

**Counter-Insurgency Operations  
and Economic Decision-Making:  
The Case of Afghanistan**

*Ethan Kapstein, Ph.D.  
April 8, 2010*



**Evidence-Based Policy  
for Controversial Claims**

***The Case of Cold Fusion***

*Thomas W. Grimshaw, Ph.D.  
April 15, 2010*



## Ethan Kapstein Lecture: Some (More or Less) Quotes



- “Not all good policy-related questions are researchable.”
- “This program will test my premise that private investment is a leading indicator of stability in conflicted states.”
- “The World Bank data are difficult to process for meaningful information or inference.”
- “Land titling is accepted as essential policy in foreign aid to developing countries; there is little or no evidence that this is true.”

## Some Commonalities...



- Researchable – amenable to getting data, gathering evidence
- Test the premise – gather evidence in real-world conditions (Afghanistan)
- Process data – examine the evidence obtained in the field (World Bank)
- Policy based on evidence (land titling)

## **Evidence-Based Policymaking**

### *The Cold Fusion Case*



- What is Evidence-Based Policymaking?
- What is Cold Fusion?
- Levels of Evidence for Policymaking
- Cold Fusion Levels of Evidence
- Policy Responses for Cold Fusion Evidence
- Conclusion: Evidence-Based Policy Choices for Cold Fusion
- Applicability to Other Cases (time permitting)

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## **I. What is Evidence-Based Policymaking?**



## What is Evidence-Based Policymaking?



1. Foundations
2. Applications
3. Development
4. Alternative Approaches
5. Current Status



<http://thecanadian-medshop.com/articles/>

## EBP Foundations



- Rational
  - Faith in reason
  - Outgrowth of the Enlightenment
  - “Common sense”
- Realistic
  - Solidly based in reality
  - Contrasted, for example, to Idealism
- Pragmatic
  - Best approach is the most effective
  - “What works” is normally what should be selected

## EBP Applications



- Current
  - Health care
  - Education
  - Criminal justice
  - Social care and welfare
  - Housing
  - Transportation
  - Urban Planning
- Recent Extensions
  - Business management
  - Public policymaking



<http://www.psychologytoday.com/files/u107/health%20care.jpg>

<http://tristategeneralstore.com/images/Education.jpg>

<http://blog.lib.umn.edu/schne644/architecture/htdocs/blog/schne644/architecture/denmark%20housing%20development.jpg>

## EBP Development



- Origins in U.S. Social Policy
  - LBJ Great Society
  - Campbell: public programs as “social experiments”
- Adoption in Medicine
  - Diagnosis and treatment grounded in science
  - Strengthen connection between researchers and practitioners
  - **Cochrane Collaboration**
- Extension to Public Policy-making
  - Applications in Britain
  - Central tenet of early years of New Labour government
- “Modernising Government” 1999



<http://archive.cabinetoffice.gov.uk/moderngov/images/leaflet.jpg>

## Alternative Approaches to EBP

- Ideological
  - Policy based on “what’s right”
  - Advancement of ideas on how things should be
- “Democratic governments are superior and our policy should be to get them in place everywhere.”
- Other ideological examples?

## Current Status of EBP

Primarily emphasized in Britain (New Labour Party)

