

Why We Get Sad: How Evolution Makes Sense of Emotional Disorders

*How understanding evolution
made me a better psychiatrist*

Randolph Nesse

 **Center for
Evolution & Medicine**

A R I Z O N A S T A T E U N I V E R S I T Y

Our shared vision: A Genuinely Medical Model for Psychiatry

- Evolution provides for psychiatry what physiology offers the rest of medicine

Effective but deep problems

- Diagnosis in disarray
- Massive comorbidity
- Huge prevalence
- Cannot find brain lesions
- Cannot find genes for genetic diseases
- No breakthroughs in causes or treatment

Fragmenting Schemas

- Brain disorders → Drug treatment
- Early conflicts → Psychoanalysis
- Distorted thinking → CBT
- Faulty learning → Behavior Tx
- Relationship problems → IPT, PT

George Engel, Science, 1961

At a recent conference on psychiatric education, many psychiatrists seemed to be saying to medicine, "Please take us back and we will never again deviate from the 'medical model.'" For, as one critical psychiatrist put it, "Psychiatry has become a hodgepodge of unscientific opinions, assorted philosophies and 'schools of thought,' mixed metaphors, role diffusion, propaganda, and politicking for 'mental health' and other esoteric goals." In contrast, the rest of medicine appears neat and tidy. It has a firm base in the biological sciences, enormous technologic resources at its command, and a record of astonishing achievement in elucidating mechanisms of disease and devising new treatments. It would seem that psychiatry would do well to emulate its sister medical disciplines by finally embracing once and for all the medical model of disease.

+50 years: Thomas Insel, 2011

“Whatever we’ve been doing for five decades, it ain’t working...When I look at the numbers—the number of suicides, the number of disabilities, the mortality data—it’s abysmal, and it’s not getting any better. Maybe we just need to rethink this whole approach...With no validated biomarkers and too little in the way of novel medical treatments since 1980... it is time to rethink mental disorders.”

Engel in 1961 continued...

But I do not accept such a premise. Rather, I contend that all medicine is in crisis and, further, that medicine's crisis derives from the same basic fault as psychiatry's, namely, adherence to a model of disease no longer adequate for the scientific tasks and social responsibilities of either medicine or psychiatry.

The BioPsychoSocial Model

- Advocated by many
- Followed by few
- Eclipsed by a “medical model” that seeks specific diseases, each with a specific cause

Evolutionary Medicine

Applies the basic science of evolutionary biology to medicine

Integrates Bio Psycho & Social

**Medicine &
Public Health**

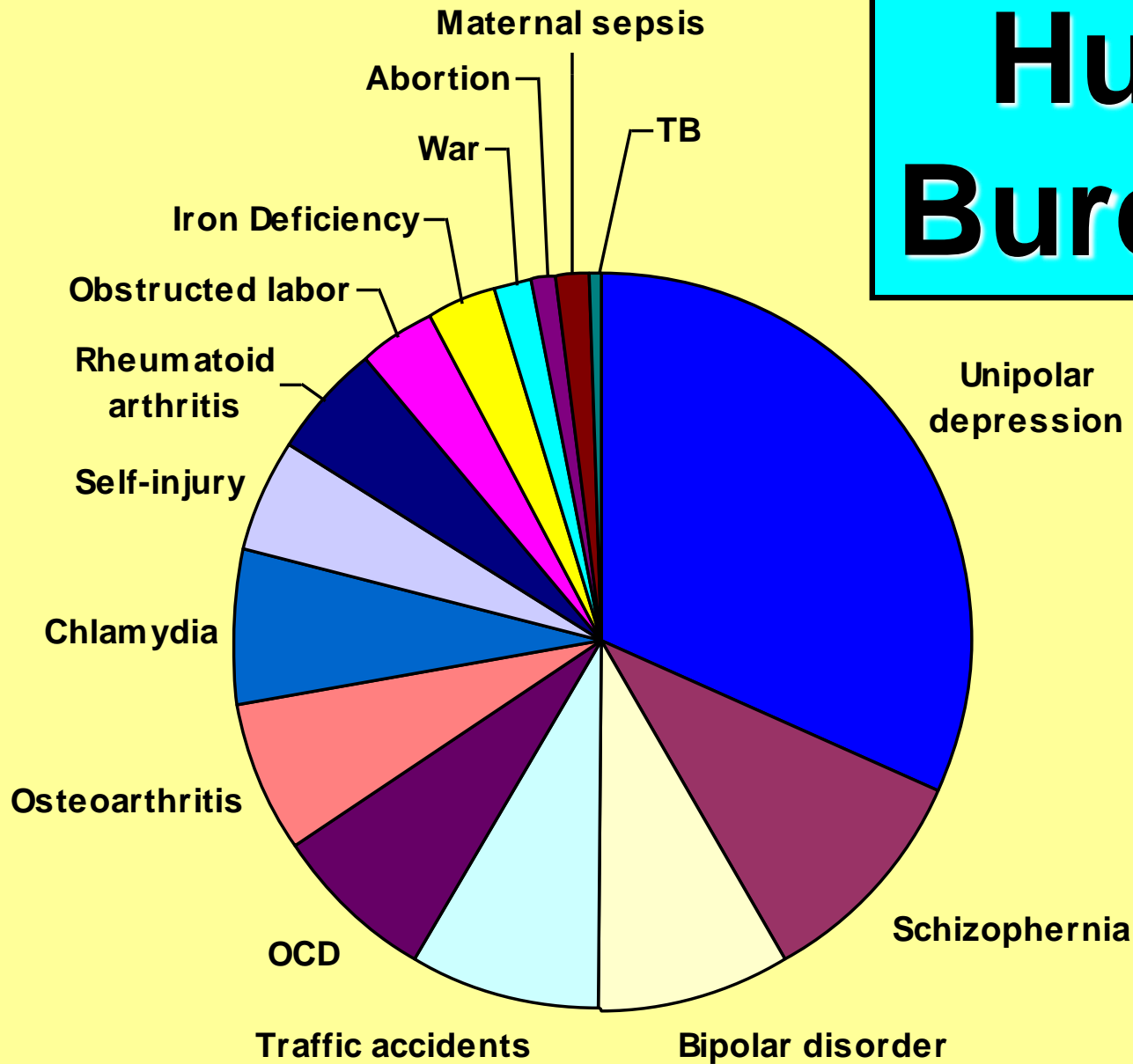
The diagram consists of three overlapping ovals on a dark blue background. The top oval is yellow and contains the text 'Medicine & Public Health'. The bottom-left oval is cyan and contains the text 'Evolutionary Biology'. The bottom-right oval is light blue and contains the text 'Evolutionary Medicine'. The intersection of the yellow and cyan ovals is shaded light green. The intersection of the yellow and light blue ovals is shaded light purple. The intersection of the cyan and light blue ovals is shaded light blue. The central intersection of all three ovals is shaded a darker blue.

Evolutionary Medicine

Evolutionary Biology

The Core Mystery:
If natural selection is
so powerful, why isn't
the body better?

Huge Burden



WHO 15 leading DALYs for women 18-45 in developed countries



If the immediate and direct purpose of our life is not suffering, then our existence is the most ill-adapted to its purpose in the world.

Schopenhauer, 1851

Why are we vulnerable?

