



The Scientific Method Origin, Basis of Science, ▶ It's Limitations

George Parks

Announcements

- ▶ Baby shower today for Bri Pettipas. 1-3 in Gathering Room. It's a boy. Registered at Target & Amazon.
- ▶ Room in the Inn sign up schedule is active! RITI begins in November!
- ▶ Singers are needed for our annual Lessons and Carols service. Contact Lee Flatt.

Prayer Concerns

- ▶ Susan Lassiter. Blood clots in lower leg and foot. No visitors.
- ▶ Preston Harper, father of Katie Casey, passed away September 17. Visitation Friday, October 4, 1-1:45 p.m. at St. Andrew Lutheran. Services follow at 2:00
- ▶ Russel Miller, father of Vickie Tomlinson passed away September 28. Services today in Spring Hill.
- ▶ Clive Anderson brother-in-law of Linda and Winston Biggs and long time OC member passed away on September 28. Services were Thursday.
- ▶ Congratulations to Abigail Glisson who was baptized September 29. Abigail is the daughter of Brad and Rebekah Glisson,

**Getting
Started**

Announcements

Visitors

Prayer Requests

Future Classes

Date	Topic	Teacher
10/13	Enlightenment, Pre & Post-Modernism	Parks
10/20	Creation Narratives, Flood	T. Briley
10/27	Creation Narratives, Flood	L. White
11/3	Cosmology & Origins	Mundie
11/10	Biochemistry/Genetics	??
11/17	Cosmology, Big Bang	Mundie
11/24	Evolution I	J. White
12/1	Evolution II	J. White
12/8	Radiometric Dating	J. White
12/15	Looking Back to Genesis	Panel?

Educational & Professional History

- ▶ 1971, B.A Chemistry, David Lipscomb College
- ▶ 1971-72, German Academic Exchange Fellow, University of Heidelberg
- ▶ 1976, Ph.D. Physical Chemistry, Rice University
- ▶ 1976-2008, R&D ConocoPhillips
- ▶ 2008-Present, Consulting, Phillips 66, US Department of Energy FCTO & BETO

Primary Research Areas



Surface Science, Fundamental Catalysis



Molecular Scale Simulation: Quantum and Classical Mechanics



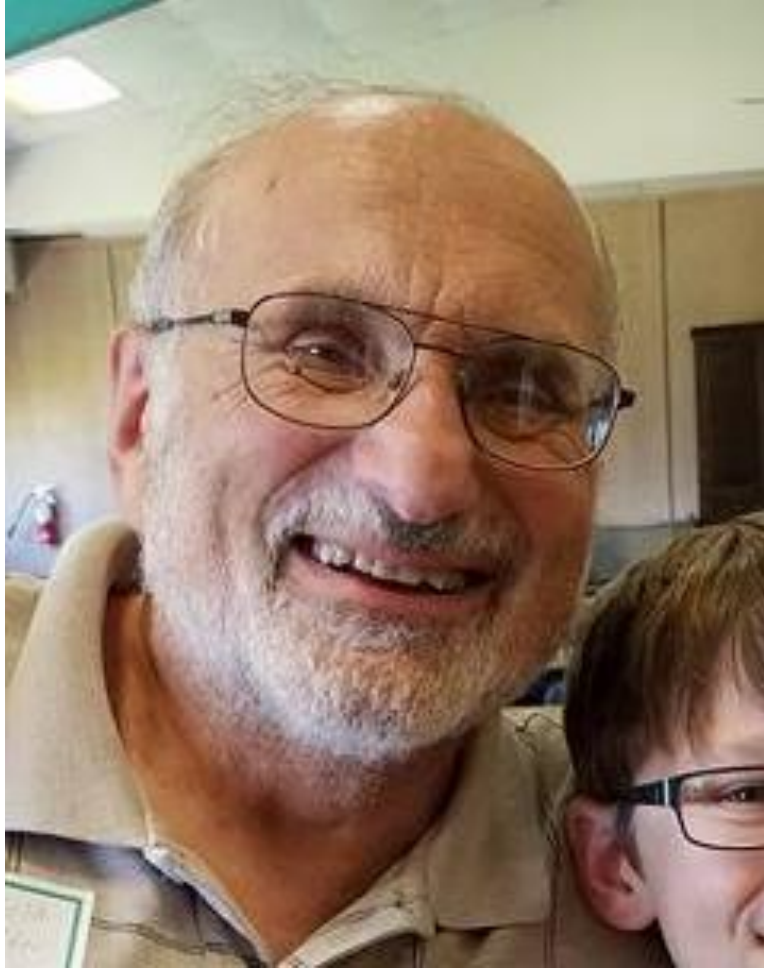
Advanced Fuels: Biofuels, Hydrogen & Fuel Cells

