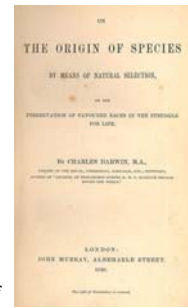


## Natural Selection

- Discovered independently by Charles Darwin and Alfred Wallace.
- *Origin of Species*: landmark book that laid out natural selection.
  - Darwin spent 20 years preparing book!
  - Proposed an explanation for adaptations that Darwin observed.
  - Best-seller throughout U.K.
- Thomas Huxley upon reading it:
  - “How stupid of me not to have thought of that!”



2

## Natural Selection

- **Variation:** Organisms vary in all sorts of ways.
  - e.g., wing length, eye color, strength, cell structure, fighting ability, etc.
- **Inheritance:** Some of these variations (i.e., genetic variations) can be passed down from parent to offspring.
  - e.g., if you break your arm skateboarding, your kid won't be born with a broken arm. But if you have blue eyes, your kid might very well inherit this. Natural selection only relevant to inherited traits.
- **Selection:** Variations (i.e., genetic traits) that help with the tasks of survival and reproduction (i.e., that are adaptive) are more likely to be inherited by the next generation.
  - Every animal in the world produces more offspring than will survive to reproductive age. Animals with helpful traits are more likely to be these survivors and these *survivors will populate the next generation.*
  - You have to survive and reproduce to be represented in the next generation!



Adaptation doesn't involve trying.



Natural selection does not grant organisms what they "need".

- **Adaptive traits:** Traits that help survival and reproduction (i.e., increase *reproductive fitness*).
- **Maladaptive traits:** Traits that hurt reproductive fitness.
- **Benign traits:** Traits that have no effect on reproductive fitness.
- Nature **selects** adaptive traits
  - because animals with them are more likely to survive and reproduce and be represented in future gene pool.
- Nature **deletes** maladaptive traits
  - because animals with them are less likely to survive and reproduce and be represented in future gene pool.
- Nature **ignores** benign traits

4

## Reproductive Success/Fitness

- Success:
  - How many children do you have?
- Fitness:
  - How many children, grandchildren, great-grandchildren, etc. do you have?



## Survival of the Fittest?

- Darwin hated this phrase!
- What would he have meant by it?
  - Survival = are your genes present in future generations?
  - Fittest = those who have the most genetic presence in future generations.



Whose more fit? The cheetah or the wildebeest? Can we tell by this picture?

6

## Selection Coefficients ( $s$ )

- How fast does evolution work?
  - Quicker than you might think.
- $s$  = percentage advantage/disadvantage associated with particular genetic trait.
  - $+0.01$  = organisms with this trait reproduce 1% more than organisms without trait.
- Advantageous traits spread quickly throughout population.
  - e.g.,  $s = +0.01$ , traits would go from less than 1% to more than 90% of the population within 3,000 generations.
  - $s = +0.10$ , less than 1% to 90% in just 300 generations.

7

## Natural Selection and moths

If you're a moth in Manchester, England, being black or white can be adaptive or maladaptive depending on how the environment changes.



As pollution increases, light colored vegetation on trees decreases, causing trees to be darker. This creates a population of moths that are mostly black (black moths were naturally selected). The opposite occurs when pollution decreases.

8

## Natural Selection and elephants

If you're an elephant living in Sri Lanka, big tusks can be adaptive or maladaptive depending on whether you live near a lot of ivory poachers or not.

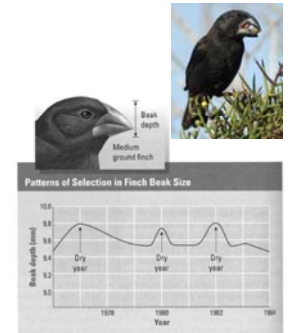


Tuskless (Asian) elephants range from 50% to 90% of the population in Sri Lanka. They are more common in areas where poaching has been highly prevalent for generations.

