation
- Altruism

Controlling motivation
- Drugs



Theories of motivation

Behavioral

- Classical conditioning states that biological responses to associated stimuli energize and direct behavior
- Operant learning states the primary factor is consequences: the application of reinforcers provides incentives to increase behavior; the application of punishers provides disincentives that result in a decrease in behavior

Theories of motivation

Cognitive

- Trace their roots to the information processing approach to learning.
- Focus on the categories and labels people use help to identify thoughts, emotions, dispositions, and behaviors
- E.g., cognitive dissonance theory (Festinger, 1957): when there is a discrepancy between two beliefs, two actions, or between a belief and an action, we will act to resolve conflict and discrepancies.

Theories of motivation

- Attribution theory (Heider, 1958; Weiner, 1974). This theory proposes that every individual tries to explain success or failure of self and others by offering certain "attributions." These attributions are either internal or external and are either under control or not under control.

- In a teaching/learning environment, it is important to assist the learner to develop a self-attribution explanation of effort (internal, control). If the person has an attribution of ability (internal, no control) as soon as the individual experiences some difficulties in the learning process, he or she will decrease appropriate learning behavior (e.g., I'm not good at this).
- If the person has an external attribution, then nothing the person can do will help that individual in a learning situation (i.e., responsibility for demonstrating what has been learned is completely outside the person). In this case, there is nothing to be done by the individual when learning problems occur.

Expectancy theory (Vroom, 1964)

- **Motivation = Perceived Probability of Success (Expectancy) * onnection of Success and Reward (Instrumentality) * Value of Obtaining Goal (Valance, Value)**

Sources of Motivational Needs

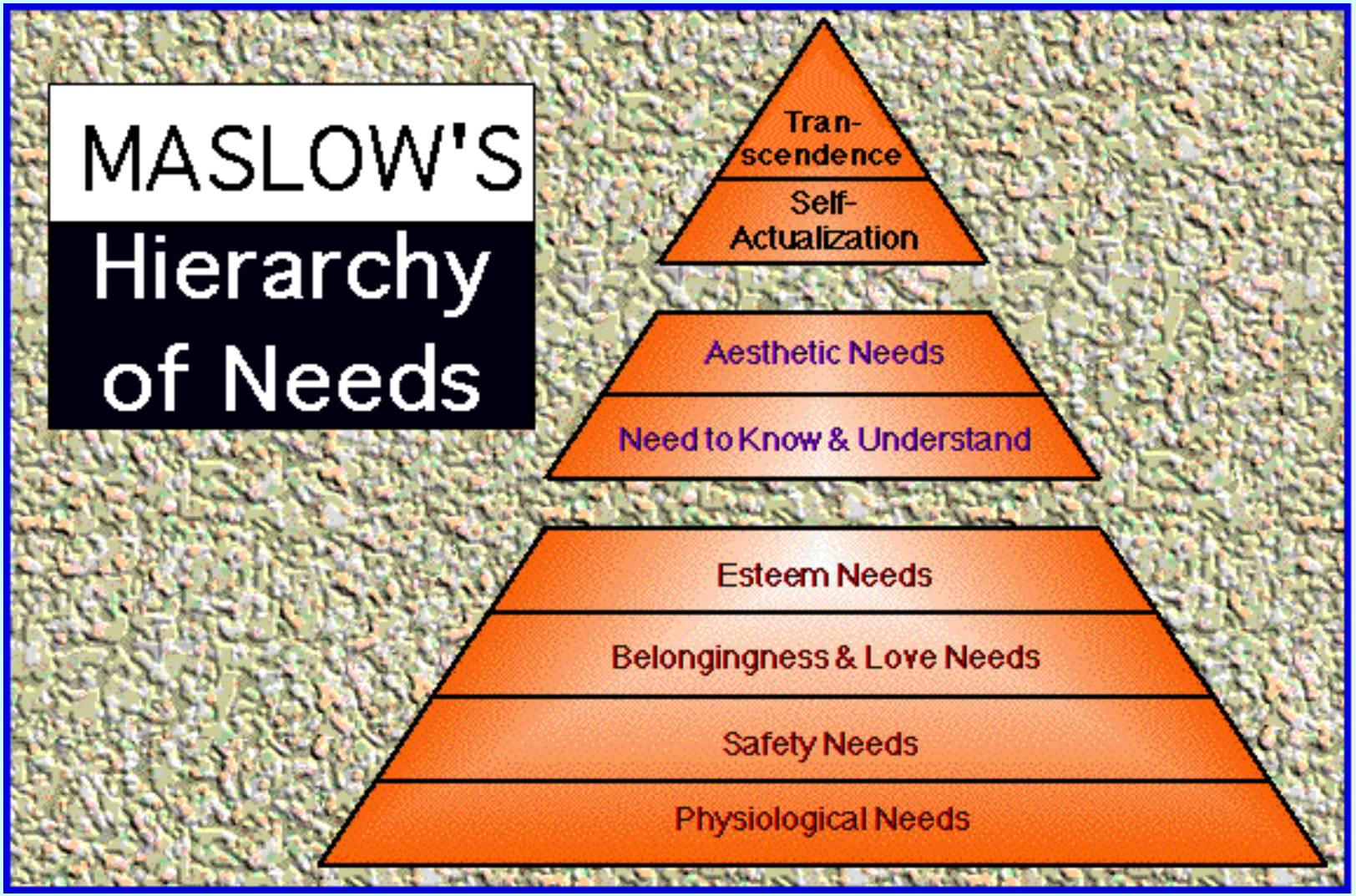
Behavioral/external	•elicited by stimulus associated/connected to innately connected stimulus •obtain desired, pleasant consequences (rewards) or escape/avoid undesired, unpleasant consequences
Social	•imitate positive models •be a part of a group or a valued member
Biological	•increase/decrease stimulation (arousal) •activate senses (taste, touch, smell, etc. •decrease hunger, thirst, discomfort, etc. •maintain homeostasis, balance
Cognitive	•maintain attention to something interesting or threatening •develop meaning or understanding •increase/decrease cognitive disequilibrium; uncertainty •solve a problem or make a decision •figure something out •eliminate threat or risk