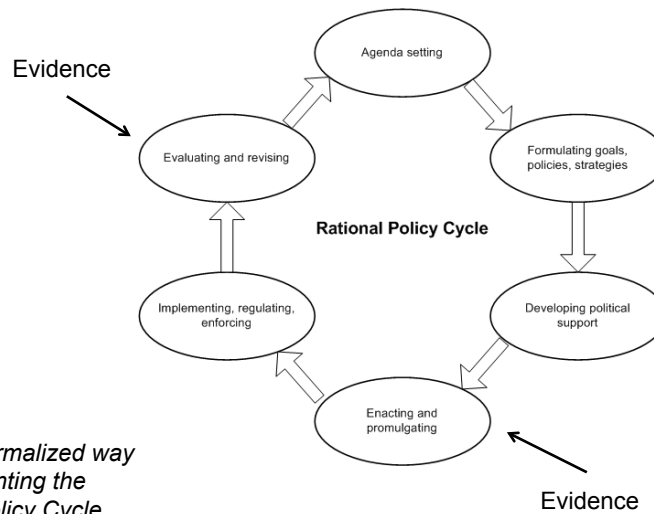


Many (falsely?) believe that policymaking is a rational process

# Traditional Rational Policy Cycle



BCF-3



*EBP is a formalized way of implementing the Rational Policy Cycle*

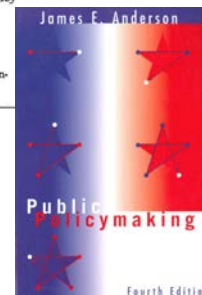
# Anderson: The Policy Process



TABLE 1.1 The Policy Process

Policy Terminology	Stage 1: Policy Agenda	Stage 2: Policy Formulation	Stage 3: Policy Adoption	Stage 4: Policy Implementation	Stage 5: Policy Evaluation
Definition	Those problems, among many, that receive the serious attention of public officials	Development of pertinent and acceptable proposed courses of action for dealing with a public problem	Development of support for a specific proposal so that a policy can be legitimized or authorized	Application of the policy by the government's administrative machinery	Efforts by the government to determine whether the policy was effective and why or why not
Common sense	Getting the government to consider action on the problem	What is proposed to be done about the problem	Getting the government to accept a particular solution to the problem	Applying the government's policy to the problem	Did the policy work?

Source: Adapted from James E. Anderson, David W. Brady, and Charles Bullock III, *Public Policy and Politics in the United States*, 2d ed. (Monterey, Calif.: Brooks/Cole, 1984).



## II. What is Cold Fusion?



### What is Cold Fusion?



- Importance
- Hot Fusion Context
- Announcement
- Investigation and Rejection
- Reasons for Rejection
- Repudiation and Ridicule
- Continued Experimental Success?



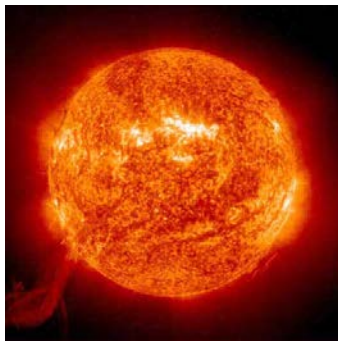
## Why Is Cold Fusion Important?

- Potentially unlimited free (almost) energy
- Potential elemental transmutation (aka alchemy)
- PUBLIC WELFARE BENEFIT



<http://id.mind.net/~zona/mstm/physics/mechanics/energy/introduction/introduction.html>  
<http://www.fyndo.com/life.html>

## The Hot Fusion Context...



Occurs naturally inside sun and other stars



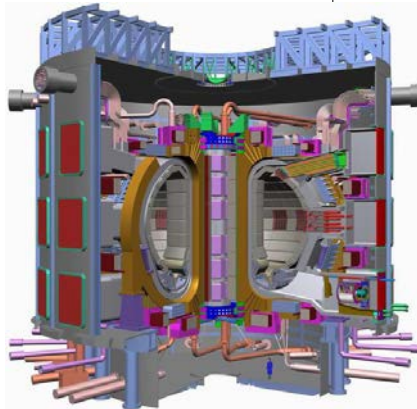
MIKE, Eniwetok, October 31, 1952

<http://spaceflightnow.com/news/n0211/04soho/>

<http://en.wikipedia.org/wiki/Image:IvyMike2.jpg>

## Energy from Hot Fusion?

- Pursued since first H-bomb in 1952
- Difficult technological problem: plasma containment
- “Breakeven” (energy in = energy produced) not yet consistently reached
- Very clean environmentally; including global warming
- Latest step: ITER (International Tokamak Engineering Research) project
- Under construction in France



[http://www.plasma.inpe.br/LAP\\_Portal/LAP\\_Site/Figures/](http://www.plasma.inpe.br/LAP_Portal/LAP_Site/Figures/)

## Scientific American, March 2010

# FUSION'S

# FALSE DAWN

“Scientists have long dreamed of harnessing nuclear fusion - the power plant of the stars - for a safe, clean and virtually unlimited energy supply.