- Cancer
- Atherosclerosis
- Alzheimer's disease
- Schizophrenia
- Anorexia
- Anxiety
- Depression



Tinbergen's 4 Q, organized

Nesse, 2002, *TREE*, 2013

	<u>Proximate</u>	<u>Evolutionary</u>
<u>Transition over time</u>	Ontogeny	Phylogeny
<u>Cross section</u>	Mechanism	Selective Advantage

Evol. can explain maladaptation & adaptation

6 Reasons For Vulnerability

1. Constraints on natural selection
2. Mismatch: body in a novel environment
3. Co-evolution with pathogens
4. Trade-offs prevent perfection
5. Reproductive success at a cost to health
6. **Defenses and suffering are adaptations**

Defenses vs. Defects

■ Defects

- ◆ Seizures
- ◆ Cancer
- ◆ Paralysis
- ◆ Jaundice
- ◆ Injury

■ Defenses

- ◆ Fever
- ◆ Cough
- ◆ Pain
- ◆ Fatigue
- ◆ Anxiety

Emotions are defenses, not diseases

- The Fundamental Mistake
 - ◆ Makes diagnosis confusing
 - ◆ Not a medical model

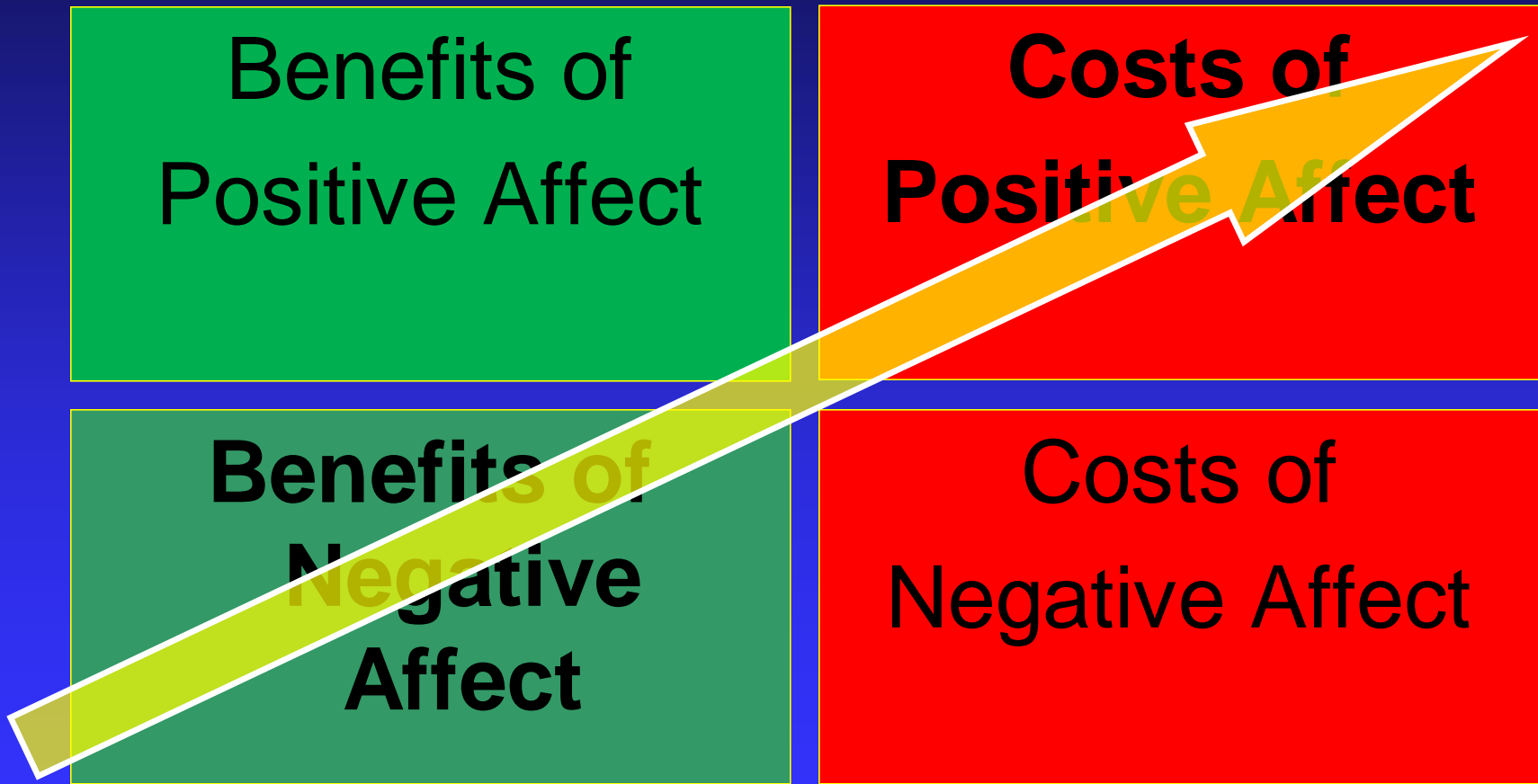
Diagonal Psychology

Benefits of
Positive Affect

Costs of
Positive Affect

Benefits of
Negative Affect

Costs of
Negative Affect



Emotions theory is crucial for understanding mental disorders, but neglected.

Why?