Huitt, 2001

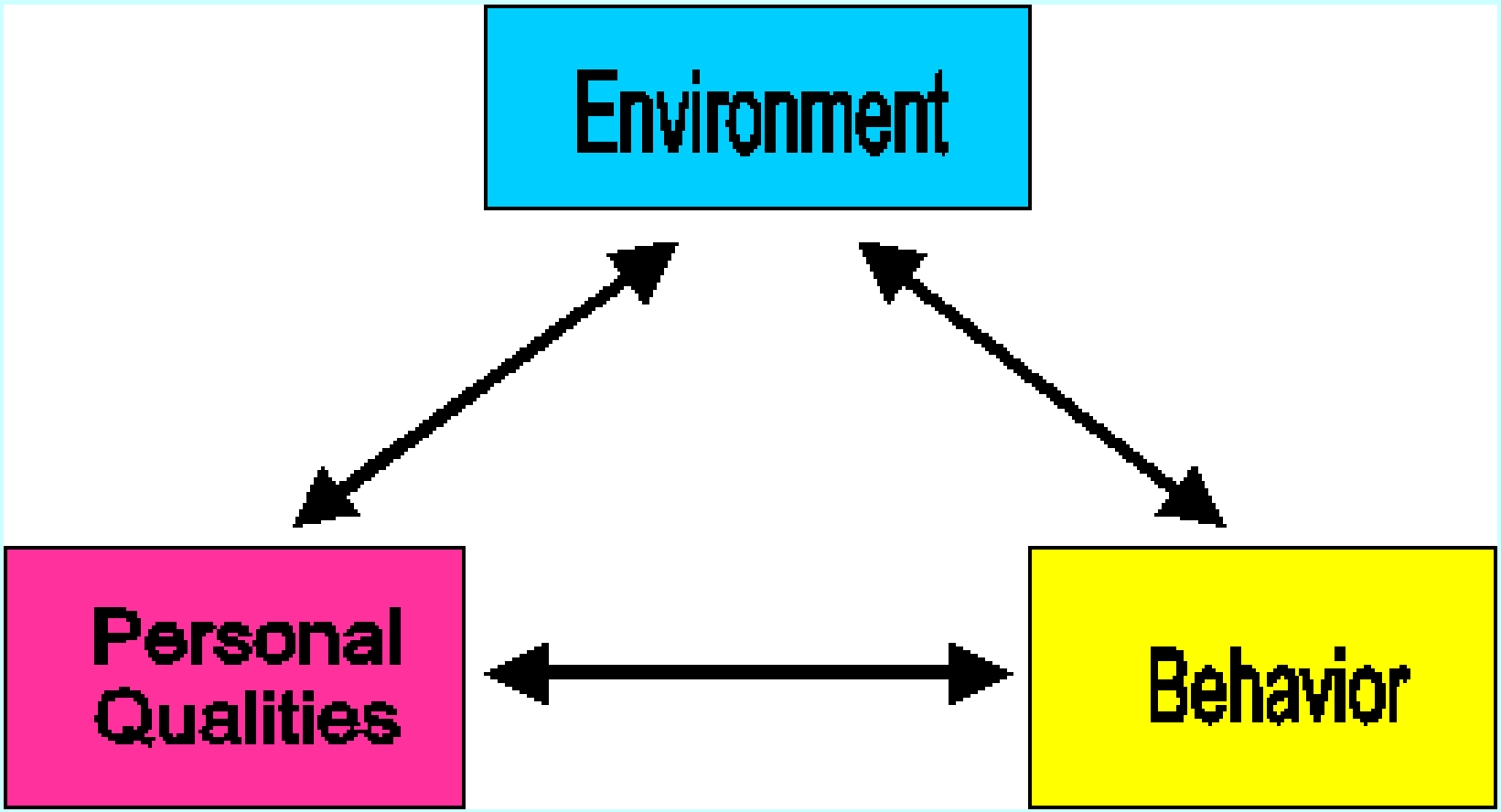
Sources of Motivational Needs

Affective	•increase/decrease affective dissonance •increase feeling good •decrease feeling bad •increase security of or decrease threats to self-esteem •maintain levels of optimism and enthusiasm
Conative	•meet individually developed/selected goal •obtain personal dream •develop or maintain self-efficacy •take control of one's life •eliminate threats to meeting goal, obtaining dream •reduce others' control of one's life
Spiritual	•understand purpose of one's life •connect self to ultimate unknowns

Huitt, 2001