***Even as a historic milestone nears, skeptics question whether a working reactor will ever be possible.”***

By  
Michael Moyer

## Cold Fusion Announcement

- March 23, 1989
- Press Conference, University of Utah
- Stanley Pons, Chemistry Dept Chairman
- Martin Fleischmann, Retired Distinguished Electrochemist
- Conference instigated by university officials
- Race for “precedence” against Brigham Young University, Provo

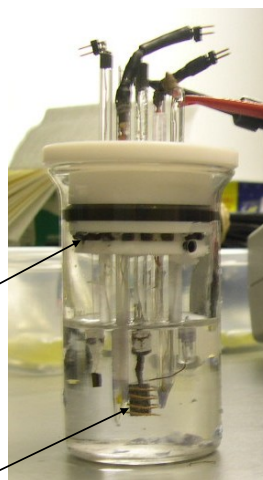


*Stanley Pons and Martin Fleischmann*

<http://www.fusionim.com/creatingfusion.html>

## Typical Cold Fusion Electrolytic Cell

- Glass container (200 mL)
- Deuterium (heavy water) solution
- Anode (coiled wire)
- Cathode (Pd plate inside anode)
- Thermistors (temperature)
- Direct current supply
- Recombiner for D & O (at top)

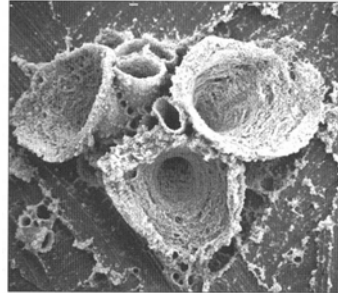


Anode and cathode

Dennis Letts, Austin, TX

## Cold Fusion “Maybes”

- Electrolytic cell setup with platinum anode and palladium (Pd) cathode
- Applied voltage causes deuterium to hydrolyze (into D & O) and D to enter Pd cathode crystal lattice
- Entire assembly is contained in calorimeter to measure heat input and output
- Cold fusion reaction occurs when Pd is sufficiently “loaded” with deuterium (**SOMETIMES**)
- “Excess heat” (non-chemical) indicates that cold fusion reaction is occurring
- May be result of microspots of fusion that explode and self destruct (NAEs)
- New elements not present before experiment found (transmutation)



Mizuno, 1998

## What Happened After the Announcement?

- Many attempts to replicate
  - *Some successful, most not*
  - Hampered by missing details of the experiment
- Attacked by hot fusion physicists as “not consistent with nuclear theory”



May 8, 1989

[http://burgundyjade.blogspot.com/2007\\_03\\_01\\_archive.html](http://burgundyjade.blogspot.com/2007_03_01_archive.html)

## Key Events in 1989 That Led to Quick Rejection

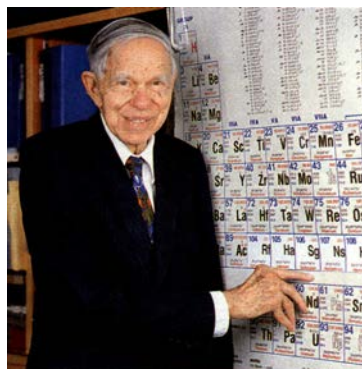


1. Announcement by press conference not well accepted by scientists
2. Glenn Seaborg meeting with George Bush in April
3. Meeting of American Physical Society in May, in Baltimore
4. U.S. DOE ERAB report – draft and final (July, December)

## Glenn Seaborg on Cold Fusion “FDR to Bush: 50 Years of Advising Presidents” Lawrence Berkeley National Lab, October 1995



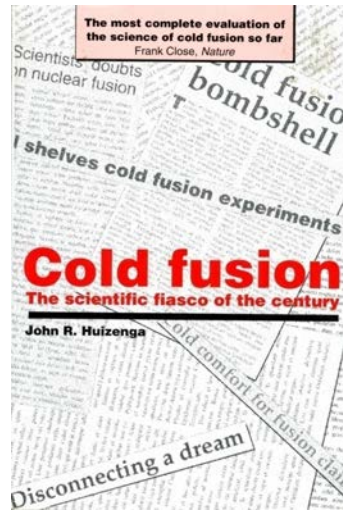
- “The idea swept the country. I was called to Washington to brief President Bush on it.
- It was a real dilemma. What should I do? I decided to take my background as a nuclear scientist and come to the sensible conclusion that this work was not right.
- It was really, well, you might say, really cold. You couldn't do it. That's what I told him at that time.
- I said you can't just go out and say this is not valid.
- **You are going to have to create a high level panel that will study it for six months and then they will come out and tell you it's not valid.**
- And that's what he did.”