9

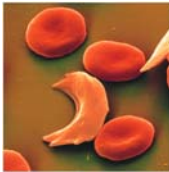
## Natural Selection and birds

- Peter and Rosemary Grant tracked the depth of finch beaks on the Galapagos Islands for several years.
  - Beak depth increased during droughts.
  - Why? Droughts killed most of the soft seeds that finches with smaller beaks rely on. Thus, only large beaked finches could survive and reproduce.



## Natural Selection and humans

If you're a human, then carrying the gene that causes sickle-cell anemia can be either adaptive or maladaptive depending on where in the world you live (and where your recent ancestors lived).



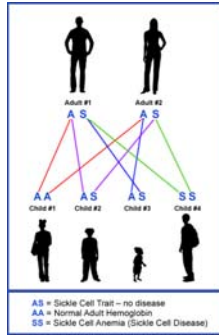
SSA causes hemoglobin cells to take on sickle-shape. This causes painful blood clotting and all sorts of other problems. People with SSA used to die between 20-40. Now they can live into their 50s and life expectancy is continually improving.<sup>81</sup>

## Why hasn't nature deleted SSA?

- SSA is entirely genetic.
  - Caused by a recessive gene allele, thus, if you inherit it from both parents you have SSA.
- People with SSA reproduce at much lower rates than the rest of the population.
- SSA has been around long enough for natural selection to have culled it from the population.

## Why hasn't nature deleted SSA?

- SSA comes in two forms:
  - Full-blown
  - Carrier
- F-B: you inherit the SSA genetic allele from both of your parents.
  - Homozygous recessive for SSA = very bad
- Carrier: you inherit one SSA allele and one normal allele.
  - Heterozygous recessive for SSA = not very bad

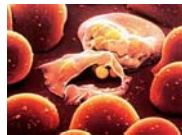


## SSA genetics

		Mom (C)				Mom (F)	
		Normal	Sickle			Sickle	Sickle
Dad (C)	Normal	25% Normal	25% Carrier	Dad (C)	Sickle	25% Full	25% Full
	Sickle	25% Carrier	25% Full		Normal	25% Carrier	25% Carrier
		Mom (F)				Mom (C)	
		Sickle	Sickle			Normal	Sickle
Dad (F)	Sickle	25% Full	25% Full	Dad (N)	Normal	25% Normal	25% Carrier
	Sickle	25% Full	25% Full		Normal	25% Normal	25% Carrier

## Malaria

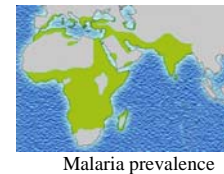
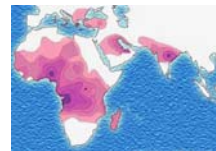
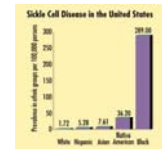
- Caused by parasite called *Plasmodium*, which infects red blood cells
- Today:
  - ½ billion infections/year
  - 1-3 million deaths/year
  - Almost all deaths children
    - A child dies every 45 seconds in Africa from malaria
- Drug treatments are very difficult because parasite evolves (yes, parasites evolve too) and becomes resistant to medications.



15

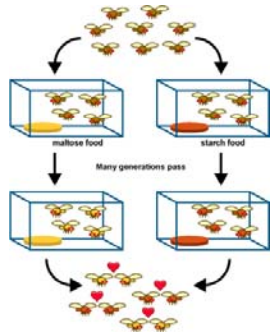
## SSA and Malaria

- Modern-day SSA and malaria rates are *very* strongly positively correlated.
- People who can trace recent ancestry to place with high levels of malaria are *far* more likely to get SSA.
- Laboratory experiments showed once and for all that *Plasmodium* has great trouble attaching itself to sickle-shaped blood cells (carriers have some of these), which causes immunity to malaria.



## Speciation

- Species: Group of organisms that interbreed and produce fertile offspring.
- Over many, many generations, natural selection can create new species.
- Diane Dodd's classic fruit fly experiment demonstrating allopatric speciation (speciation by geographic separation).