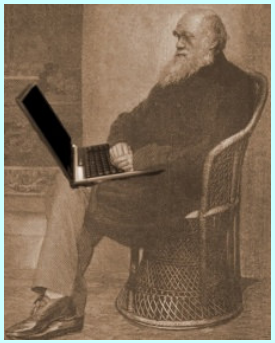

MASLOW'S
Hierarchy
of Needs
Tran-
scendence
Self-
Actualization
Aesthetic Needs
Need to Know & Understand
Esteem Needs
Belongingness & Love Needs
Safety Needs
Physiological Needs

Maslow, 1971



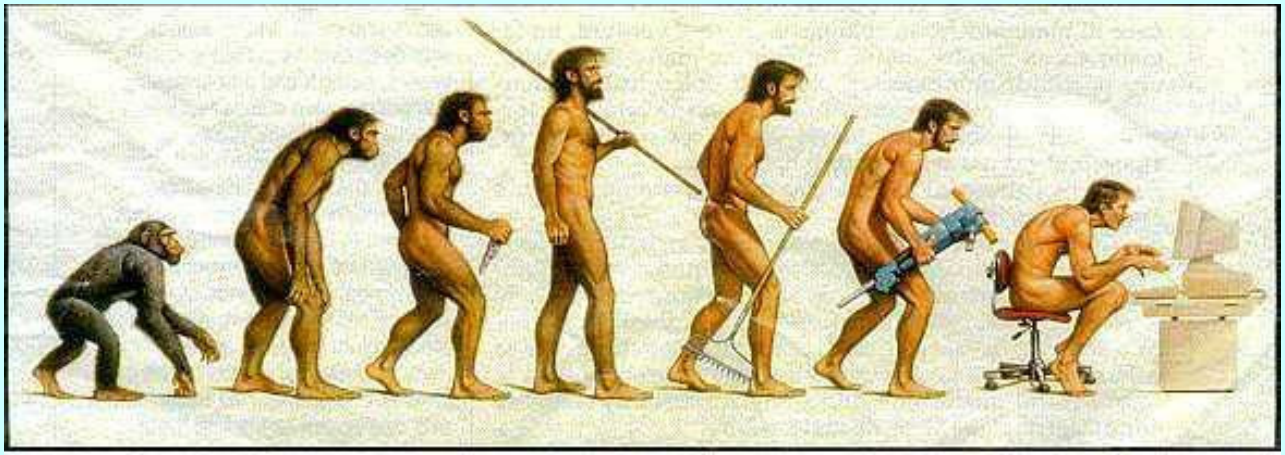
Huitt, 2001

Darwinian (evolutionary) medicine



Nothing in standard field
or laboratory biology makes sense
except in the light of evolution

Theodoris Dobzhansky (1900-1975)



Lewis, 2008

Darwinian medicine

- Mental illnesses may be beneficial
- Save from dangers
- Preserved by natural selection
- Can “cure” each other?