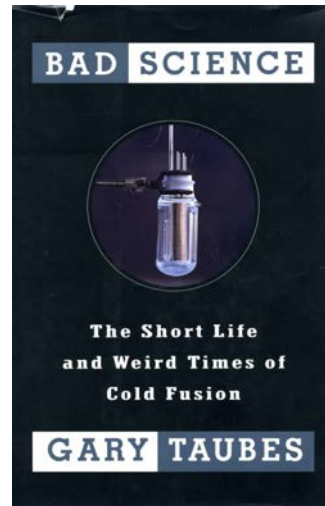
[Parenthetical note: Seaborg's graduate student Huizenga led the 1989 ERAB committee.]

<http://www.kfki.hu/chemonet/TermVII/tv2001/tv0104/inzelt.html>

## CF Ridiculed As “Fiasco”, “Bad Science”



Huizenga, 1992



Taubes, 1993

## Why Was Cold Fusion Rejected?



- Method of initial announcement and publication
- Many mistakes by both proponents and antagonists
- Erratic reproducibility (variables not understood)
- Experimental failures used to conclude non-existence
- “The Absence of Evidence is Not Evidence of Absence”

## Why Was Cold Fusion Rejected?

- Difficulties in selection of control experiments
- Explicit antagonism of hot fusion physicists (chemists vs. physicists)
- Incorrect interpretation as pathological science
- Overall failure of the scientific process??

## Current Status: *The Other Side of the Coin...*

- Has not followed path of discredited discoveries
  - N-rays
  - Polywater
- Continued investigation
  - At the margin
  - Reputable scientists
- “Undead Science”



## Continued Experimental Success?



- (More on this in a minute...)

[http://www.urbanmoms.ca/get\\_mommed/support/wednesday-affirmation-5.html](http://www.urbanmoms.ca/get_mommed/support/wednesday-affirmation-5.html)

## III. Levels of Evidence for Policymaking





## Level of Evidence Categories: Associated Probabilities



- Borrowing from the legal profession...

Low Level of Evidence	<50%
Preponderance of Evidence	>50%
Clear and Convincing Evidence	>70%
Beyond a Reasonable Doubt	>90%

POE: Civil law standard  
BRD: Criminal law standard

## Advantages of LOE Approach



- Solid foundations in the legal field
- Utilizes well understood terminology
- Highly rational underpinnings
- Grounded in evidence-based approach
- Easy to comprehend by lay persons
- Many policymakers have a legal background

## Challenges of the Approach



1. Varied opinion in interpretation of other (e.g. scientific) kinds of evidence
2. Not always clear what the policy response should be for various levels

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## IV. Policy Responses for Cold Fusion Evidence



## Policy Responses for Cold Fusion Evidence



- Alternatives
  1. Discontinue cold fusion research altogether
  2. Continue marginalization (business as usual)
  3. Reinstate to full legitimacy
  4. Support on a par with hot fusion
  5. Institute crash program (re: Manhattan Project)
- Policymaking Scenarios
  - Conservative
  - Moderate

## Connecting the Policy Responses to Levels of Evidence...



- Rational (Evidence-Based) Policymaking Framework
- Levels of Evidence → Policy Alternatives

### ***Conservative Scenario...***

Low Level of Evidence	<b><i>Discontinue Research</i></b>
Preponderance of Evidence	<b><i>Reinstate Legitimacy</i></b>
Clear & Convincing Evidence	<b><i>Par with Hot Fusion</i></b>
Beyond a Reasonable Doubt	<b><i>Crash Program</i></b>

## Connecting the Policy Responses to Levels of Evidence...



- Given the high potential public welfare benefit...

### ***Moderate Scenario...***

Low Level of Evidence

***Reinstate Legitimacy***

Preponderance of Evidence

***Par with Hot Fusion***

Clear & Convincing Evidence

***Crash Program***

Beyond a Reasonable Doubt

***Crash Program***

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## V. Cold Fusion Levels of Evidence



## What Is the CF Level of Evidence? *Four Perspectives*



1. Early Experimental Successes – Excess Heat
  - Richard Oriani
  - Robert Huggins
  - Melvin Miles
  - Michael McKubre
2. Verifications Since 1989
  - Excess Heat
  - Ash (Helium, Radiation)
  - Transmutation
3. Particularly Demonstrative Experiments
  - Arata 2008
  - Mizuno 2005
4. Statistical Analysis of Experimental Results:  
Bayesian Network Analysis

## Assertion #1

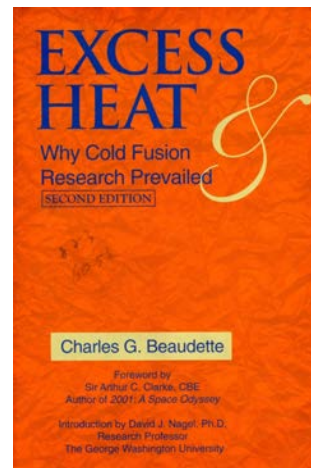


Early experimental successes  
establish a Preponderance of  
Evidence that CF is real.