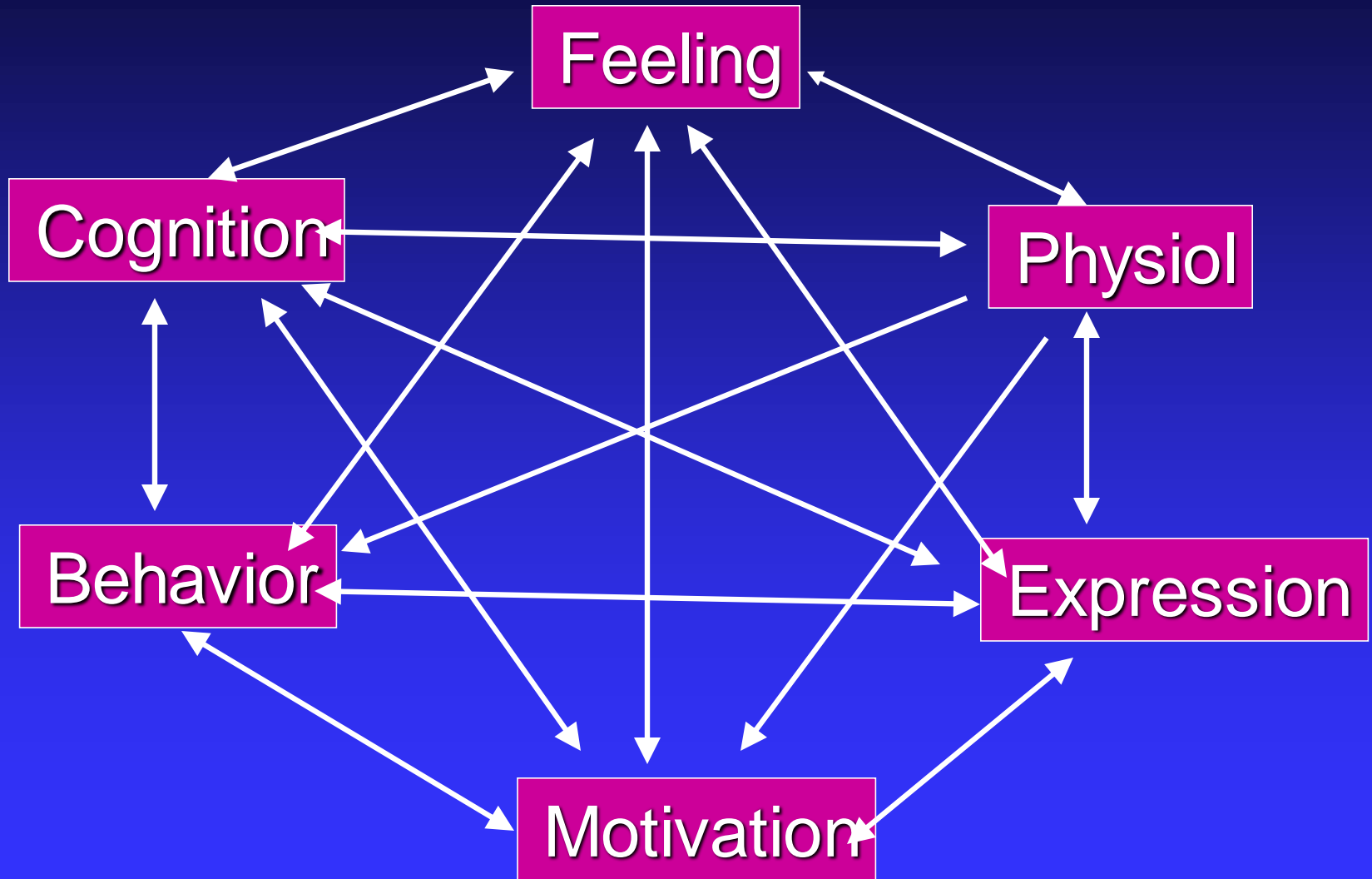
Interminable debates

- Definition
- Aspects
- Structure: Dimensions vs. Basic
- Regulation: innate, learned, appraisal
- Does each emotion have a function?

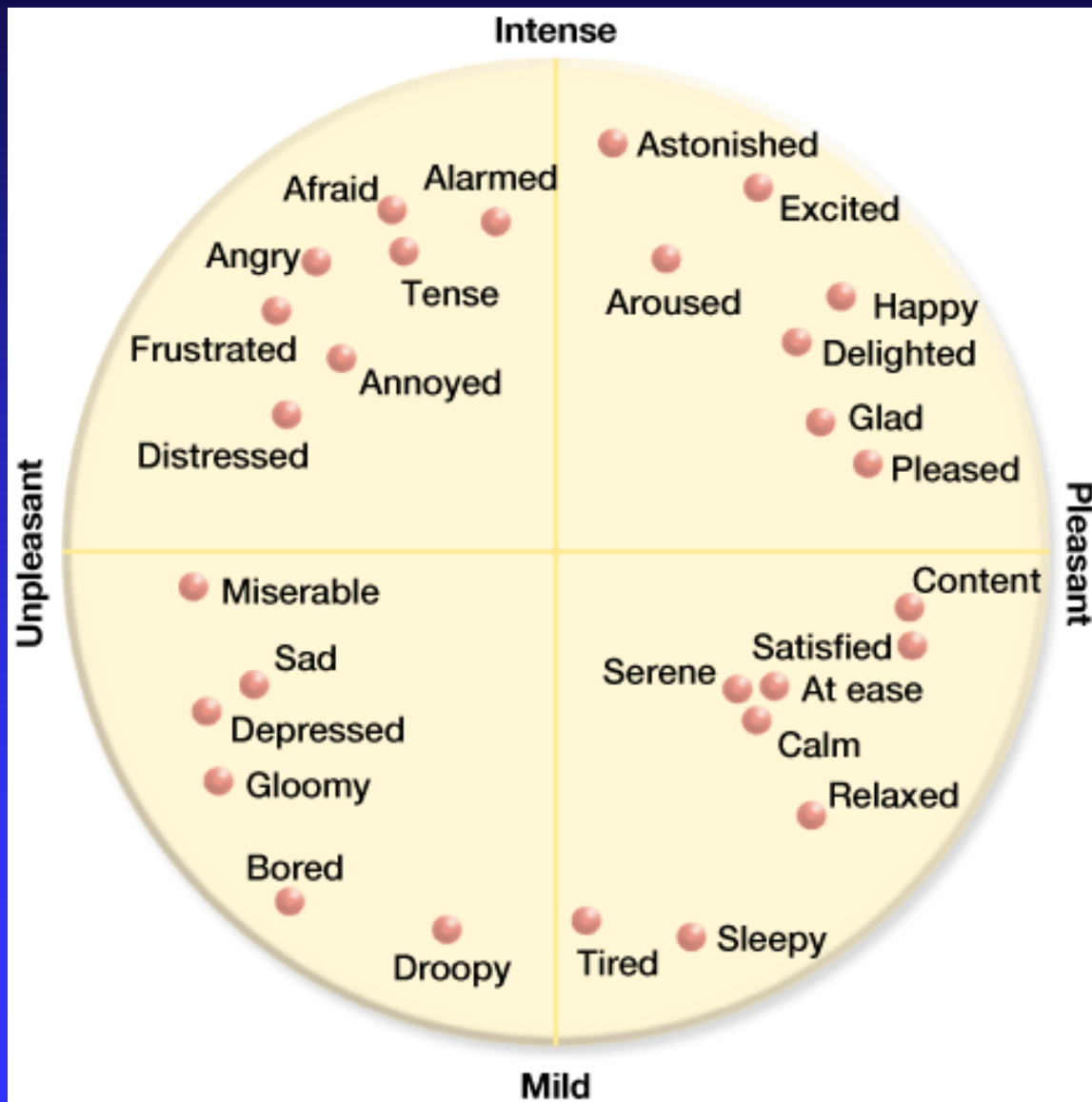
What is emotion?

- 92 definitions (Kleinginna & Kleinginna, 1981)
- *What Is an Emotion?* Robert Solomon
- *What Is Emotion?* Jerome Kagan
- *What Emotions Really Are* Paul Griffiths
- *The Nature of Emotion* Ekman & Davidson

Aspects of Emotions



Dimensions



Basic Emotions... How Many?

Ortony and Turner 1990

Ekman, Friesen, and Ellsworth

Anger, disgust, fear, joy, sadness, surprise

Frijda

Desire, happiness, interest, surprise, wonder, sorrow

Gray

Rage and terror, anxiety, joy

Izard

Anger, contempt, disgust, distress, fear, guilt, interest, joy, shame, surprise

James

Fear, grief, love, rage

McDougall

Anger, disgust, elation, fear, subjection, tender-emotion, wonder

Mowrer

Pain, pleasure

Oatley and Johnson-Laird

Anger, disgust, anxiety, happiness, sadness

Panksepp

Expectancy, fear, rage, panic

Plutchik

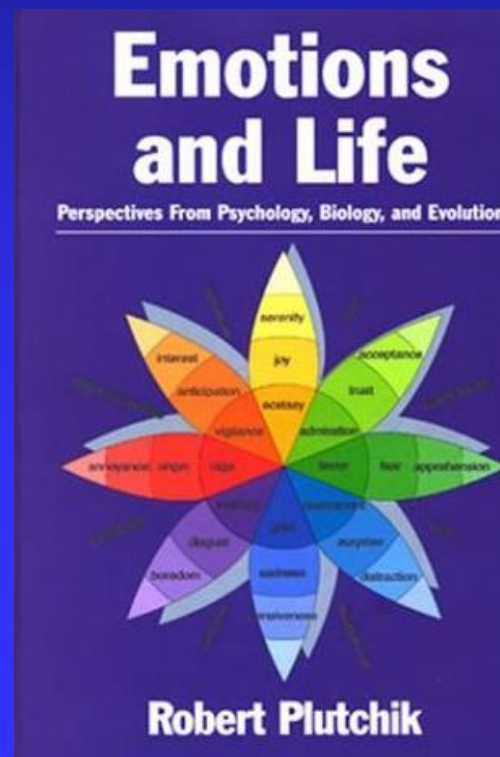
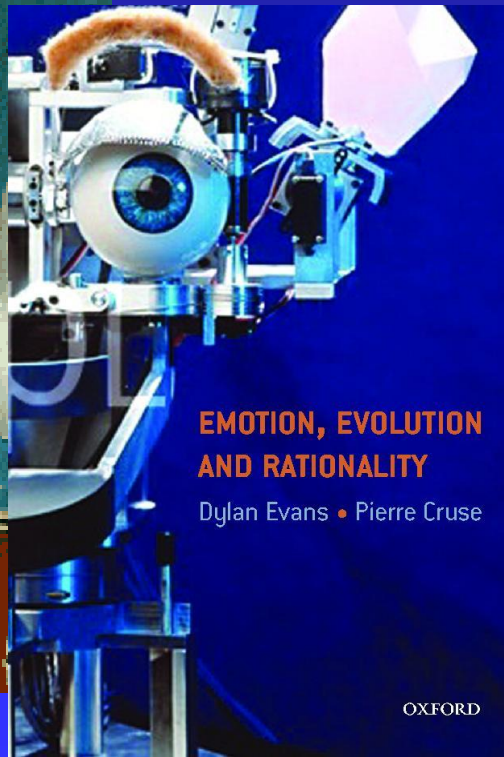
Acceptance, anger, anticipation, disgust, joy, fear, sadness, surprise

Tomkins

Anger, interest, contempt, disgust, distress, fear, joy, shame, surprise

Emotions aroused by studying emotions

Frustration!
Confusion!
Hopelessness...



