Lessons from cold fusion archives and from history

1. Cold fusion is chaotic, and that is a good thing.
2. The literature *does* prove the effect is real and it teaches how to replicate.
3. This is a multidisciplinary subject.
4. The worst error you can make is an unexamined assumption.

Chaos in emerging science

A description of Hahn and Meitner: “Their early papers are a mixture of error and truth as complicated as the mixture of fission products resulting from the bombardments. Such confusion was to remain for long time a characteristic of much of the work on uranium.” – E. Segré

Experts agree cold fusion is real

"There are now **undoubtedly overwhelming** indications that nuclear processes take place in metal alloys." – Prof. Heinz Gerischer, 1991

Proof positive it is nuclear

Graham Hubler wants:

✓ More reproducibility. Better than transistors in 1954!

✓ Proof positive it is nuclear. Tritium, helium correlated with heat.

✘ A viable model . . . Two out of three isn't bad.

Sisyphus starting over from scratch

How to replicate

Miles, M. and K.B. Johnson, *Anomalous Effects in Deuterated Systems*, *Final Report*. 1996, Naval Air Warfare Center Weapons Division.

Cravens, D. *Factors Affecting Success Rate of Heat Generation in CF Cells*. in *Fourth International Conference on Cold Fusion*. 1993. Lahaina, Maui: Electric Power Research Institute 3412 Hillview Ave., Palo Alto, CA 94304.

Storms, E., *How to produce the Pons-Fleischmann effect*. Fusion Technol., 1996. **29**: p. 261.

Miles Table 10 Summary of Palladium Materials Tested for Excess Power

Source	d, cm	V, cm^3	Px/V, W/cm3	Success ratio
NRL Pd-B (0.75%)	0.6	0.57	0.6	2/2
NRL Pd-B (0.75%)	0.25	0.12	2.1	1/2 (7/8)
NRL Pd-B (0.50%)	0.40	0.25	0.4	2/2
NRL Pd-B (0.25%)	0.40	0.25	0.8	2/2
JM Pd	0.63	0.36	1.4	9/14
JM Pd	0.63	0.67	0.3	1/1
JM Pd JM	0.40	0.20	0	0/2 (15/28)
(F/P) Pd	0.20	0.038	3.1	1/1
JM (F/P) Pd	0.10	0.012	14.0	1/1
JM Pd	0.10	0.02	15.0	3/7
JM Pd-Ce (F/P)	0.41	0.25	1.1	2/2
NRL Pd	0.40	0.25	0.4	1/2 (2/5)
Tanaka Pd (Sheet)	…	0.05	1.2	1/3
NRL Pd	0.40	0.25	0	0/4
NRL Pd-Ag	0.42	0.21	0	0/3
IMRA Pd-Ag	0.40	0.20	0	0/2 (0/19)
WESGO Pd (1989)	0.14	0.09	0	0/6
Pd/Cu	(0.63)	0.02	0	0/2
John Dash Pd (sheet)	…	0.04	0	0/2
Co-deposition (1992)	(0.63)	0.002	75	2/34

NRL Pd-B worked okay

JM (F/P) is best

Okay

Misc. sources did not work

Miles Table 10, JM (F/P) Pd

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Fleischmann and Pons results in France

Roulette, T., J. Roulette, and S. Pons. *Results of ICARUS 9 Experiments Run at IMRA Europe*. in ICCF6
158 days, including 30 days at 101 W, 294 MJ

Experiment	1	2	3	4	5
Cathode	Pd	Pd	Pd	Pd	Pd
Rod size, mm	100x2	100x2	100x2	100x2	100x2
Anode	Pt coil	Pt coil	Pt coil	Pt coil	Pt coil
Electrolyte: 0.1M	LiOD	LiOD	LiOD	LiOD	LiOD
Electrolyte, mL:	90.7	90.0	90.6	97.0	97.0
Expt time, days	94	134	158	123	123
Pwr_{excess}/W/4.2hr	-0.1	-0.6	101	17.3	13.8
Total energy, MJ	-0.0	-5.5	294	102	0.3
% excess power	0	0	150 (30d)	250 (70d)	0

