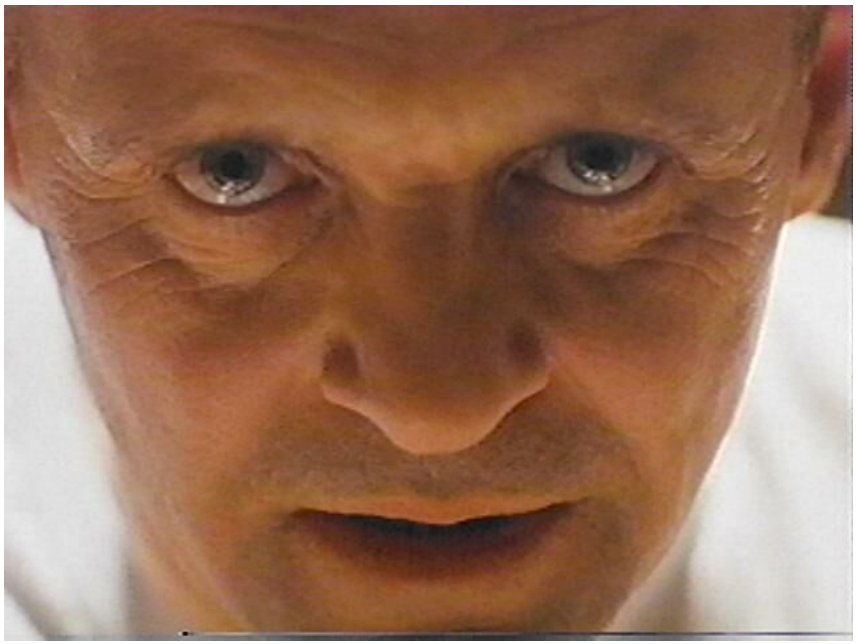
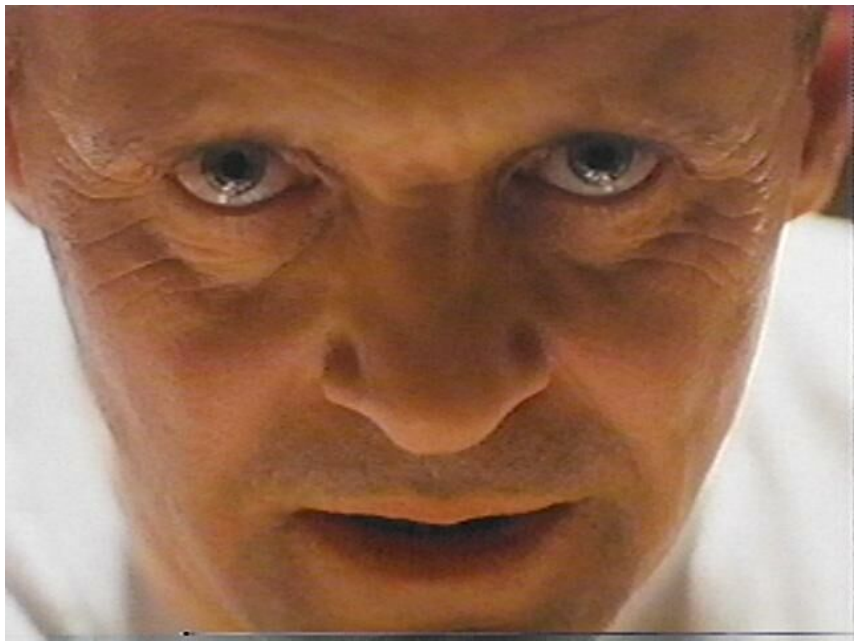
Behavior Genetics:
Predicting Individual Differences

Behavior Geneticists study our differences and weigh the relative effects of heredity and environment.





Heritability

Heritability refers to the extent to which the *differences among people* are attributable to genes.

What percentage of the *difference among people's* height can be attributed to their genes?