Confusion is nothing new

As far as the scientific psychology of the emotions goes, I may have been surfeited by too much reading of classic works on the subject, but I should as lief read verbal descriptions of the shapes of the rocks on a New Hampshire farm as toil through them again. They give one nowhere a central point of view, or a deduction or general principle. They distinguish and refine and specify in infinitum, without ever getting on to another logical level.

William James, 1893

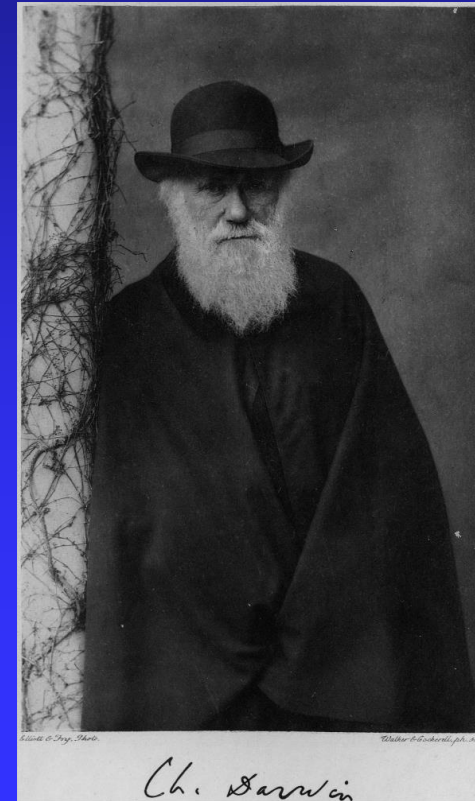
Evolution seems unhelpful

- Darwin's Expression of Emotions
- MacLean's Triune brain
- EvPsych's modularity
- Mapping functions to emotions

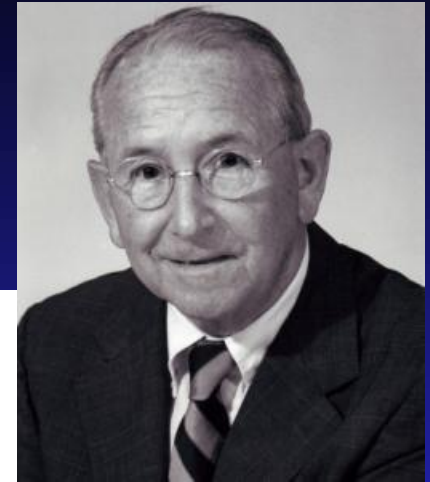
“Darwin’s Anti-Darwinism in *The Expression of Emotions in Man and Animals*”

Fridlund, 1992

- Mainly to challenge Bell’s theory by establishing continuity with animals
- All about communication
- Minimizes other functions



Triune brain



Survival Brain

- Reptilian

Emotional Brain

- Limbic

Thinking Brain

- Neo-cortex

Emotions not discrete modules

- Not fully separate states
- Do not correspond to specific brain loci
- Not domain specific

(Barrett, 2006)

Different emotions do not have different functions

- One emotion serves many functions
- One function effected by many emotions



Now what?

The Emotions: Not an Italian garden, but a wild tangled bank



Evolutionary Explanations of Emotions, Nesse, 1990



Love joins hate; aggression, fear; expansiveness, withdrawal, and so on; in blends designed not to promote the happiness of the individual, but to favor the maximum transmission of the controlling genes.

E. O. Wilson, 1975

21st century

Behavioral Ecological

AN EVOLUTIONARY APPROACH

1. How do emotions increase fitness?
2. How did different emotions evolve?
3. How were regulation mechanisms shaped?
4. Why are negative emotions excessive?
5. Why can emotions be so irrational?

1. HOW DO EMOTIONS INCREASE FITNESS?

- Individuals get an advantage if their behavior regulation systems shift into special modes to cope with recurring **situations.**
- Like sweating, shivering, pain

2. HOW DID DIFFERENT EMOTIONS EVOLVE?

- Partially differentiated from precursor emotions to cope with different situations

It's the Situation!