Darwinian (evolutionary) medicine

Tries to find evolutionary explanations for vulnerabilities to disease, since every trait needs an evolutionary explanation

Does not seek evolutionary explanations for disease itself, and does not usually try to understand why one individual becomes ill when another does not

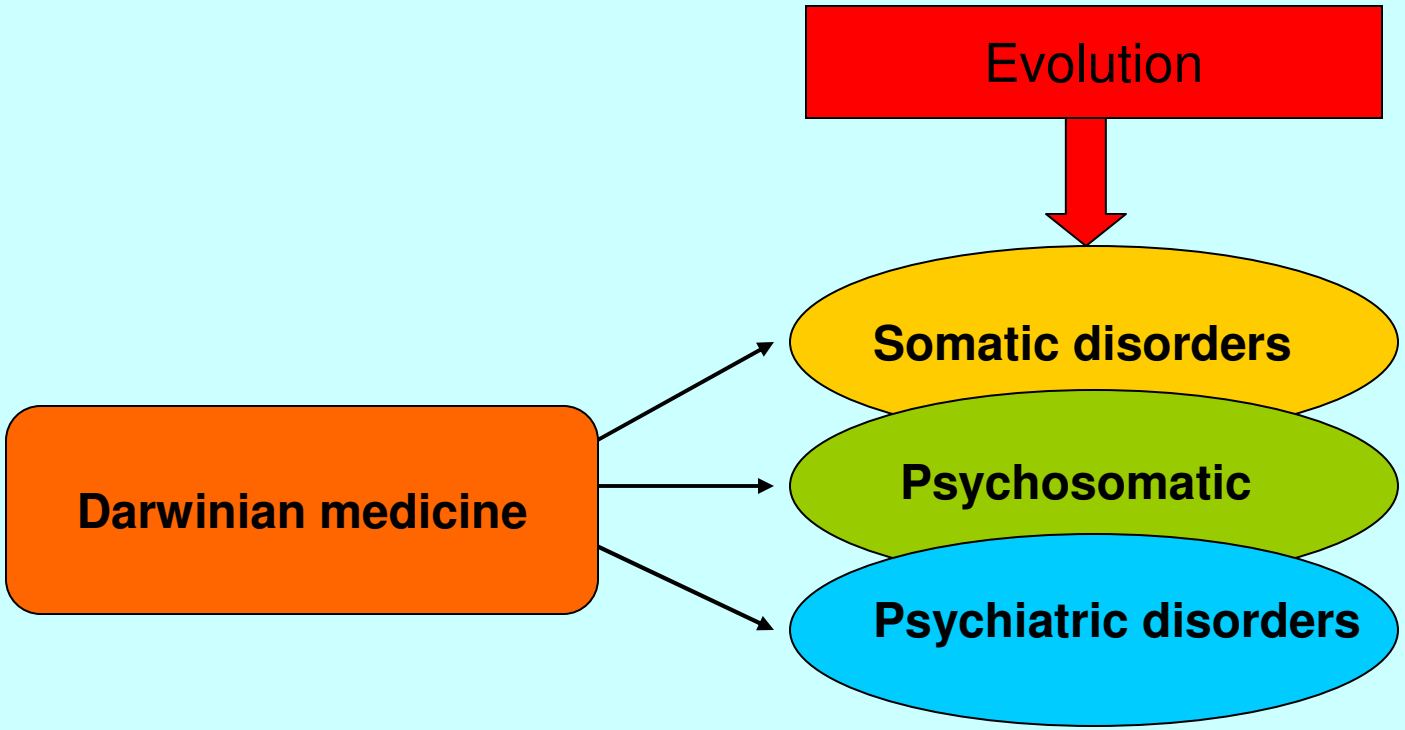
Instead, it tries to understand why all humans are vulnerable to each disease