## Sexual Selection

- **SEXY TRAITS**
  - Possessing sexy traits allow us more opportunities to reproduce.
  - PLUS, there is a chance they will be inherited by our children giving them the same advantages!
- **Runaway selection:** traits that are so sexy that even though they actually hinder the individual, they still increase how much they reproduce.

18

## Runaway Selection



Sir Ronald Fisher

Examples of probable runaway selection in peacocks and proboscis monkeys.

19

## Runaway Selection



Example of probable runaway selection in humans (*steatopygia*).

20

## Triver's (1972) Differential Parental Investment Theory

- When it comes to relationships, men and women should be largely the same.
  - Because men and women faced similar obstacles during evolutionary history.
- One difference between men and women deals with costs associated with reproduction.
  - **Male costs:** About 2-5 minutes of their time and about 50 million sperm (men make about 250 million sperm per day).
  - **Female costs:** An extremely dangerous condition known as pregnancy.
  - Differential investment costs should make women pickier, specifically when it comes to sex.



21

## Specific example of evolutionary psychology: Gender Differences

- Who is the pickier sex?
- What level of intelligence would you require in the following types of mates?
  - Casual date
  - Have sex with
  - Steady date
  - Marriage
- Does it depend on what you're talking about?

22

## Evolutionary Gender Differences



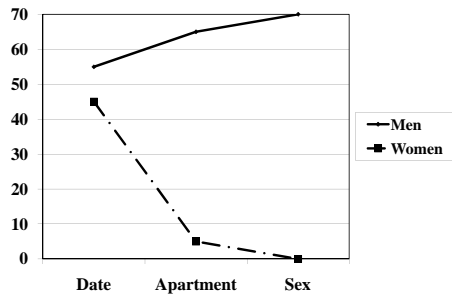
23

## Evolutionary Gender Differences

- Hatfield and Russell's "Florida State Study"
    - How would you respond in an attractive member of the opposite sex approached you on campus with one of the following questions?
    - Do you think men and women will respond differently?
1. Will you go out on a date with me?
  2. Will you come back to my apartment with me?
  3. Will you go to bed with me?

24

## Evolutionary Gender Differences



25

## What do men and women want in mates?

### What men prefer in women

1. Kindness
2. Intelligence
3. Physical Attractiveness
4. Exciting personality
5. Good health
6. Adaptability
7. Creativity
8. Desire for children
9. College graduate
10. Good heredity
11. Good earning capacity
12. Good housekeeper
13. Religious orientation

### What women prefer in men

1. Kindness
2. Intelligence
3. Exciting personality
4. Good health
5. Adaptability
6. Physical attractiveness
7. Creativity
8. Good earning capacity
9. College graduate
10. Desire for children
11. Good heredity
12. Good housekeeper
13. Religious orientation

26

## Behavior Genetics

- Investigate extent to which behavior/personality can be attributed to nature versus nurture.
- Genes versus Environment!

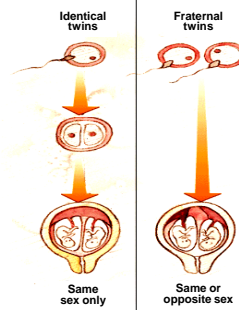


Are people born to smoke, or does their environment "force" them to do so?

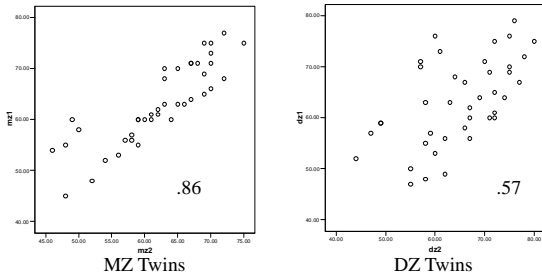
27

## MZ versus DZ Twins

- Identical Twins (MZ)
  - develop from a single fertilized egg that splits in two, creating two genetically identical organisms
- Fraternal Twins (DZ)
  - develop from separate eggs
  - genetically no closer than brothers and sisters.



## IQ scores for 80 Sets of Twins



The results of this study suggest that IQ **does** have an underlying genetic cause (because MZ correlation was stronger than DZ correlation).