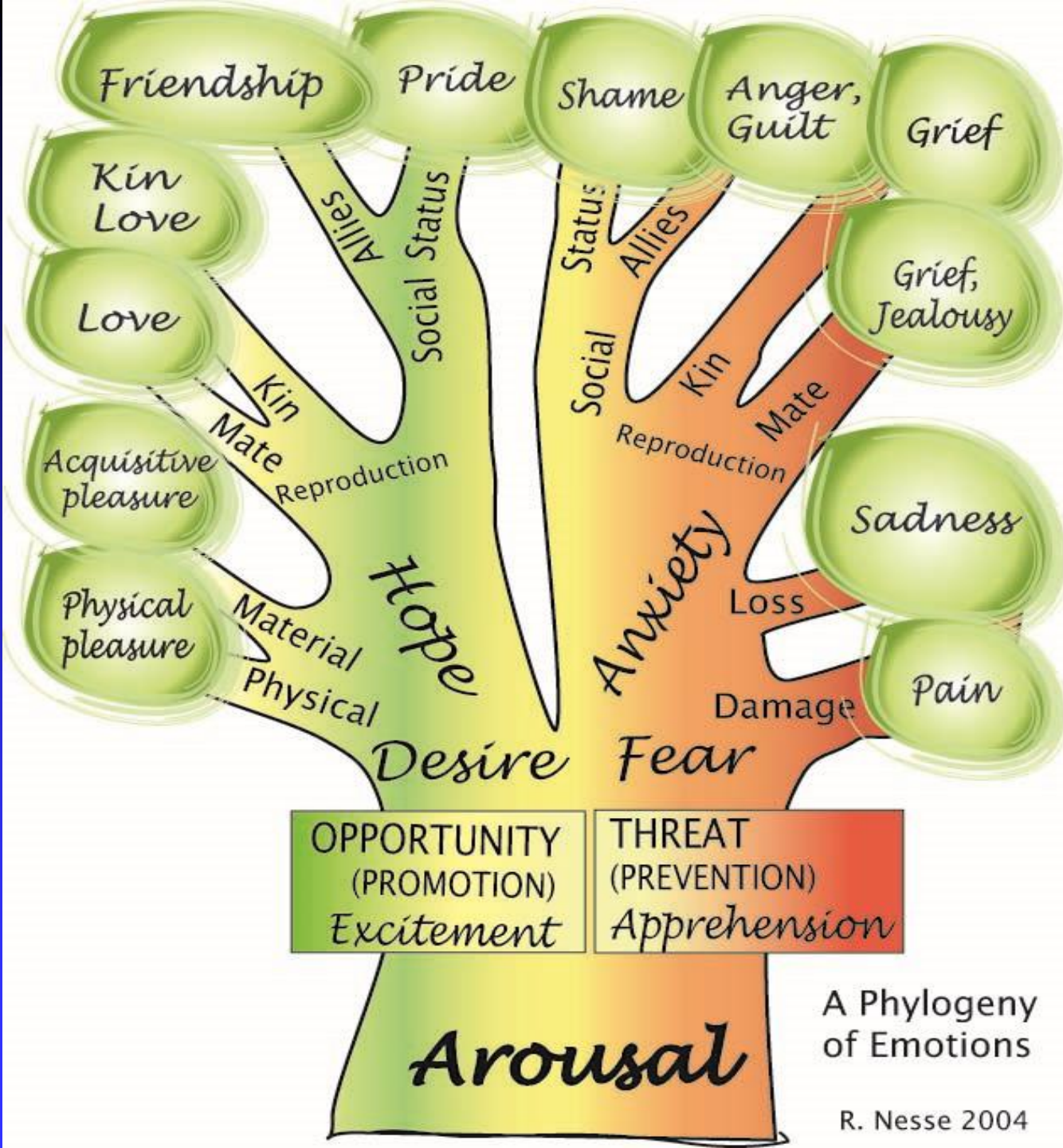
shaped to cope with

Responses ← Situations

- Sweating ← Heat
- Cough ← Foreign matter in bronchi
- Inflammation ← Infection
- Pain ← Tissue damage
- Anxiety ← Threat of loss
- Sadness ← Loss
- Jealousy ← Threat of loss of mate

What situations?

- Situations that have **recurred over evolutionary time and influenced fitness**
 - ◆ Simple cues: e.g. looming threat
 - ◆ Situations that arise in goal pursuit
 - ◆ Situations involving social life



A Phylogeny of Emotions

R. Nesse 2004

Emotions correspond to situations (Not functions or brain loci)

Overlapping fuzzy boundaries

No distinct set of basic emotions

Emotions for the Situations that Arise in Pursuing Goals

	Before	After success	After failure
Opportunity (Promotion)	Hope (desire)	Happiness (pleasure)	Disappointment
Threat (Prevention)	Anxiety (fear)	Relief	Sadness (pain)

Plato, Stoics, Cicero, Hume, et al.

3. HOW DID SELECTION SHAPE REGULATION MECHANISMS?

- Detect situation every way possible
 - ◆ Innate responses
 - ◆ Learned responses
 - ◆ Appraisal of meaning of information for ability to reach personal goals
- Response whenever Benefits > Costs

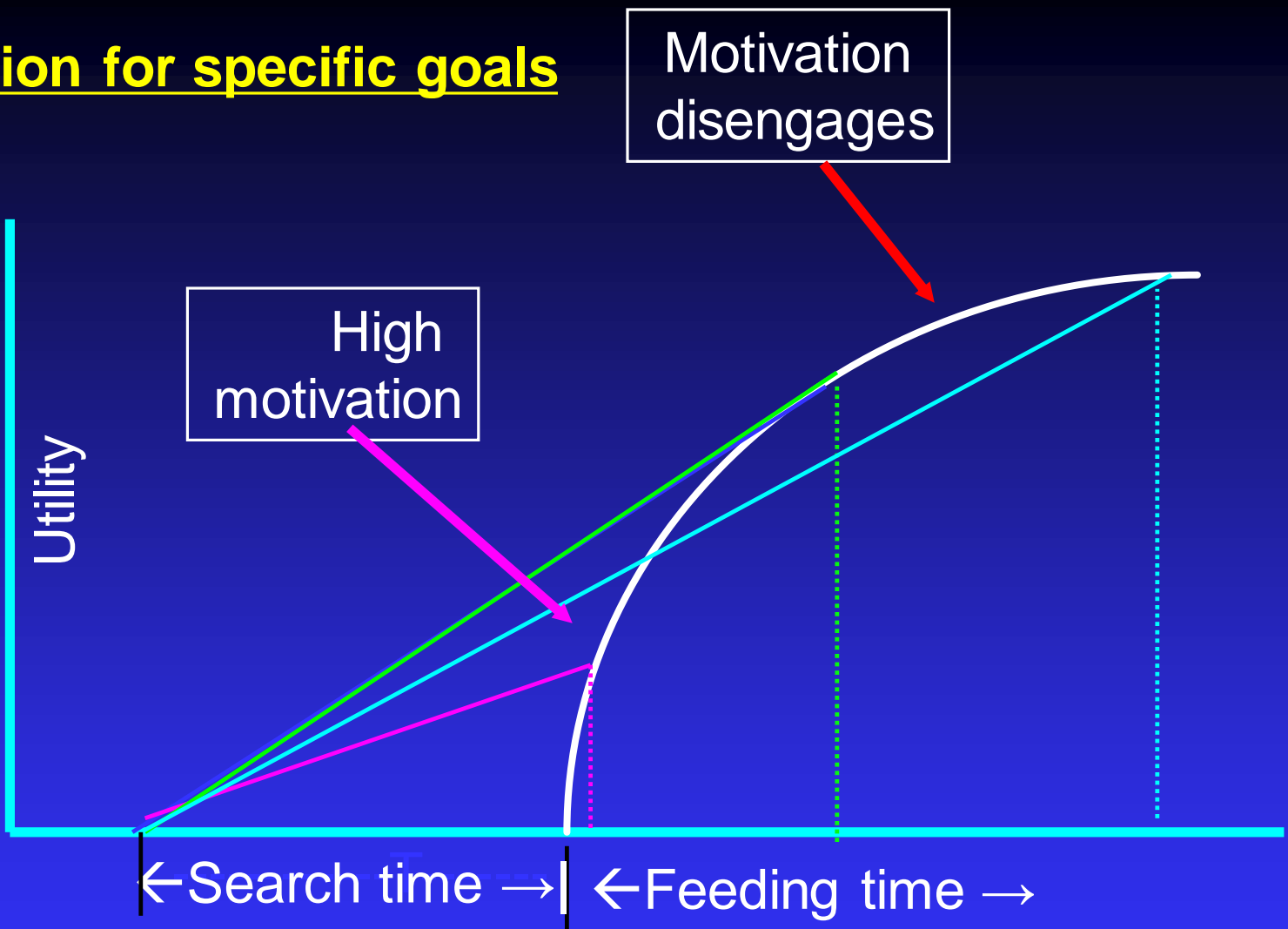
Why does Motivation Vary?

- Increases when payoff is high/temporary
- Decreases
 - ◆ From a specific activity when $\text{benefits/min} < \text{benefits/min for another activity}$
 - ◆ From all activity when all options have $\text{costs} > \text{benefits}$