It asks how it is possible that natural selection can shape the eye or heart or brain but cannot eliminate our vulnerabilities to nearsightedness, atherosclerosis, depression, or cancer

Applies the advances that have revolutionized evolutionary biology to the problems of medicine: defence systems, infection, novel environments, genes

R. Nesse

Darwinian medicine



Anti-psychiatry

- Mental illnesses do not exist
- Social labeling (not a medical problem)
- Poor live causes brain stress
- We do not need to study brain
- Brain is impossible to study

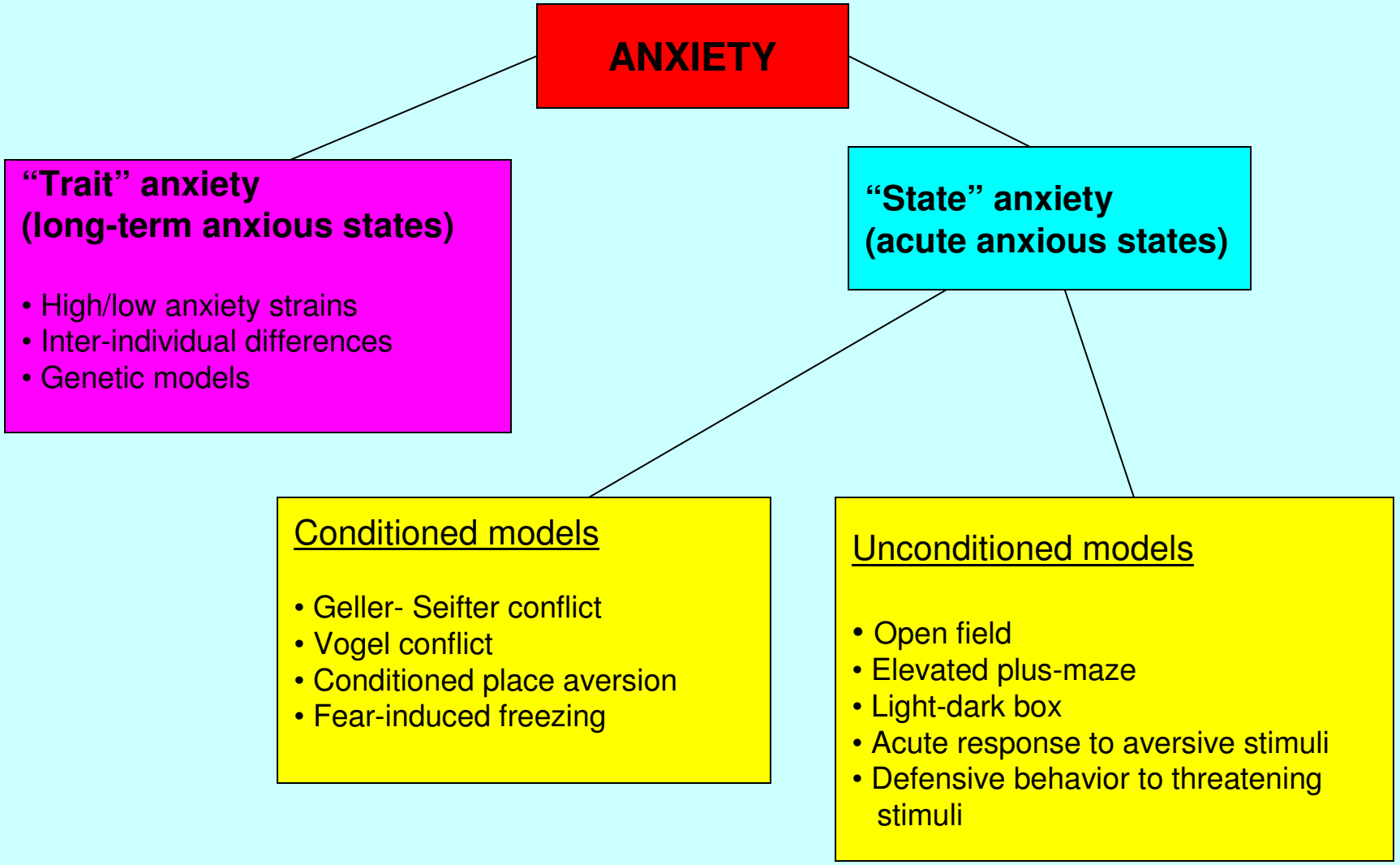
Anti-psychiatry coalition

A nonprofit volunteer group consisting of people who feel they have been harmed by psychiatry - and of their supporters