## Early Successes: Described by Beaudette, 2002



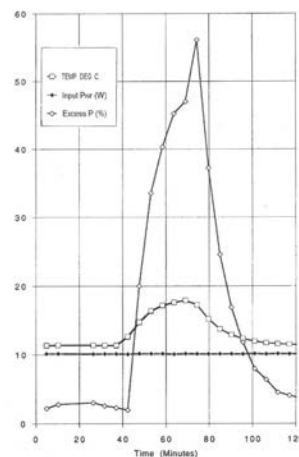
- Robert Huggins
- Melvin Miles
- Richard Oriani
- Michael McKubre



## Early Success 1 Robert Huggins



- Excess power (% over input power) began at ~45 min
- Reached a maximum of 55% excess power at 55 min
- Continued until 95 min
- Temperature rise noted in same timeframe

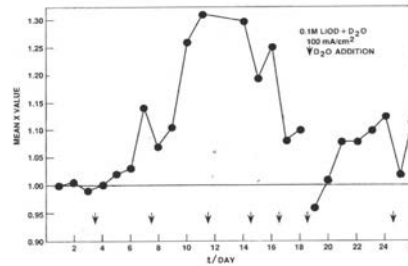


Beaudette, 2002

## Early Success 2 Melvin Miles



- Plot of ratio of output power to input power
- Excess power began on Day 4
- Reached a maximum of 1.3 (30% excess) on Day 11
- Continued to end of experiment

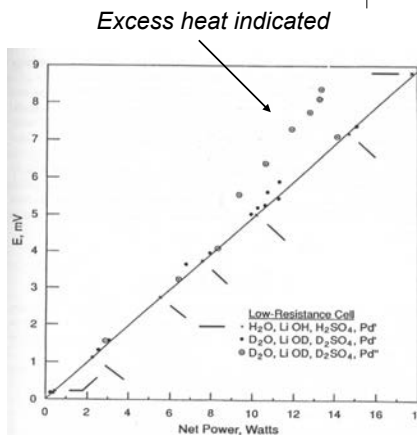


Beaudette, 2002

## Early Success 3 Richard Oriani



- Plot of power in vs power out
- Input and output balance indicated by diagonal line
- Total of eight points (six more definitive) above the line
- Strong indication of excess heat where heat output exceeds input



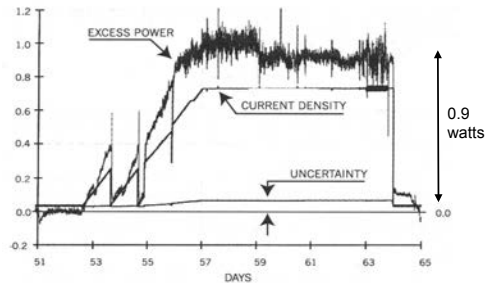
Beaudette, 2002

\*Oriani, R.A., John C. Nelson, et al., Calorimetric Measurements of Excess Power Output During the Cathodic Charging of Deuterium into Palladium. *Fusion Technology*, v. 18 (Dec 1990), p. 652.

## Early Success 4 Michael McKubre



- Excess power initiated on Day 53 of experiment and continued through Day 65
- Experimentally initiated by increasing current on Day 53
- Excess power of about 0.9 watts observed



\*McKubre, Michael, et al. "Isothermal flow calorimetric investigations of the D/Pd system," *Journal of Electroanalytical Chemistry*, vol. 368, 1994) p. 61.

Beaudette, 2002

## Assertion #1



Early experimental successes establish a Preponderance of Evidence (>50%) that CF is real.