29

## MZ vs DZ Studies of Behavior/Personality

- If one DZ twin gets divorced, the other is 1.6 times more likely to get divorced (compared to non-twin siblings).
  - If one MZ twin gets divorced, the other is 5.5 times more likely to also get divorced!
  - MZ twins more similar than DZ twins in terms of extraversion and neuroticism.
  - MZ twins share more similar attitudes compared to DZ twins.
- Is this just because MZ twins are more likely to be treated the same by other people?
    - In other words, are we really controlling for environment?
  - Research frequently suggests that MZ twins who are treated more alike are *not* more similar than MZ twins who are not treated alike.

30

## Separated Twins Studies

- MZ vs DZ twin studies attempt to control for environment while letting genetics vary.
- What if we want to control for genetics and allow environment to vary?
- For various reasons, identical twins sometimes get separated from each other at birth.
- They share 100% genetics, but their environments are different!

31

## What do these results suggest?

- 100 sets of MZ twins raised together (RT).
- 100 sets of MZ twins raised apart (RA).
- IQ score correlations
  - RT = .72
  - RA = .72
- This suggests that IQ **does** have an underlying genetic cause (if environment played a role, we'd expect correlations to differ based on whether the environments were the same or different).

32

## What do these results suggest?

- 100 sets of MZ twins raised together (RT).
- 100 sets of MZ twins raised apart (RA).
- IQ score correlations
  - RT = .95
  - RA = .05
- This suggests that IQ **does not** have an underlying genetic cause (IQ only correlated when environment is the same).

33

## What do these results suggest?

- 100 sets of MZ twins raised together (RT).
- 100 sets of MZ twins raised apart (RA).
- 100 sets of DZ twins raised together (DZ).
- IQ score correlations
  - RT = 1.00
  - RA = 1.00
  - DZ = .50
- This suggests that IQ is **entirely** genetic.

34

## Bouchard and Lykken, et al.

- Located group of separated MZ twins.
- Compared them to group of together MZ twins.
- Do correlations between “togethers” exceed correlations between “separates”?



David Lykken

35

## Results

	A vs T	
• Brain wave activity	.80 vs .81	
• Blood pressure	.64 vs .70	
• Heart rate	.49 vs .54	
• WAIS IQ	.69 vs .88	
• Raven IQ	.78 vs .76	
• Multidimensional personality I	.50 vs .49	
• California personality I	.48 vs .49	
• Strong Campbell Interested I	.39 vs .48	
• Minnesota occupational interest S	.40 vs .49	
• Religiosity	.49 vs .51	
• Nonreligious social attitudes	.34 vs .28	
• <b>Average</b>	<b>.55 vs .58</b>	Not much of a difference.

For many variables related to human functioning, genetics seems to win out over environment!

36

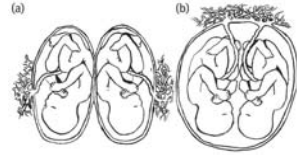
## Is “nurture” important at all?

- Bouchard and Lykken suggest that for many traits, genetics is more important than environment.
- However, this does not mean that environment is unimportant!
- Example:
  - Even in genetics accounts for 70% of variability in IQ, this still leaves a whole lot of room to fluctuate.
  - If you don't care about 30% of the variability in a variable, you haven't done any research!

37

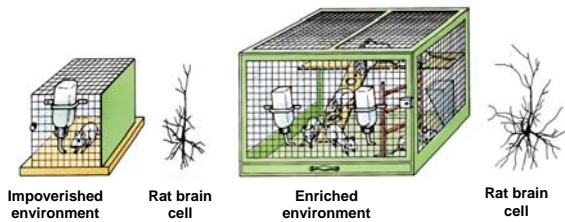
## Impact of Environment

- Environment appears to influence us in the womb!
- Identical twins who develop in same placenta more similar than those who develop in different placenta.