Descriptors

I am...	
Old (70)	a Cruiciverbalist
a Christian	a Modernist
a Chemist	an INTP
a Curmudgeon	Dealing with Cancer
a Nerd	

Turn on Recorder!





A Final Thought

You don't have to be schizophrenic to be a scientist and a believer, but it helps.

Arnie Schaffer

Living, Working, & Searching for Truth in Two Worlds

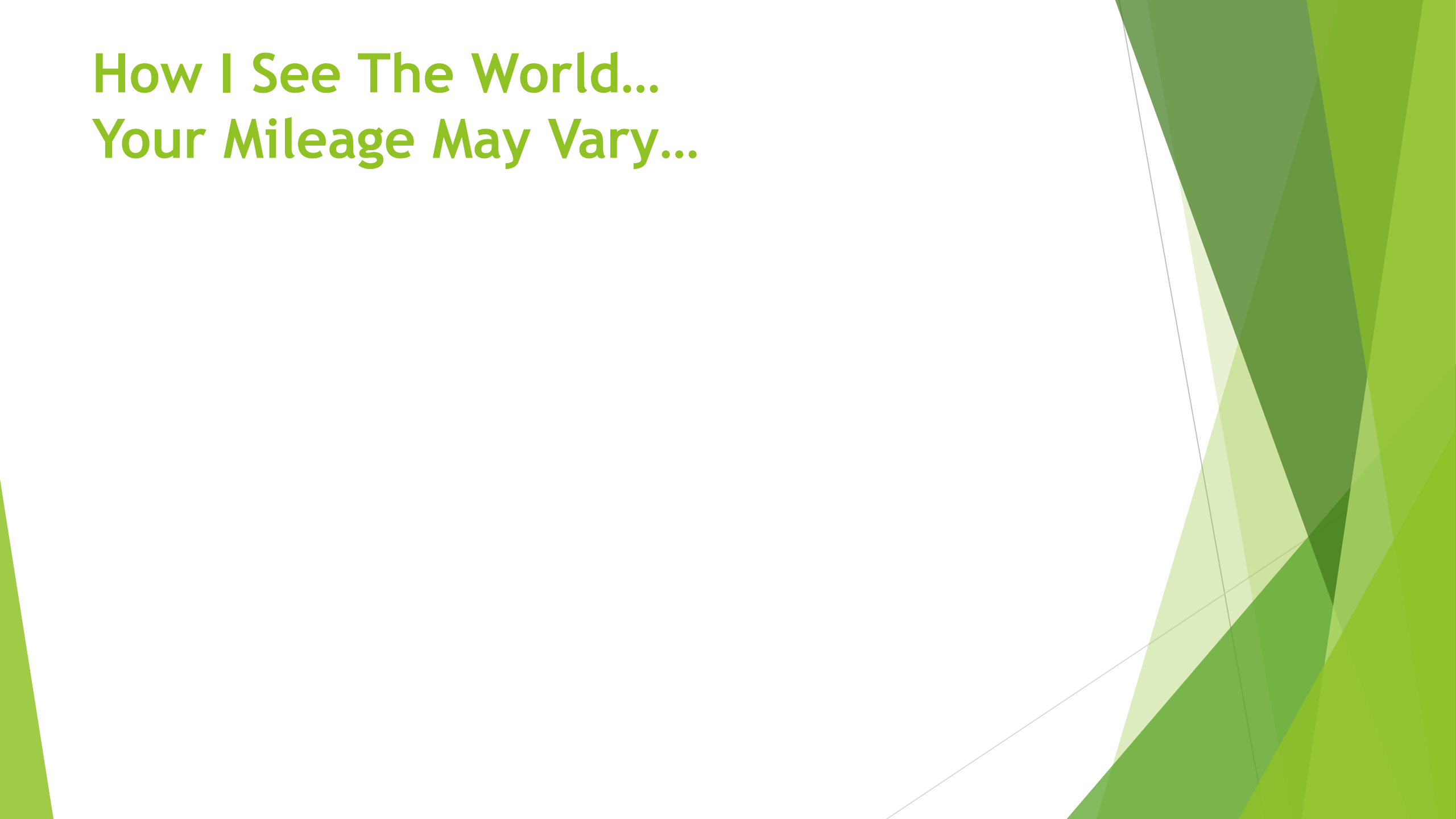
▶ Science—the Natural World

- ▶ Take Nothing by Faith
- ▶ Observe
- ▶ Hypothesize
- ▶ Test

▶ Religion—The Supernatural

- ▶ So we are always confident;... for we walk by faith, not by sight.
- ▶ Have you believed because you have seen me? Blessed are those who have not seen and yet have come to believe.”

How I See The World...
Your Mileage May Vary...



Truth

Phenomena

Revelation

Observation

Transmission

Data

Sacred Text

Interpretation

Theory

Doctrine

Physical World

Religion

Science

Science, in common parlance, is both a body of knowledge claims and a practice; it deals with the knowledge and study of the natural world.

Religion

- ▶ Religion is difficult to define neatly; more useful and more precise terms are religious practice, theology, and faith.
 1. *Religious practice* can be defined as the observances and practices that flow from a religious commitment (attendance at church, works of charity, moral self-discipline, and so on).
 2. *Theology* is “a rational discourse about God;” that is, it is the intellectual and methodical study of God and the spiritual world and God’s attributes, actions, and relationship to creation. Like science, theology is both a body of knowledge claims and a practice of generating them.
 3. *Faith* is a method (through belief or suspended disbelief) of arriving at some knowledge claim, for example, “that God exists.”
 4. These three concepts are interconnected, but individuals combine them in different ways and proportions.

Models of Science-Religion Relationship

- ▶ Warfare Model—a Recent Development