90%

Animal behavior genetic studies include

- Strain studies
  - Intense inbreeding over the course of many generations creates a genetically similar strain.
  - Two or more strains are raised at once to determine the extent to which the *differences among the two groups* are attributable to genes (hereditability)

→ ? ←

Animal behavior genetic studies include

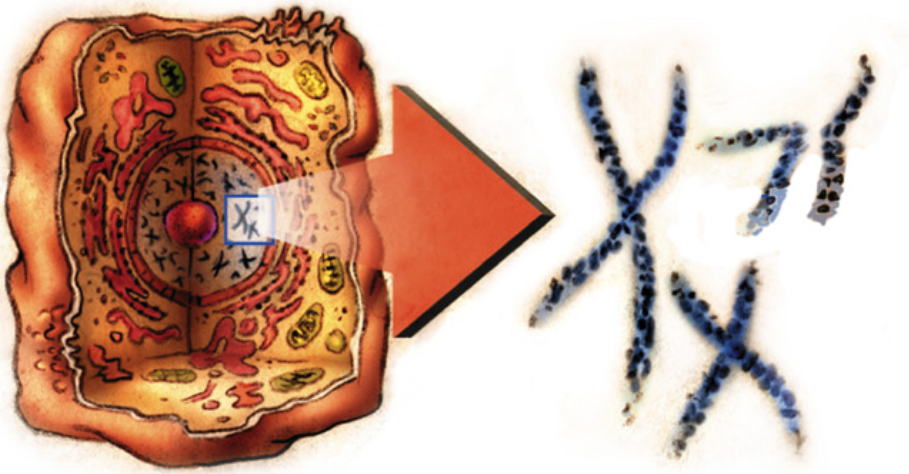
- Selection Studies
  - If a trait is closely regulated by genes then if animals with trait are interbred with those that don't, more of their offspring should have the trait then in a normal population

Genes: Our Codes for Life

Chromosomes containing DNA (*deoxyribonucleic acid*) are situated in the nucleus of a cell.

Nucleus
(the inner area of a cell that houses chromosomes and genes)

Chromosome
(threadlike structure made largely of DNA molecules)



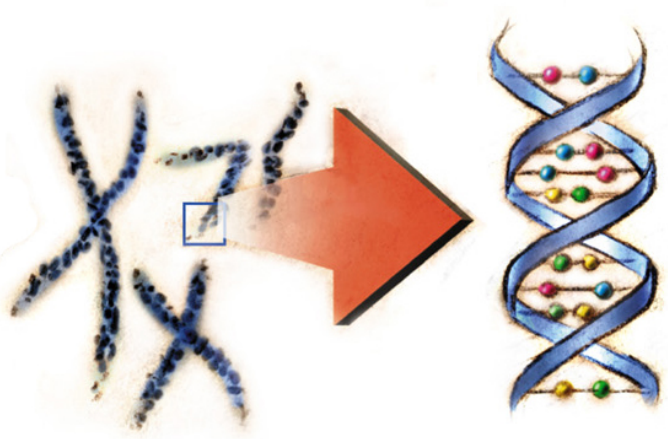
Cell
(the basic structural unit of a living thing)

Genes: Our Codes for Life

Segments within DNA consist of genes that make proteins to determine our development.

Chromosome
(threadlike structure made largely of DNA molecules)

DNA
(a spiraling, complex molecule containing genes)



Gene
(segment of DNA containing the code for a particular protein; determines our individual biological development)

Genome

Genome is the set of complete instructions for making an organism, containing all the genes in that organism. Thus, the human genome makes us human, and the genome for *drosophila* makes it a common house fly.

Genes 101

- Dominant Gene – Member of a gene pair that controls the appearance of a certain trait.