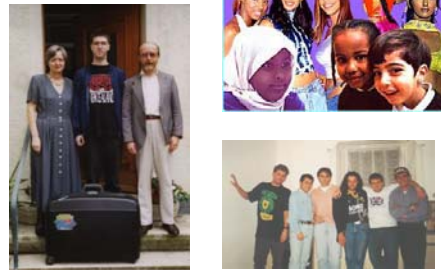
38

## Environmental Impact on Brain Rosenweig et al. study



39

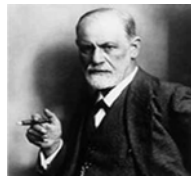
## Other environmental influences



40

## Parents

- “The major source of human misery is the neglected, wounded child within each of us”
  - From pop psychology book
- How much blame or credit do our parents really deserve for our behavior/problems?
- Freud suggested that many of our problems stem from our parents.
  - “Tell me about your mother”



41

## Should we blame our parents?

- “Two children in the same family are on average as different from one another as are pairs of children randomly selected from the population”
  - Robert Plomin & Denise Daniels
- Research suggests that home influences account for about 10% of the variability in personality.
- “Parents should be given less credit for kids who turn out great and blamed less for kids who don’t”
  - Sandra Scarr



Robert Plomin, left, and Denise Daniels



42

## Who is important?

- Consider what people are most important to your successes and failure right now?
  - Probably not your parents.
- How about when you were 4 years old?
  - Parents certainly more important then!
- Research suggests that different people influence us at different times in our lives.
- It all depends on who is most important to our “survival”.

43

## Research on peer influence

- Children who are disgusted by certain foods that their parents want them to eat will often eat them if their friends do.
- Children will adopt the accent of their peers over their parents.
- Immigrant children quickly disidentify with their parents when placed into groups of other children.
  - “When in Rome, children do as Romans, even if their parents happen to be British or Chinese”
- You can better predict whether children will smoke based on observing their friends rather than their parents.

44

## Take-home message

- Parents are very important to our development during our early years, but our peers quickly become much more powerful in determining who are and how we behave.
- How can parents help their kids become the best they can be?

45

## Culture

- All cultures have norms.
  - Expectations for our behavior/thinking.
  - Some simply tell us what is typical or common (descriptive).
  - Some tell us what to do (prescriptive) or what not to do (proscriptive).
  - What are some norms of the USA and how do they influence who we are and how we behave?
  - Are they different from the norms of other countries?

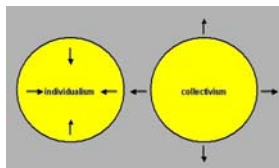


Cultural norms differ with respect to the types (and amount) of clothes that we wear.

46

## Individualistic vs Collectivistic

- Individualistic
  - United States
  - “Me” identity
  - Celebrate uniqueness
  - “be all you can be”
  - “An army of one”
- Collectivistic
  - Many Asian Countries
  - “We” identity
  - Celebrate belongingness
  - “nail that stick out the furthest is the first to get hammered”
  - “it takes a village to raise a child”



47

USA	1	Israel	19	Hong Kong	37
Australia	2	Spain	20	Chile	38
Great Britain	3	India	21	West Africa	39
Canada	4	Japan	22	Singapore	40
Netherlands	5	Argentina	23	Thailand	41
New Zealand	6	Iran	24	Salvador	42
Italy	7	Jamaica	25	South Korea	43
Belgium	8	Brazil	26	Taiwan	44
Denmark	9	Arab Countries	27	Peru	45
Sweden	10	Turkey	28	Costa Rica	46
France	11	Uruguay	29	Pakistan	47
Ireland	12	Greece	30	Indonesia	48
Norway	13	Philippines	31	Colombia	49
Switzerland	14	Mexico	32	Venezuela	50
Germany	15	East Africa	33	Panama	51
South Africa	16	Yugoslavia	34	Equador	52
Finland	17	Portugal	35	Guatemala	53
Austria	18	Malaysia	36		

Source: HOFSTEDE, G., (1997) *Culture and Organisations: Software of the mind. Intercultural cooperation and the importance for survival* McGraw\_Hill, London, P53.

48