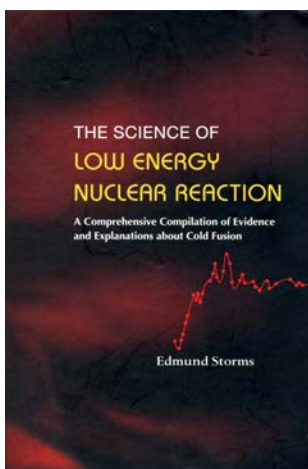


## Assertion #2

Experimental successes since 1989 establish Clear and Convincing Evidence of CF reality.



## Confirmations, 1989-2004 *Excess Heat: Primary Signature*



Storms, 2007

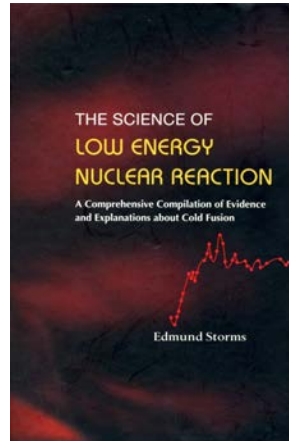
Assembled from Table 2...

1989	2	1998	17
1990	15	1999	1
1991	8	2000	12
1992	21	2001	1
1993	20	2002	16
1994	8	2003	11
1995	17	<u>2004</u>	<u>8</u>
1996	20		
1997	7	<b>Total</b>	<b>184</b>

## Confirmations, 1989-2004, Elemental Transmutation, Radiation



- Two additional fusion “signatures”
- Elemental Transmutation
  - 80 Reports
- Anomalous Radiation
  - 55 Reports
- *Total Confirmations*
  - 319 Reports



Storms, 2007

Assembled from Tables 8 and 11

## Assertion #2



Experimental successes since 1989 establish Clear and Convincing Evidence (>70%) of CF reality.

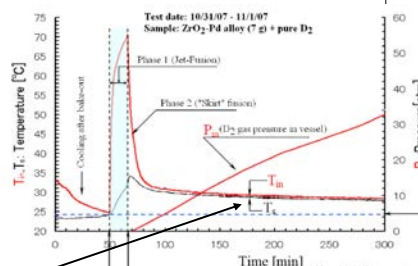
## Assertion #2A

Demonstrative experiments further verify Clear and Convincing Evidence of CF reality.

- Arata 2008
- Mizuno 2005

## Demonstration 1 Arata, May 2008

- Osaka, Japan
- Palladium powder and deuterium gas
- Continued heat generation for 2 days
- Differential temperature of 2° C as cell cooled
  - $T_{in}$  – inside cell
  - $T_s$  – outside cell
- Demonstrates replicability (excess heat)



## Demonstration 2 *Mizuno, 2005*



- Hokkaido University, Japan
- Differs from Fleischmann-Pons cell
  - Potassium carbonate electrolyte
  - Tungsten cathode
- Still electrochemical cell
- Many experiments conducted – produced excess heat without incident



## Demonstration 2 (continued) *Mizuno, January 2005*



- Sudden explosion in early stages of experiment
- Over 800 times as much output energy as input
- Elemental transmutation found in tungsten cathode
  - Primarily Ca, S
  - Also K, Si, Ba, Ti, 6 others
  - Only tungsten present prior to experiment





## Assertion #2A

Demonstrative experiments further verify Clear and Convincing Evidence (>70%) of CF reality.

- Arata 2008
- Mizuno 2005



## Assertion #3

Statistical analysis of the first 10 relevant experiments (of 30 considered) establishes CF reality Beyond a Reasonable Doubt.



## Bayesian Network Analysis

- Based on Bayes' Theorem
- "Starting Probabilities"
  - P = 0.50 ("unbiased jury")
  - P = 0.05 (chemists v. physicists)
- First 10 relevant experiments
  - 7 successes
  - 3 failures
- Change in probability with successive experiments
- # of experiments for
  - BRD (>90%)
  - CCE (>70%)
  - POE (>50%)

### Bayes' Theorem

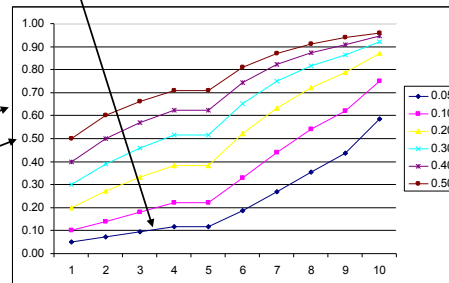
$$P(A|B) = [P(B|A) * P(A)] / P(B), \text{ where:}$$

P(A) = marginal probability of A

P(B) = marginal probability of B

P(A|B) = conditional probability of A, given B

P(B|A) = conditional probability of B, given A



## Assertion #3



Statistical analysis of the first 10 relevant experiments (of 30 considered) establishes CF reality Beyond a Reasonable Doubt (>90%).

