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

*How understanding evolution made me a better psychiatrist*

Randolph Nesse
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
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.
“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
The Core Mystery:
If natural selection is so powerful, why isn’t the body better?
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

Because the disease is somehow useful?
<table>
<thead>
<tr>
<th>Tinbergen’s 4 Q, organized</th>
<th>Nesse, 2002, TREE, 2013</th>
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<tbody>
<tr>
<td><strong>Proximate</strong></td>
<td><strong>Evolutionary</strong></td>
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<tr>
<td>Transition over time</td>
<td>Ontogeny</td>
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<td>Cross section</td>
<td>Mechanism</td>
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<td></td>
<td>Phylogeny</td>
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<td>Selective Advantage</td>
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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 Emotions Really Are* Paul Griffiths
- *The Nature of Emotion* Ekman & Davidson
<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Emotions</th>
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</thead>
<tbody>
<tr>
<td>Ekman, Friesen, and Ellsworth</td>
<td>Anger, disgust, fear, joy, sadness, surprise</td>
</tr>
<tr>
<td>Frijda</td>
<td>Desire, happiness, interest, surprise, wonder, sorrow</td>
</tr>
<tr>
<td>Gray</td>
<td>Rage and terror, anxiety, joy</td>
</tr>
<tr>
<td>Izard</td>
<td>Anger, contempt, disgust, distress, fear, guilt, interest, joy, shame,</td>
</tr>
<tr>
<td></td>
<td>surprise</td>
</tr>
<tr>
<td>James</td>
<td>Fear, grief, love, rage</td>
</tr>
<tr>
<td>McDougall</td>
<td>Anger, disgust, elation, fear, subjection, tender-emotion, wonder</td>
</tr>
<tr>
<td>Mowrer</td>
<td>Pain, pleasure</td>
</tr>
<tr>
<td>Oatley and Johnson-Laird</td>
<td>Anger, disgust, anxiety, happiness, sadness</td>
</tr>
<tr>
<td>Panksepp</td>
<td>Expectancy, fear, rage, panic</td>
</tr>
<tr>
<td>Plutchik</td>
<td>Acceptance, anger, anticipation, disgust, joy, fear, sadness, surprise</td>
</tr>
<tr>
<td>Tomkins</td>
<td>Anger, interest, contempt, disgust, distress, fear, joy, shame, surprise</td>
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</tbody>
</table>
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
- 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

E1  Motivation
E2  Communication
E3  Physiology
E4  Learning
Now what?
The Emotions: Not an Italian garden, but a wild tangled bank
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
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
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

shaped to cope with
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
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

<table>
<thead>
<tr>
<th>Opportunity (Promotion)</th>
<th>Before</th>
<th>After success</th>
<th>After failure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hope (desire)</td>
<td>Happiness (pleasure)</td>
<td>Disappointment</td>
</tr>
<tr>
<td>Threat (Prevention)</td>
<td>Anxiety (fear)</td>
<td>Relief</td>
<td>Sadness (pain)</td>
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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 benefits/min < benefits/min for another activity
  - From all activity when all options have costs > 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

Utility

Big payoff

Small search costs
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
If any could desire what he is incapable of possessing, despair must be his eternal lot.
Different sx. for different situations

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
Why Life Is Hard

Offspring

Personal

Status

Allies

Material

Mate

Offspring
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
S. O. C. I. A. L

Children

Occupation

Social

Income

Abilities

Love
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 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