- Disorders do not exist
- Remove psychiatry from the list of medical professions
- Therapy kills
- Treatment is involuntary and therefore cruel
- “Brain butchery” (e.g., ECT) and “brain washing”
- Big money (e.g., companies) vs. small people
- Unethical doctors

http://www.antipsychiatry.org/

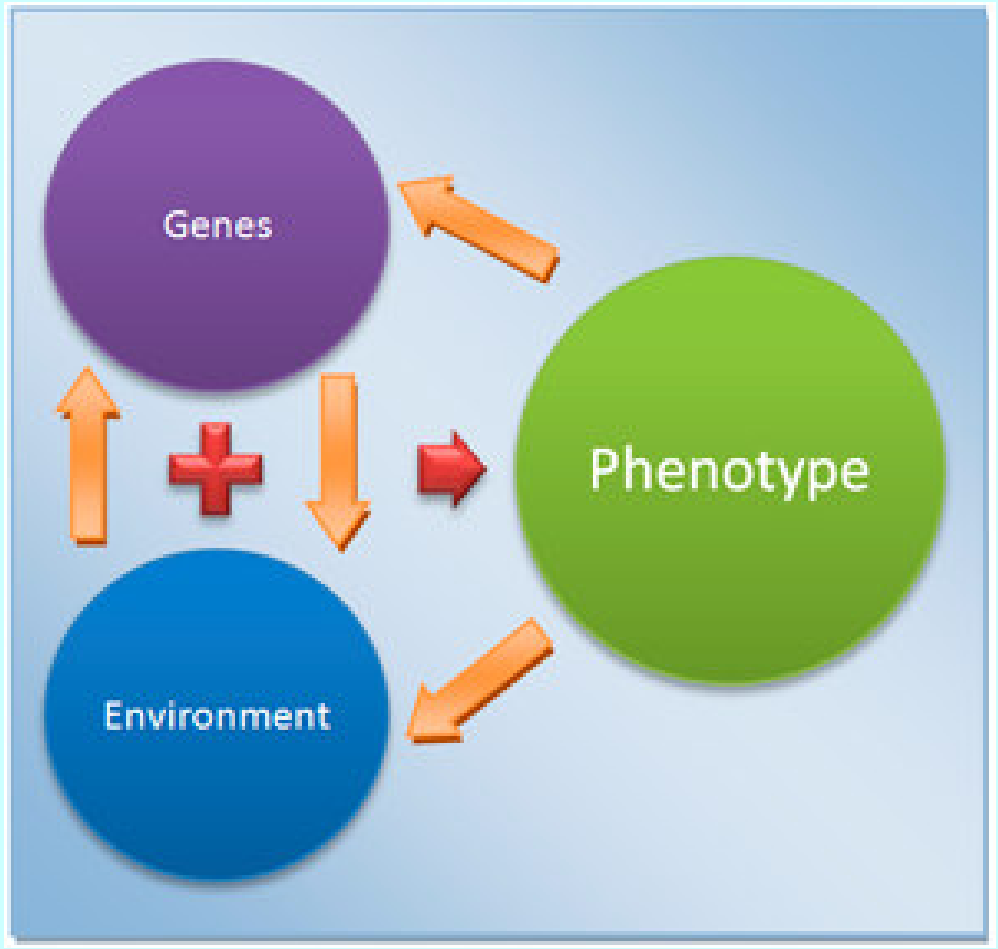
“Trait” vs. “state” anxiety



Voikar, 2006

Cross-species animal models

Gene x environment interactions



Mice vs. Rats: Muricide

- A form of predatory behavior
- 70% of wild rats kill mice (Karli, 1956)
- Male and female rats equally likely to kill rats
- A sterotyped behavior
- Very rapid behavior, only a few seconds
- Rats usually bite the back
  - 89% on spinal cord
  - 7% on the belly
  - 4% on the head
- All rats consumed at least part of the mice they killed (usually the brain, thoracic, and abdominal viscera)
- More likely to occur at night than during daytime
- Occurs more often when rats are hungry

Mouse response to a rat

- Rat odor stresses mice; it affects their behavior/ reproduction. Used to study anxiety or anti-predator behavior in mice