## Conclusion: Rational Public Policy



- Given the enormous potential public welfare benefit...
- In order to maximize the public interest...
- Within evidence-based framework...
- With rational interpretation of the science...
- Given the level of evidence...
- Considering the policy options...
- Adopting a **conservative** policy scenario...
  
- ...**Assertion #4**

## Assertion #4



- POE: Definite → Reinstatement to full legitimacy
- CCE: Strong Case → Hot fusion level of support
- BRD: Possible → Crash program (like Manhattan)
  
- That is to say...  
*Cold fusion should, at a minimum, be **reinstated** on a par with other emerging technologies!*



<http://arcanaimp.com/forum.html>

## Summary: Rational Public Policy toward Cold Fusion



- We have...
  - Established evidence-based policymaking framework
  - Defined levels of evidence and probabilities
  - Set forth appropriate CF responses for levels
  - Reviewed scientific evidence
  - Made correlation of science to evidence levels
  - Developed rational policy choices based on level of evidence
  - Concluded with strong basis for reinstatement as rational policy choice (at a minimum)

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## VI. Applicability to Other Cases



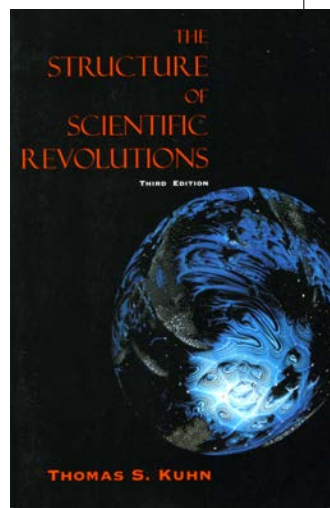


## Applicability to Other Cases

- Structure of Scientific Revolutions (Kuhn)
- Prominent Examples
  - Heliocentric theory (Galileo)
  - Continental drift (Wegener)
  - Heavier-than-air flight (Wright Brothers)
- U.S. Defense Advance Research Projects Activity (DARPA)
- Lessons learned

## Structure of Scientific Revolutions

- Thomas Kuhn
- 1962, 1964, 1970, 1996
- “Paradigm Shifts”
- Initial rejection, eventual adoption, with more advanced viewpoints
- Controversial; not universally accepted
- *Will apply if CF proves to be real!*





## Some Example Precedents...

Heliocentric Theory (Copernicus, Kepler, Galileo)  
Flight (Orville and Wilbur Wright)  
Continental Drift (Alfred Wegener)



Galileo



Wright Brothers

Wegener



<http://home.dayton.lib.oh.us/Archives/Exhibits/2002/wright14.html>

<http://en.wikipedia.org/wiki/Heliocentrism>  
[http://en.wikipedia.org/wiki/Alfred\\_Wegener](http://en.wikipedia.org/wiki/Alfred_Wegener)

## U.S. Defense Advanced Research Projects Agency (DARPA)



“DARPA’s mission is to maintain the technological superiority of the U.S. military and prevent technological surprise from harming our national security by sponsoring revolutionary, high-payoff research bridging the gap between fundamental discoveries and their military use.”

## U.S. Defense Advanced Research Projects Agency (DARPA)



- Created in response to 1957 Sputnik launch
- Plenty of examples of support for marginalized phenomena
- Many technological breakthroughs
  - Internet precursor
  - Graphical user interface (GUI)
- History of support of phenomena outside mainstream science
  - ESP
  - Telekinesis
- Some DARPA support for cold fusion in the past...

## Lessons Learned...

**“When a distinguished but elderly scientist states that something is possible, he is almost certainly right. When he states that something is impossible, he is very probably wrong.”**

*Arthur C. Clarke's First Law*



**“Every revolutionary idea seems to evoke  
three stages of reaction. They may be  
summed up by the phrases:**

- 1- It's completely impossible.*
- 2- It's possible, but it's not worth doing.*
- 3- I said it was a good idea all along.”*

*Arthur C. Clarke*



**Lessons Learned...**