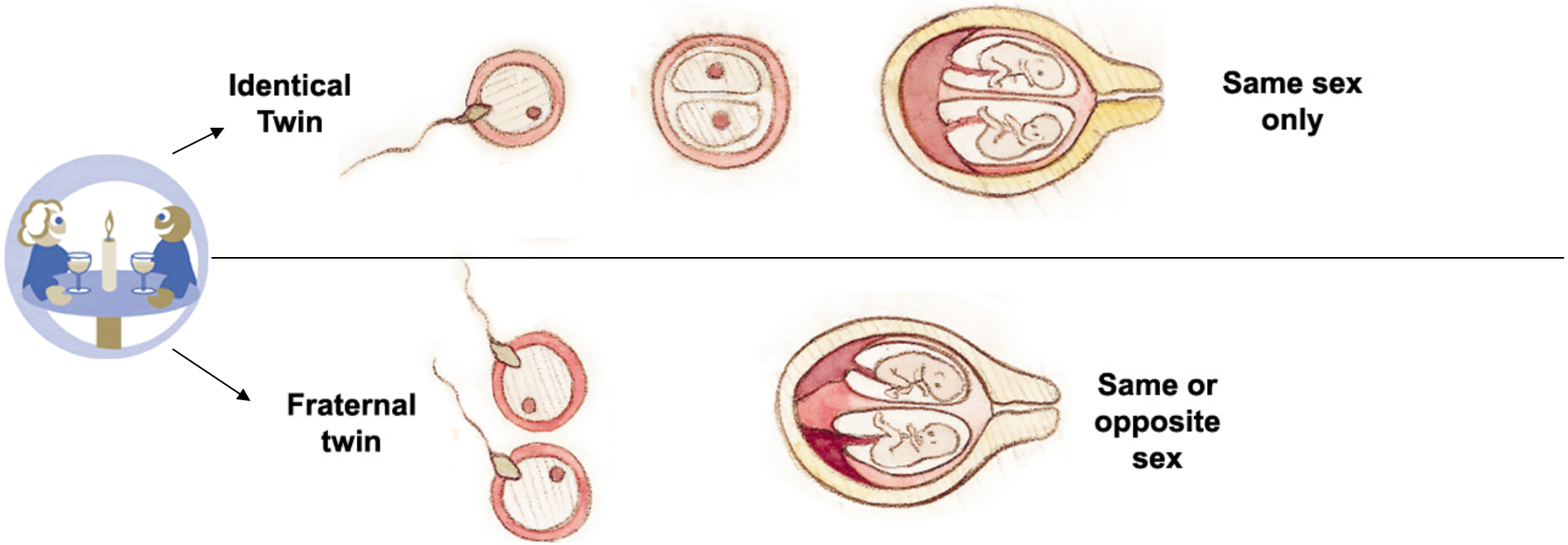
- Recessive Gene - Member of a gene pair that controls the appearance of a certain trait only if it is with another recessive gene.

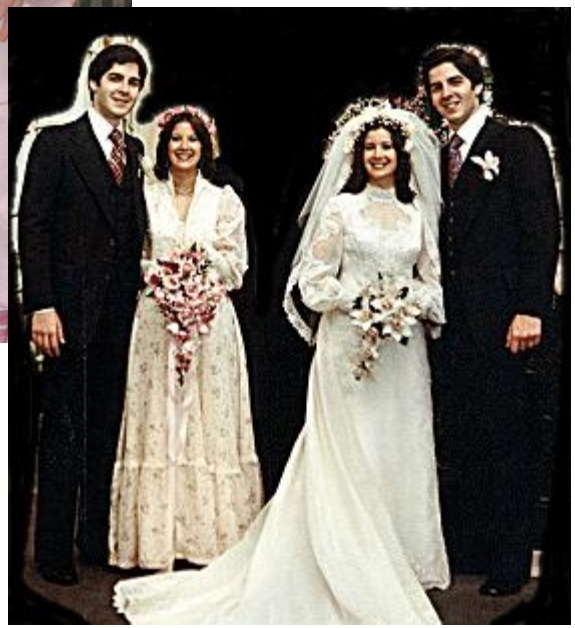
Genes 101 cont'd

- Polygenic Inheritance – Process by which several genes interact to produce a certain trait; responsible for our most important traits.

Twin Biology

Studying the effects of heredity and environment on two sets of twins, identical and fraternal, has come in handy.





Separated Twins

A number of studies compared identical twins raised separately from birth, or close thereafter, and found numerous similarities.

Separated Twins
Personality, Intelligence
Abilities, Attitudes
Interests, Fears
Brain Waves, Heart Rate

Jim Lewis

- Middle Class
- Wife named Betty – left her love notes
- Son named James Alan
- Dog named Toy
- Woodworking hobby
- Circular white bench around a tree in his yard.
- Chain Smoker
- Bit his fingernails
- Drove a Chevy, watched stock car racing, and drank Miller-Lite
- Suffered from High Blood Pressure and Migraines

Jim Springer

- Calls his 37 year separated twin in February 1980
  - Everything down to the dog's name is the same (except sons James Allan vs. James Alan)
- When played their voices, they would mistake themselves for their twin
- They are the first in Thomas Bouchard's twin study
- Studied 80 pairs of identical twins reared apart

Separated Twins

Critics of separated twin studies note that such similarities can be found between strangers.

Let us see if they might be correct

but

Researchers point out that differences between fraternal twins are greater than identical twins.