Picking raspberries: How mood helps



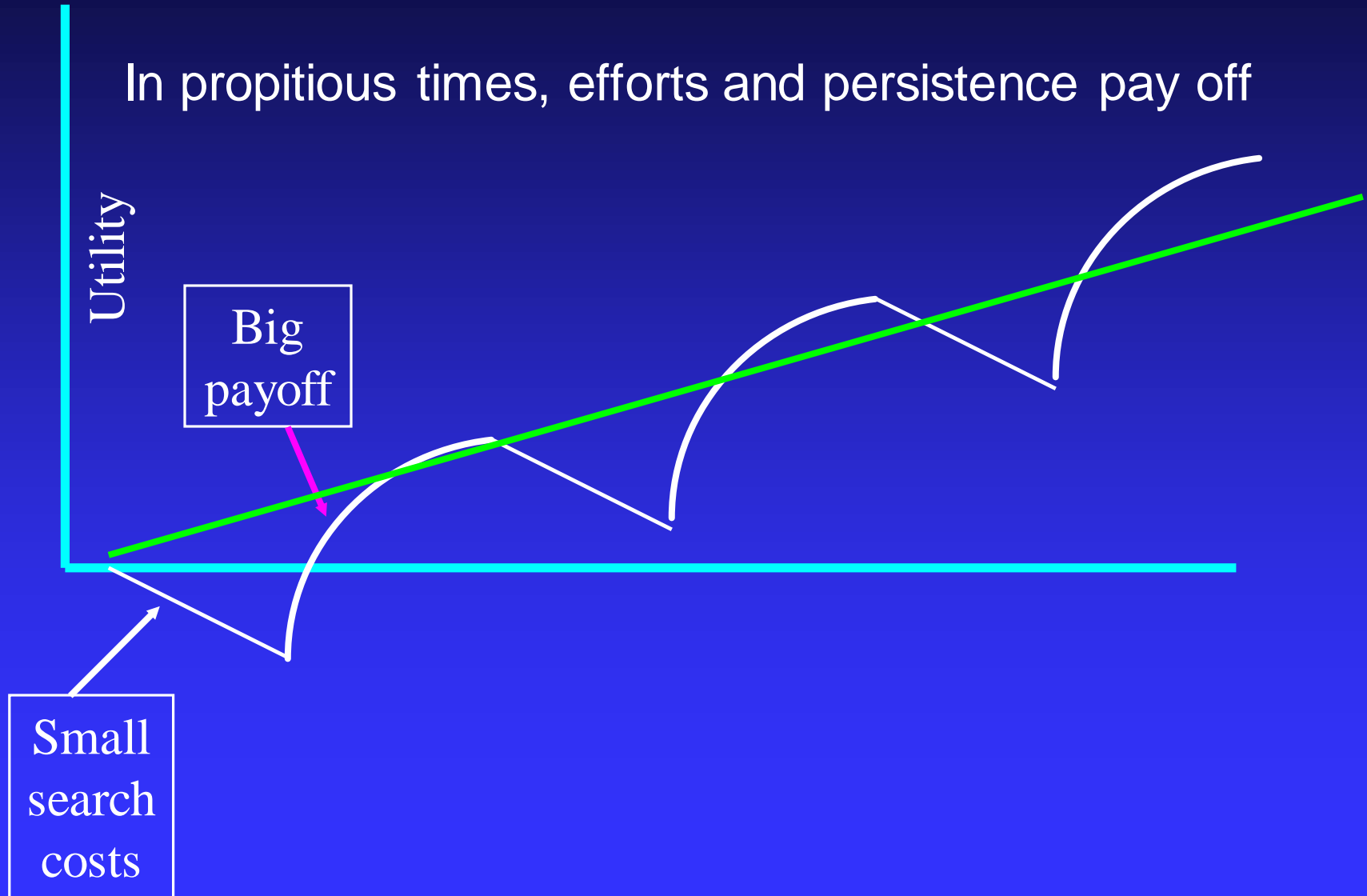
Motivation for specific goals



Marginal Value Theorem- Charnov

High motivation when payoff is positive

In propitious times, efforts and persistence pay off



When costs > benefits, global motivation disengages

In unpropitious situations,
all initiative is maladaptive



When is it best to do nothing?

When costs $>$ benefits for all available actions

A Motto for Unpropitious Times



Don't just do
something.
Stand there!

The Depressogenic Situation

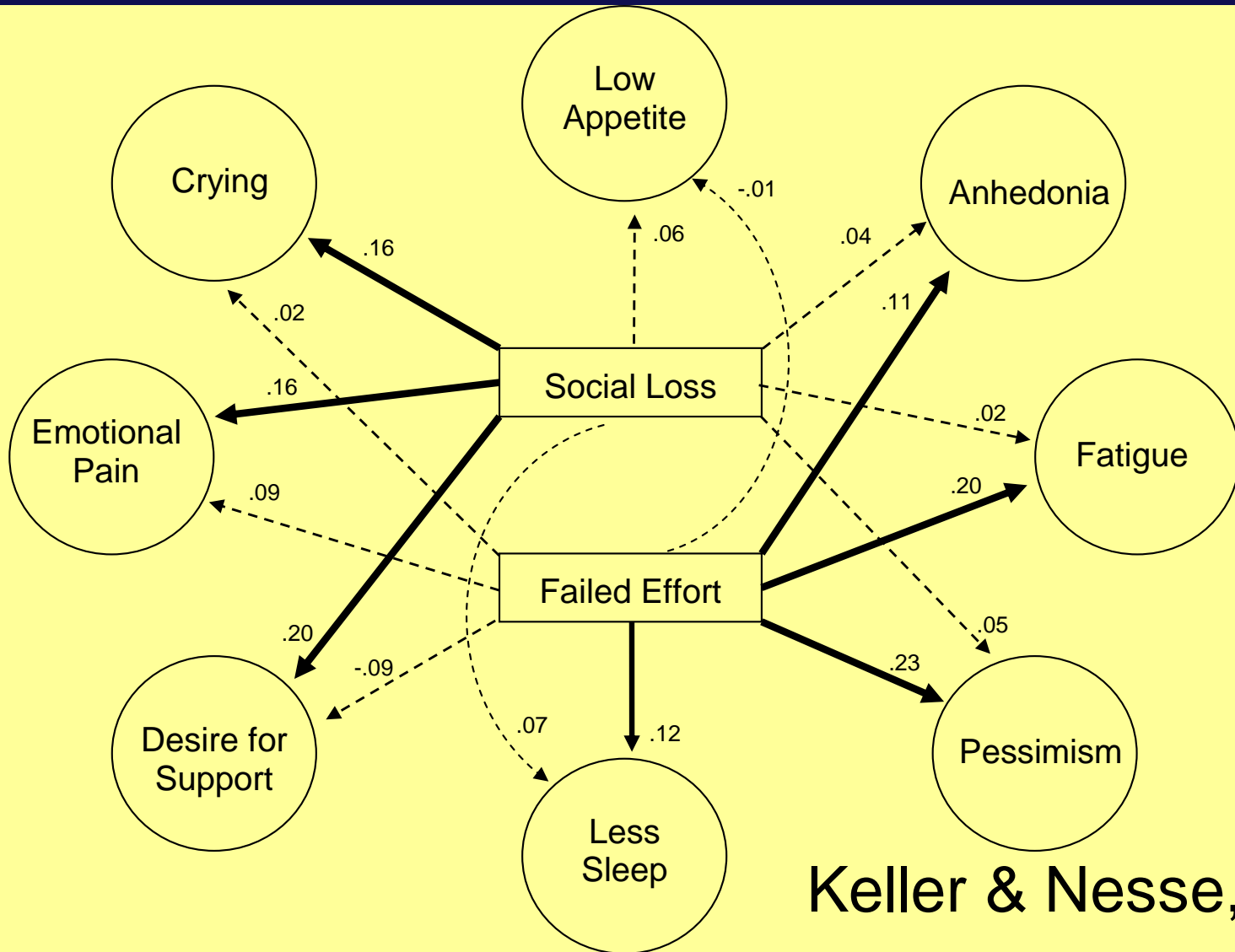
Trapped pursuing an unreachable goal

XVI

If any could de-
sire what he is in-
capable of posses-
sing. despair must
be his eternal
lot



Different sx. for different situations



Keller & Nesse, 2005

Figure 3.3 Significant pathways ($p < .05$) are bold. Nonsignificant pathways are dotted.

The Crucial Question

Is there something very important you are trying to do that you can't give up, despite knowing you are unlikely to succeed?