- ▶ Separate Realms Model—Uses Present Borders, Can't Apply to Historical Issues
- ▶ Models from *complexity thesis*: No single model can be Used to Describe Historical Relationships
 - ▶ Translation, Appropriation, Assimilation, and Cross-Fertilization

Little Known Science/Religion Conflicts

- ▶ Vacuum—Was there a small area where God did not exist?
- ▶ Lightning Rods—Controlled by the “Prince of the Powers of the Air.” Lightning struck church in Brescia, Italy in 1769 where 200,000 pounds of powder were stored. As many as 3,000 died. Lightning rods quickly appeared on churches.
- ▶ Anesthetics in childbirth—Genesis 3:16. James Simpson cited Genesis 2:21 to counter arguments.
- ▶ Smallpox vaccinations—“a judgment of God on the sins of the people...to avert it is but to provoke him more.”

Warfare Model

- ▶ Almost Entirely Due to Two Men,
 - ▶ John William Draper, *A History of the Conflict between Religion and Science* 1874
 - ▶ Andrew Dickson White, *A History of the Warfare of Science with Theology in Christendom* 1896
- ▶ Both Wrote Polemic Texts that Were Highly Inaccurate and Took Statements Out of Context!

**St. Augustine
(454-540)
Four Points**

Unity of Truth

Two Books—Book of Scripture &
Book of Nature

Recognition that Both Books Require
Careful Interpretation

In the pursuit of religion versus the
pursuit of science or philosophy,
religion has primacy, but scientific
knowledge is a key *ancilla*
("handmaiden") that assists true
religion.

Augustine on Interpretation

- ▶ Layered meanings: for example, a literal, an allegorical, an anagogical, and a moral meaning.
- ▶ Literal interpretation? St. Augustine's Literal Interpretation of Genesis denies a six-day, and even a six-period, creation.
- ▶ Doctrine of accommodation: Biblical expressions were accommodated to the understanding of their original audience
- ▶ Correct interpretation of either Scripture or the world requires the assiduous exercise of reason.