Cold fusion projects often end badly

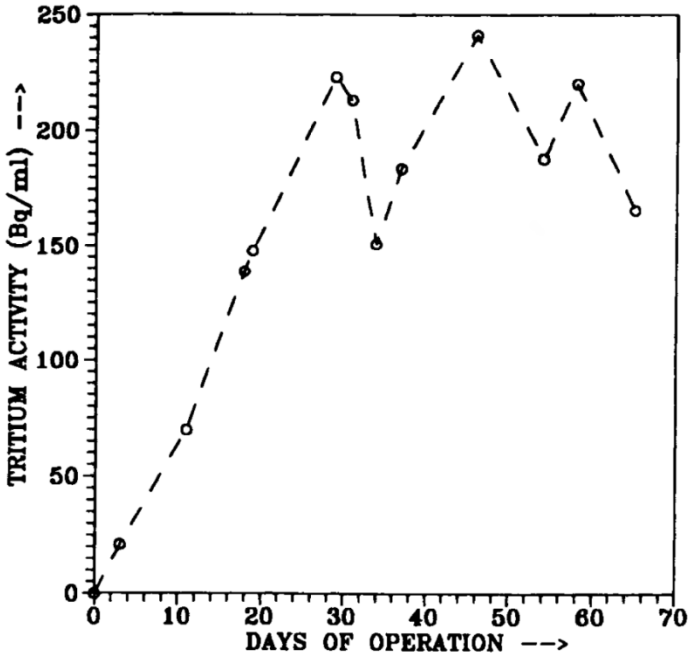
- IMRA program in France closes despite success.
- Uncle Martin unable to buy J-M Pd.
- Melvin Miles demoted from Distinguished Fellow of China Lake to stock room clerk.

Srinivasan's Ni-H experiments

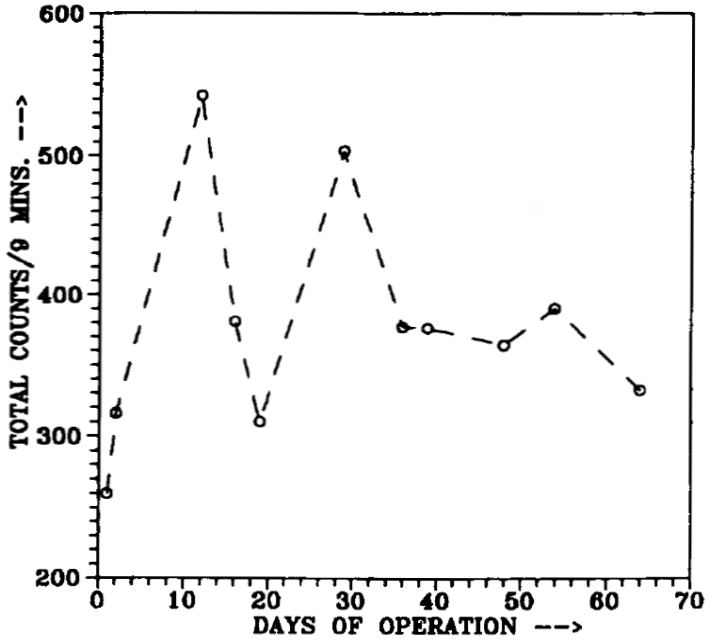
Series 1. BARC (1992). Produced excess heat and tritium

Series 2. SRI (1994) After six months of intense effort, Srinivasan concluded that the excess heat in Series 1 was caused by recombination.

Series 3. BARC. (1996) They made no attempt to measure heat, only tritium. Tritium was again detected, but not at levels as high as the first series.



Tritium vanishing in "sawtooth fashion," OM-3



OM-7

Kamiokande (1990-91)
Electrochemistry as an afterthought

- Texas A&M instructions ignored.
- All cells run on the same circuit. Wired electrically in series first. Rewired in parallel.
- Cells run at high voltage from the start.
- Researchers shown on national TV pulling out the cathode with their bare fingers and putting it back.
- No diagnostics other than neutrons; no attempt to measure excess heat or loading.
- Did not consult with Mizuno or any other electrochemist.

Search for genome 1900 - 1952

- Laws of genetics were well understood, BUT the physical location of genes was a mystery.
- Genes were thought to be in protein because nucleic acid was “too simple” (I. Asimov).
- People thought that complex information storage calls for complex media. This was an unfounded assumption.

James Watson describes emergent science in 1951

"Much of the talk about the three-dimensional structure of proteins and nucleic acids was hot air. Though this work had been going on for over 15 years, most if not all of the facts were soft. Ideas put forward with conviction were likely to be the products of wild crystalographers who delighted in being in a field where their ideas could not be easily disproved. Thus, though virtually all biochemists . . . were unable to understand the arguments of the X-ray people, there was little uneasiness. It made no sense to learn complicated mathematical methods in order to follow baloney."

Thank you!