Depression has different causes in different individuals

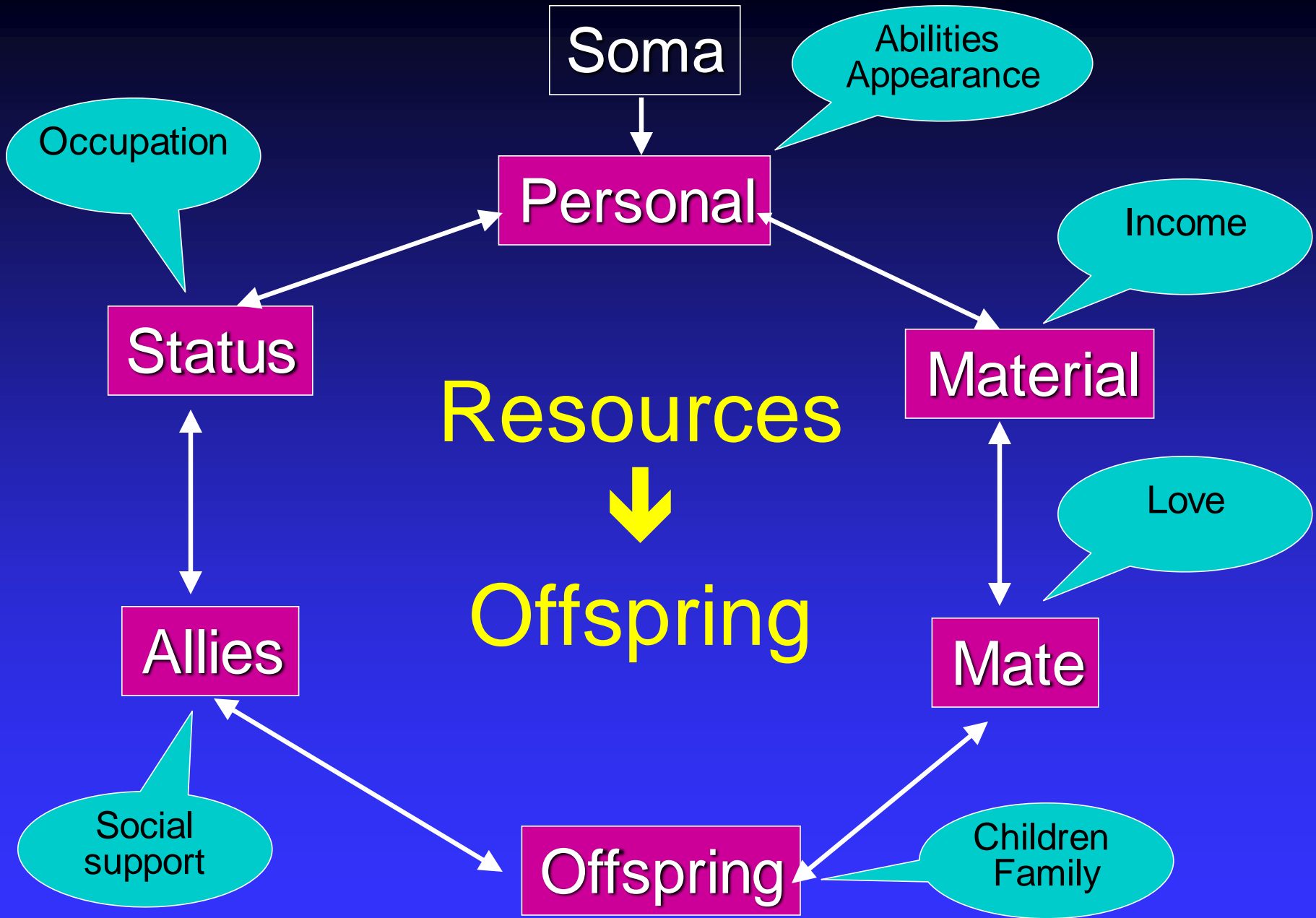
Top down: How motivational structure of an individual's life
→ brain

Bottom up: How brain →
emotions and behavior

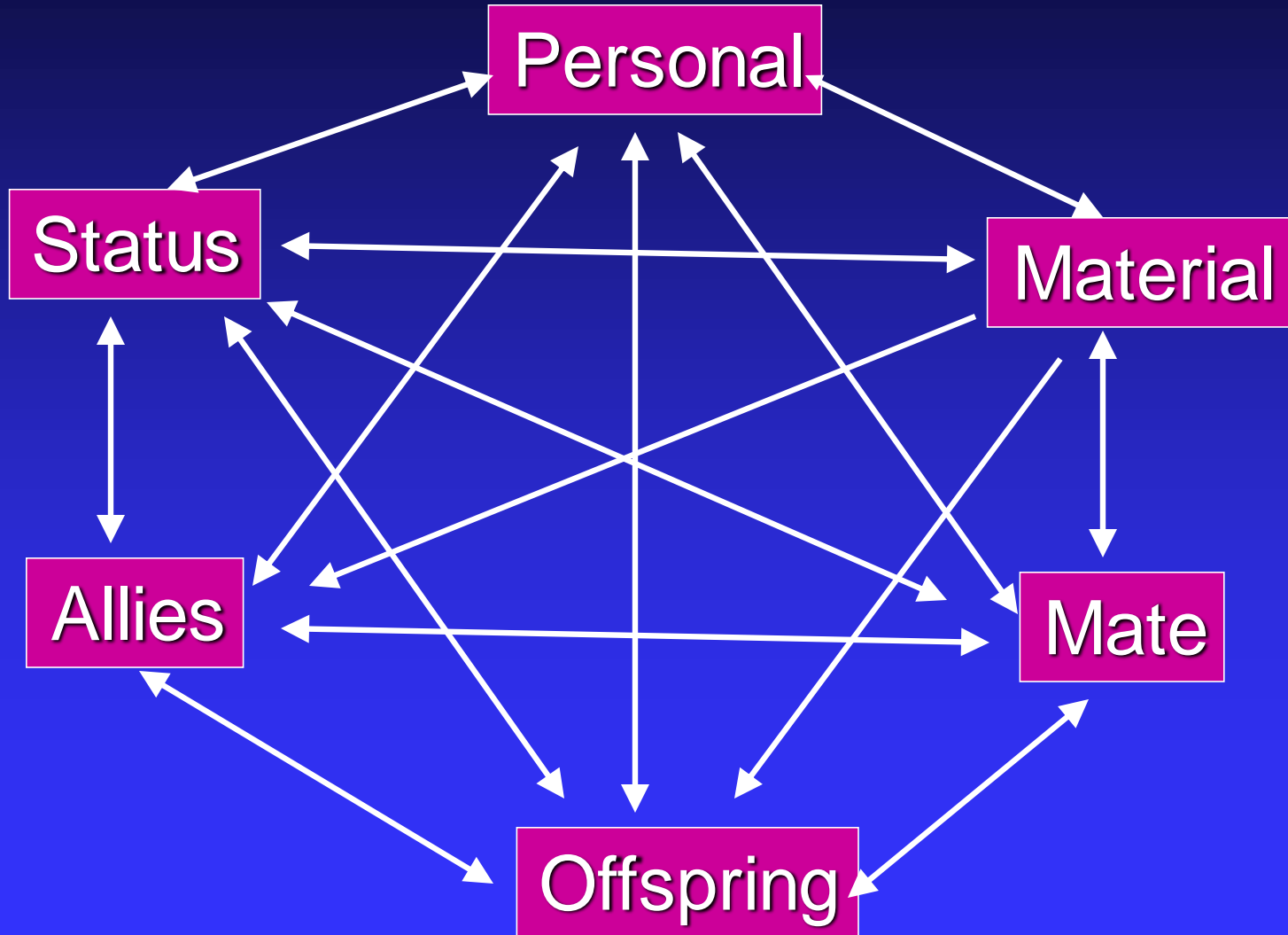
Resources



Offspring



Why Life Is Hard



ROS: Review of Systems

- General
- Cardiovascular
- CNS
- Respiratory
- Renal
- GI
- GU
- Etc.