Augustine Continued

- ▶ Because biblical interpretation is very difficult, our explanations of some passages should be held only provisionally.
- ▶ Because it is often easier conclusively to prove natural and philosophical propositions than interpretations of specific biblical passages, our interpretations of biblical passages must be informed by the current state of sure scientific and other knowledge.
- ▶ Failure to conform interpretations to the certain knowledge gained from other sources (such as the Book of Nature) opens the interpreter, and Christianity as a whole, to ridicule for being unlearned.

The Scientific Method: What is it?

- ▶ A Method to Understand the Natural World
- ▶ Makes no Claim to Address the Supernatural

What Does the Scientific Method Assume?

Natural Events Have Natural Causes

Evidence From the Natural World
Can be Used to Learn About Those
Causes.

There is Consistency in the Causes
That Operate in the Natural World

The Scientific Method: The Basic Steps

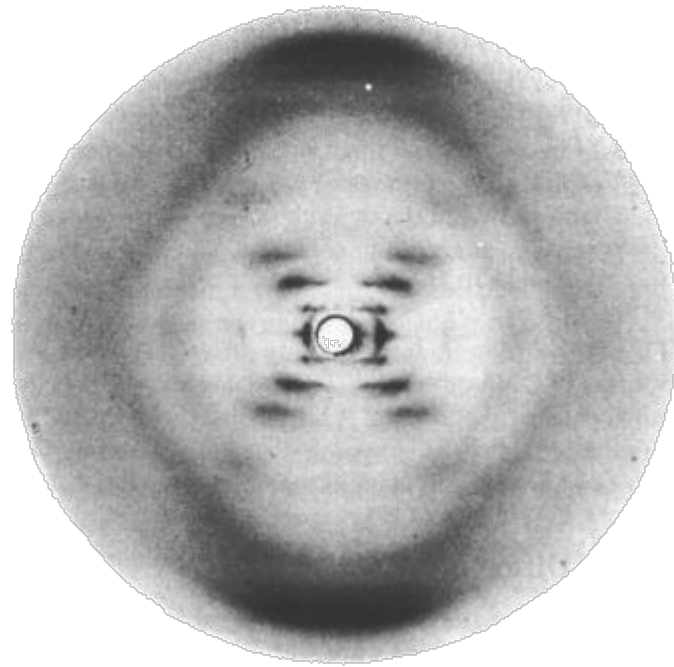
- ▶ Question
- ▶ Hypothesis
- ▶ Prediction
- ▶ Experiment
- ▶ Analysis

Example: DNA

- ▶ **Question:** Previous investigation of DNA had determined its chemical composition (the four nucleotides), the structure of each individual nucleotide, and other properties. It had been identified as the carrier of genetic information, but the mechanism of how genetic information was stored in DNA was unclear.
- ▶ **Hypothesis:** Linus Pauling, Francis Crick and James D. Watson hypothesized that DNA had a helical structure.
- ▶ **Prediction:** If DNA had a helical structure, its X-ray diffraction pattern would be X-shaped.

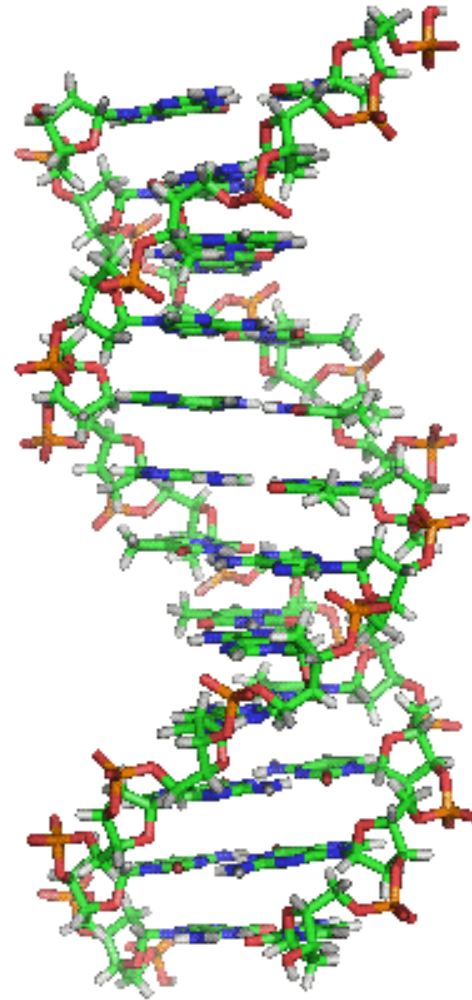
Example: DNA

- ▶ **Experiment:** Rosalind Franklin crystallized pure DNA and performed X-ray diffraction.