TABLE 1. Genetic and Environmental Influences on Political Attitudes: The 28 Individual Wilson–Patterson Items

	Polychoric Correlation							
	MZ		DZ					
Attitude Item	Corr.	*n*	Corr.	*n*	Heritability, 2 * (MZ − DZ)	Shared Environment, (2 * DZ) − MZ	Unshared Environment, 1 − MZ	*z* for (MZ–DZ) Difference[a]
School Prayer	0.66	2,687	0.46	1,774	0.41	0.25	0.34	9.83
Property Tax	0.47	2,643	0.27	1,748	0.41	0.06	0.53	7.66
Moral Majority	0.42	2,614	0.22	1,717	0.40	0.03	0.58	7.16
Capitalism	0.53	2,609	0.34	1,720	0.39	0.14	0.47	7.85
Astrology	0.48	2,631	0.28	1,721	0.39	0.09	0.52	7.39
The Draft	0.41	2,641	0.21	1,753	0.38	0.02	0.59	6.94
Pacifism	0.34	2,576	0.15	1,686	0.38	−0.04	0.66	6.43
Unions	0.44	2,661	0.26	1,752	0.37	0.07	0.56	6.89
Republicans	0.48	2,627	0.30	1,734	0.36	0.12	0.52	6.91
Socialism	0.43	2,616	0.25	1,726	0.36	0.07	0.57	6.53
Foreign Aid	0.41	2,669	0.23	1,771	0.35	0.06	0.59	6.42
X-Rated Movies	0.63	2,685	0.46	1,783	0.35	0.28	0.37	8.15
Immigration	0.45	2,658	0.29	1,748	0.33	0.12	0.55	6.20
Women's Liberation	0.46	2,666	0.30	1,779	0.33	0.13	0.54	6.27
Death Penalty	0.56	2,684	0.40	1,775	0.32	0.24	0.44	6.83
Censorship	0.40	2,629	0.25	1,718	0.30	0.10	0.60	5.36
Living Together	0.67	2,679	0.52	1,771	0.30	0.37	0.33	7.54
Military Drill	0.38	2,625	0.24	1,733	0.29	0.09	0.62	5.24
Gay Rights	0.60	2,658	0.46	1,767	0.28	0.32	0.40	6.26
Segregation	0.38	2,653	0.24	1,743	0.27	0.11	0.62	4.83
Busing	0.43	2,670	0.30	1,766	0.26	0.16	0.57	4.92
Nuclear Power	0.42	2,646	0.29	1,744	0.26	0.16	0.58	4.84
Democrats	0.47	2,639	0.34	1,726	0.26	0.21	0.53	4.96
Divorce	0.47	2,659	0.34	1,765	0.26	0.21	0.53	4.99
Abortion	0.64	2,668	0.52	1,768	0.25	0.39	0.36	6.23
Modern Art	0.43	2,662	0.30	1,765	0.25	0.18	0.57	4.69
Federal Housing	0.36	2,665	0.26	1,766	0.20	0.16	0.64	3.61
Liberals	0.44	2,629	0.35	1,734	0.18	0.26	0.56	3.40
28-item mean	0.47	2,648	0.31	1,748	0.32	0.16	0.53	

Source: Access to the data provided by Eaves et al., principal investigators, Virginia 30K twin study (see note 7).
[a] The MZ–DZ correlation difference is statistically significant for all of the table items at the 0.01 level or above.

Adoption Studies

Adoption studies, as opposed to twin studies, suggest that adoptees (who are biologically unrelated) tend to be more different from their adoptive parents and siblings than their biological parents.

Where is the environment?

- Adoptees bear more resemblance in their outgoingness and agreeableness to their biological parents then to their adopted parents
- Two adopted children in the same home bear no more resemblance to each other than kids from two separate families.

Adoptive Studies

Adoptive studies strongly point to the simple fact that biologically related children turn out to be different in a family. So investigators ask:

Why are children in the same family so different?

Do siblings have VASTLY differing experiences?

Do siblings, despite sharing half of their genes, have different combinations of the other half of their genes?

Ultimate question: Does parenting have an effect?

Parenting

Parenting does have an effect on biologically related and unrelated children.

Parenting Influences children's
Attitudes, Values
Manners, Beliefs
Faith, Politics

"Mom may be holding a full house while Dad has a straight flush, yet when junior gets a random half of each of their cards his poker hand may be a loser." David Lykken (2001)

Nature *and* Nurture

Some human traits are fixed, such as having two eyes. However, most psychological traits are liable to change with environmental experience.

Genes provide choices for the organism to change its form or traits when environmental variables change. Therefore, genes are pliable.