Review of Social Systems

An APGAR for psychiatry Score each 0-1-2

Social support

Occupation

Children/Family

Income

Abilities/Appearance

Love

REVIEW OF SOCIAL SYSTEMS Checklist of Causes for Mood and Anxiety Disorders
Situations that arouse aversive emotions in 6 life domains (SOCIAL) X 5 Vulnerability factors (ANGST)

Date _____ Person _____ Interviewer _____
Age _____ Ethnicity _____ Marital _____ Family _____ Occ. _____
Problems (circle): MDD Bipolar Dysth. Panic Ag PTSD GAD SocialAnx OCD EatingDis SubAbuse Other: _____
Description: Symptoms, precipitants, course, treatments, and responses

Use words in bold below to introduce a description of what the person is doing and main problems in each SOCIAL domain.
Enthused by an opportunity Fine/Satisfied OK/ Mild dissatisfaction Resigned/Accepting inability to get resource Waiting/Disengaged
Sad after a loss Worried about a possible future loss Frustrated by an obstacle Angry after a betrayal Stressed by excess demands
Conflicted by a difficult decision Lost no plan Demoralized by the failure of efforts to reach goal Trapped pursuing an unreachable goal

⚡ Contribution of cause to main problems 0=Low/None 1=Medium 2=High Availability of resources in domain ⚡

___ Social network: Friends, and roles and relationships in social groups and networks outside of the family S ___

___ Occupation: Work, school, homemaking, or other main occupation O ___

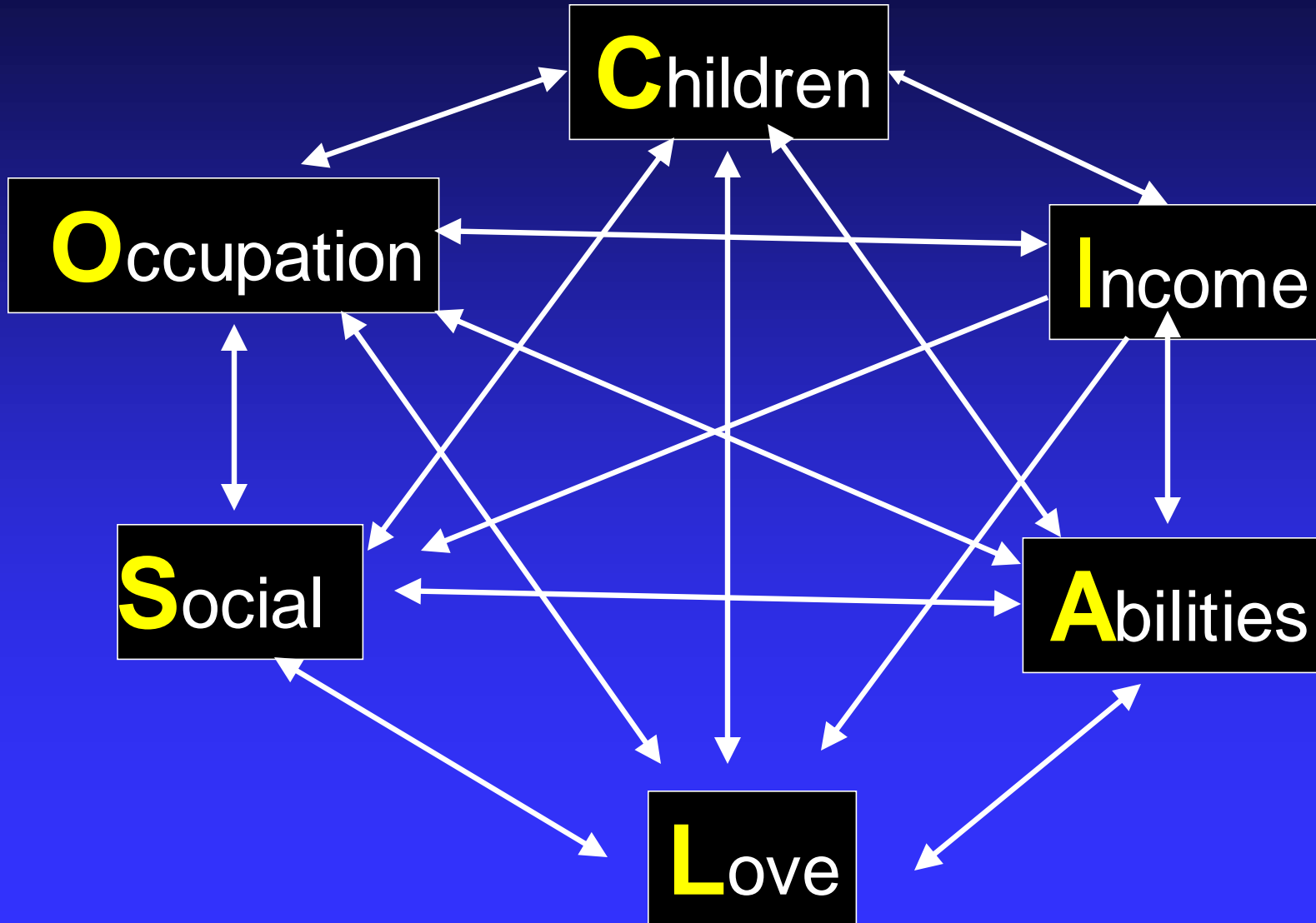
___ Children and family: Support from, or problems experienced with, children and other relatives other than spouse C ___

___ Income and finances: Sources? Adequacy? Security? I ___

___ Abilities, appearance, health: Personal characteristics that influence the person's ability to reach goals A ___

___ Love/ Intimate relationship: Finding a relationship, satisfaction, security, how partner is doing L ___

S.O.C.I.A.L



4. WHY ARE NEGATIVE EMOTIONS SO COMMON?

- They are useful—Smoke detector
- They are for our genes, not us
- Mismatch with modern environments

Smoke Detector Principle

Nesse 2005

- Express response whenever
 - ◆ $CR < CH * p(H)$
- False alarms are normal



Noise from a monkey or a chimp Should you flee?

- Cost of fleeing=100 calories
- Cost of not fleeing if lion= 100,000 calories
- Optimal: Flee whenever $p \text{ lion} > 1/1000$
- **999/1000 panic attacks will be unnecessary but perfectly normal**



Clinical application

Panic disorder

- Explain panic disorder as a false alarm
- False alarms are expected
- Danger adjusts for more sensitivity
- Positive feedback
- Down-regulate the system using drugs and behavior therapy

5. WHY ARE EMOTIONS SO *EMOTIONAL?*

Because objectivity harms fitness

- Game theory
- Commitment
- Psychodynamic defenses

Social Emotion Disorders a whole separate lecture

- And full of conflict
- The origins of relationships

Neglected Emotional Disorders: Excesses or Deficits of:

- Anger
- Love
- Jealousy
- Envy
- Awe
- Boredom
- Disgust
- Guilt

If you see an emotion, what should you do?

- Look for its cause in the life situation
- Decide if the emotion is excessive
- Try to remedy the situation
- Try to change the view of the situation
- Change brain mechanisms if necessary

Bridging the Gap

Evolution

Psychiatry

RandolphNesse.com

EvolutionaryMedicine.org

Fully Biological Psychiatry

The Evolution & Medicine Review

[Randolph Nesse.com](http://RandolphNesse.com)

EvolutionaryMedicine.org