- Domestic and wild-stock mice flee from rats. If prevented they show boxing or biting behaviors

- Mice housed in same room as rats are more stressed. Mice who smell rat urine have 10x the latency to start eating a treat

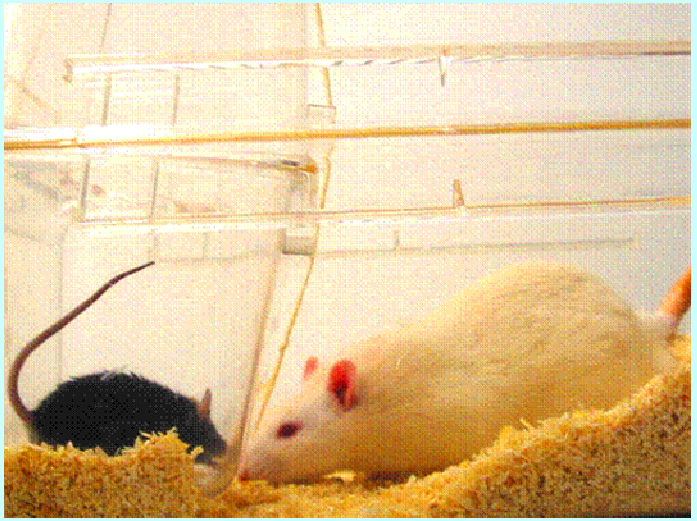
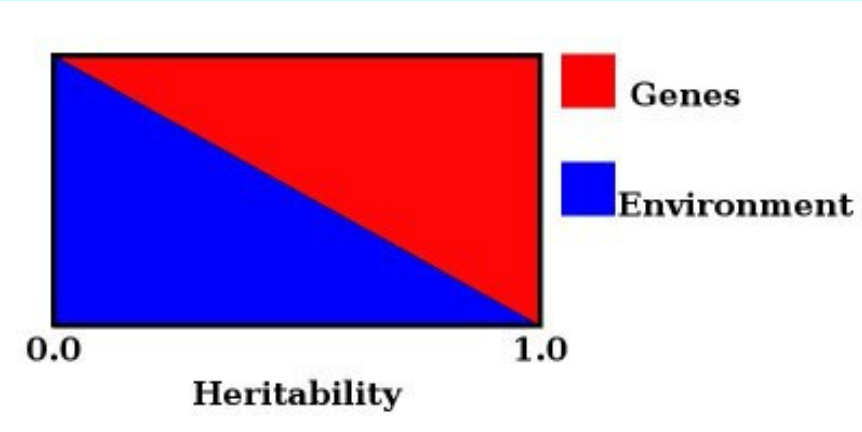
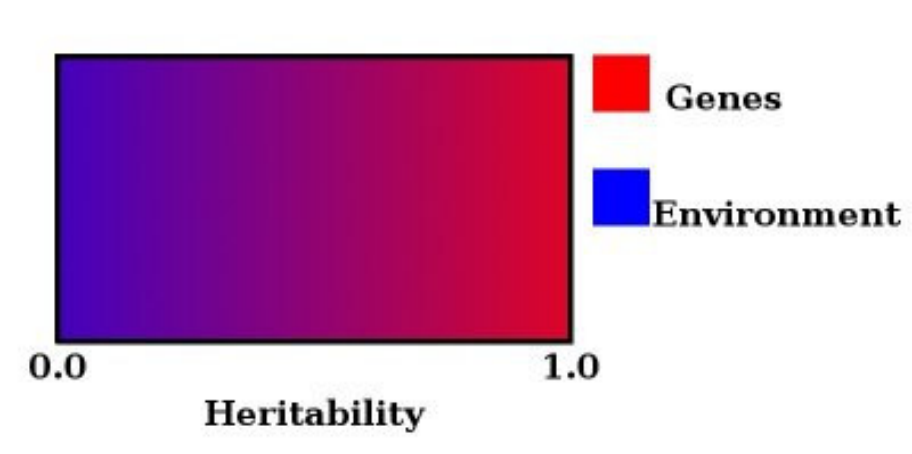


Photo: Strekalova, 2008

G x E perspectives today

An enhanced understanding of the *interplay* between genetic and environmental factors.






We've run out of lab rats, Henderson... Put this on and come with us.
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