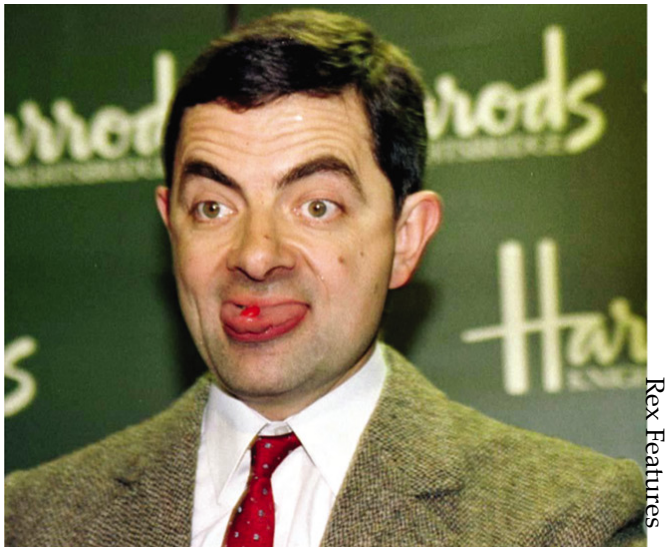
Gene-Environment Interaction

Genes can influence traits which affect responses, and environment can affect gene activity.

A genetic predisposition that makes a child restless and hyperactive evokes an angry response from his parents. A stressful environment can trigger genes to manufacture neurotransmitters leading to depression.

Gene-Environment Interaction

Genes and environment affect our traits individually, but more important are their interactive effects.

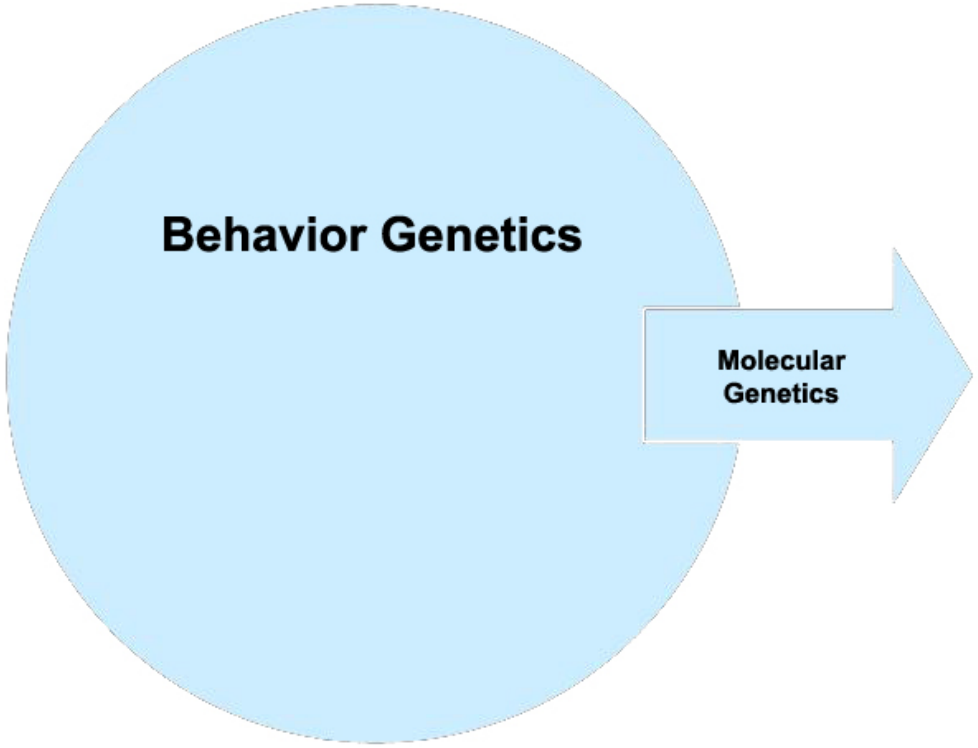


Rex Features

Alessia Pierdomenico/Reuters/Corbis

People respond differently to
Rowan Atkinson (Mr. Bean) than Orlando bloom.

The New Frontier: Molecular Genetics



Molecular genetics is a branch extension of behavior genetics that asks the question, “Do genes influence behavior?”

Molecular Genetics: Promises and Perils

Molecular geneticists are trying to identify genes that put people at risk for disorders. With this kind of knowledge, parents can decide to abort pregnancies in which the fetus is suspected of having such disorders.

However, this opens up a real concern regarding ethical issues involving such choices.