Example: DNA

- ▶ **Analysis:** When Watson saw the detailed diffraction pattern, he immediately recognized it as a helix. He and Crick then produced their model.



The Letter to *Nature*

April 25, 1953

MOLECULAR STRUCTURE OF NUCLEIC ACIDS

A Structure for Deoxyribose Nucleic Acid

WE wish to suggest a structure for the salt of deoxyribose nucleic acid (D.N.A.). This structure has novel features which are of considerable biological interest.

Did the Watson-Crick Experiment Prove that the Structure of DNA Was Helical?

No amount of experimentation can ever prove me right; a single experiment can prove me wrong.

Albert Einstein

What Can't We Investigate Using the Scientific Method?

The background of the slide features abstract, overlapping geometric shapes in various shades of green, ranging from light lime to dark forest green. These shapes are primarily located on the right side of the slide, creating a modern, layered effect. The text is positioned on the left side of the slide, set against a plain white background.

A Word About Miracles?

- ▶ Do you Believe in Miracles Today?
- ▶ How do you Define a Miracle?
- ▶ My Definition: A Miracle Breaks Natural Law (*Cursus Communis Naturae*)
- ▶ How Does God Act Today?
- ▶ Non-Interventionist God
- ▶ Miraculous God
- ▶ Providential God

A Great Resource: Lawrence Principe—Science & Religion

- ▶ Lawrence Principe
 - ▶ Johns Hopkins: Organic Chemistry & History of Science
 - ▶ Maryland Professor of the Year (Carnegie Foundation)
 - ▶ Templeton Foundation's award for courses on science and religion
 - ▶ First recipient of the Francis Bacon Award for History and Philosophy of Science
- ▶ www.greatcourses.com
- ▶ 12 30-minute lectures
- ▶ NEVER pay full price! (This Course \$90 vs. \$12.95)

Science & Religion

Principle Lectures

Science & Religion	God the Watchmaker
The Warfare Thesis	Natural Theology and Arguments from Design
Faith & Reason—Scripture & Nature	Geology, Cosmology, and Biblical Chronology
God & Nature—Miracles & Demons	Darwin & Responses to Evolution
Church, Copernicus, & Galileo	Fundamentalism & Creationism
Galileo's Trial	Past, Present, & Future

Now for the Real Final Word

Eternal Dirt or Eternal Spirit... Take your choice.

John Netterville, 1968

Theories vs. Laws

- ▶ Initial Theory Established to Explain Existing Observations
- ▶ Theory is Modified or Trashed to Explain New Observations
- ▶ If it Holds up, a Theory Becomes a Law?
- ▶ Law: A Scientific Generalization Based on Empirical Observations of Physical Behavior.
- ▶ Natural Laws?
 - ▶ Law of Gravity
 - ▶ Laws of Thermodynamics
 - ▶ Law of Conservation of Energy
 - ▶ Law of Conservation of Matter

We Seem to Eventually Discover That Many of Our Laws Aren't Laws At All

- ▶ Conservation of Energy and Matter

- ▶ Blown Apart by $E = mc^2$

- ▶ Newton:

$$F_g = \frac{Gm_1m_2}{r^2}$$

- ▶ Einstein: Mass Warps Space-Time
- ▶ Good News: For Anything We'll Ever See, Newton Can Explain it All.

Scientific Laws for Most of Us

- ▶ The “Old” Laws Explain Pretty Much Everything We Can Observe Without VERY Sophisticated Equipment.

The Brilliance of Einstein

- ▶ Instead of Basing Relativity Theory on Observations, It Arose from Thought (*Gedanken*) Experiments
- ▶ Theory Introduced in 1905, First Confirmed by Solar Eclipse of 1918 (Eddington Experiment)
 - ▶ Starlight Deflected in Agreement With Einstein's predictions (1.74 arcseconds or about $\frac{1}{2}$ inch displacement at a distance of one mile)