Mesmerism

Perkins' tractors

Radioactive water
Cold fusion

wikipedia.org/wiki/Cold_fusion

1989: Martin Fleischmann and Stanley Pons
Univ. of Utah, Salt Lake City

2011: Andrea Rossi & Sergio Focardi, Italy

Energy catalyzer (E-cat)

wikipedia.org/wiki/Andrea_Rossi_(entrepreneur)
Two important limits/shortcomings of the human brain

Psychology
(limited perception, bias/prejudice, inaccurate memories, etc.)

No natural sense for statistics
Trump’s White House Press Secretary
Sean Spicer
2009 Obama inauguration

2017 Trump inauguration

Left: Getty Images; right: 58th Presidential Inaugural Committee
I cannot tell a lie.

- George Washington
I cannot tell a lie.
- George Washington

I cannot tell the truth.
- Richard Nixon

I cannot tell the difference.
- Donald Trump
http://www.youtube.com/watch?v=vJG698U2Mvo

The Monkey Business Illusion
http://www.youtube.com/watch?v=IGQmdoK_ZfY

The colour changing card trick
http://www.youtube.com/watch?v=v3iPrBrGSJM&list=PLJkCi3vFE0ZUX95TyvQJCk_S9wqpa9d
It is not ignorance that is the problem.

Ignorance can be met with education.

The problem is false beliefs.
The good thing about science is that it’s true whether or not you believe in it.

Neil DeGrasse Tyson
astrophysicist, science communicator
Definition of science

A system of acquiring knowledge based on the scientific method, and the organized body of knowledge gained through such research.

The scientific method seeks to explain the events of nature in a reproducible way, and to use these reproductions to make useful predictions. It provides an objective process - personal preferences must not bias the interpretation. Methods strive to minimize the influence of a scientist's bias.
Definition of pseudoscience  
(Wikipedia 2008-01-13)

Pseudoscience is an alleged body of knowledge, methodology, belief or practice that is claimed to be scientific or made to appear scientific, but does not adhere to the scientific method.
Richard Feynman:

"The first principle [of science] is that you must not fool yourself - and you are the easiest person to fool."
Science is not to demand proof for everything.

Science is to try to describe and understand the world as accurately as possible.
Exemples of pseudoscience

Dowsing
Astrology
Parapsychology
Creationism
Alternative medicine (homeopathy etc.)

How explain to believers that this is pseudoscience?

By describing scientific tests!
Signs of pseudoscience

Sven Ove Hansson: Vetenskap och ovetenskap (Tiden, 1995)

1. Belief in authorities
   Examples: Samuel Hahnemann, Rudolf Steiner, L. Ron Hubbard
2. Experiments that cannot be repeated
3. Selected exemples (anecdotes)
4. Reluctance to take part in scientific tests
5. Indifference to opposing facts
6. Built-in excuses (such as the negative attitude of critics)
7. Scientific explanations are discarded without offering better explanation
The Committee for Skeptical Inquiry (U.S.A.)
Nonprofit scientific and educational organization.
Founded in 1976
www.csicop.org

International network of "skeptical" organizations now in ~40 countries

"Extraordinary claims require extraordinary evidence"

www.vof.se
Sanal Edamaruku – Wanted for Defence of Truth

Founder-president of Rationalist International in 1995, President of the Indian Rationalist Association.

Charged with hurting religious sentiments for his role in revealing a claimed miracle as fraud in a local Catholic Church in Mumbai.
Gadgets and instruments

Many devices are surprisingly simple:
Low tech – high touch (acupuncture)

Others are said to be exceedingly complicated:
Quantum medicine
Dowsing rod
Study of dowsers

Anders Bærheim & Hogne Sandvik: 
"Jordstråler" - et underjordisk fenomen? 
Tidsskr Nor Lægeforen 117(17), 2476-2477, 1997.

Norwegian word for dowsing rod: ønskekvist ("wishing rod")
German word for dowsing rod: Wunschelrute
Astrology

12 "signs" (zones) in the zodiac (ring of zones or star constellations)

(Ophiuchus is not usually considered part of the zodiac)
However:

Astrology is based on

• visual illusions

• psychology
Constellation Leo (lion)
Constellation Leo

Denebola (= Beta Leonis, from Arabic Dheneb Alased = the lion’s tail) 36 ly
Rasalas (= Mu Leonis) 133 ly
Adhafera (= Zeta Leonis) 260 ly
Alterf (= Lambda Leonis) 336 ly
James Randi’s horoscope test

http://www.youtube.com/watch?v=3Dp2Zqk8vHw
Parapsychology

ESP, extrasensory perception
  telepathy (transfer of thoughts)
  clairvoyance (remote viewing)
  precognition (to see into the future)

PK, psychokinesis (to affect something physically with no known mechanism)
  = telekinesis
Extraordinary experiences than may have contributed to supernatural explanations (including religious)

OBE (out-of-body experience)
autoscopy
NDE (near-death experience)
grief hallucinations
sensed presence
meditation
dream-sleep disorders
  hypnagogic och hypnopompic hallucinations
  waking dreams
memories thought to come from previous lives (reincarnation)
parapsychology
  telepathy
  clairvoyance (precognition och retrocognition)
déjà vu
telekinesis
myths and tricks (ghosts, seances, voodoo, zombies, etc.)
OBE elicited by electrical stimulation

Olaf Blanke et al., Nature 2002
The Experimental Induction of Out-of-Body Experiences

Henrik Ehrsson
Wellcome Trust Centre for Neuroimaging, Institute of Neurology, London
Dept of Clinical Neuroscience, Karolinska Institutet, Stockholm

Science 24 Aug. 2007
The subject views himself from behind and watches the pen move in front of this viewpoint (i.e., the camera) and simultaneously feels something touching his chest.

Conclusion: I am where my viewpoint is, if the visual impression is supported by tactile information (despite viewing in real time).

The subject perceives the camera's position as his own.
Creationism

&

intelligent design (ID)

Creationism = intelligent design (ID)
Institute for Creation Research does mostly quote mining.
Dmitri A. Kuznetsov


In vitro studies of interactions between frequent and unique mRNAs and cytoplasmic factors from brain tissue of several species of wild timber voles of northern Eurasia, Clethrionomys glareolus, Clethrionomys frater and Clethrionomys gapperi: a new criticism to a modern molecular-genetic concept of biological evolution.

Lack of experimental support for Kuznetsov's criticism of biological evolution.

Dan Larhammar

Dmitri A. Kuznetsov
Moscow (until 1989), born 1955

Fraud career
1) Fraudulent article in Int. J. Neurosci 1989
2) Nine articles: shroud of Turin is two thousand years old, 1994-96.
4) Article about Irish linens in archaeology journal 2000.

Suspected fraud
1) Article with Anatoly L. Buchachenko (Russian Academy of Science) about magnetic effect of 25Mg2+ (10% of natural Mg) on enzyme: ATP production of phosphoglycerate kinase increased 2.6-fold, PNAS 2005. (Other scientists have reported failure to replicate study.)

Other
Journal Editor for two open access journals (publisher: ScienceDomain International):
• British Journal of Medicine and Medical Research

Left the posts in July 2013 after previous frauds had been reported in The Scientist.

Case investigated by Gian Marco Rinaldi, Italy.
Evolution is inevitable

The Earth is old.

Life arose a long time ago.

Individuals vary in how well equipped they are to survive and reproduce.

This variation is heritable.

More offspring are produced than survive to adulthood.

The challenge is not for biologists to explain how evolution could take place.

The challenge is for creationists to explain how evolution could possibly be avoided.
Vitamin C synthesis

The enzyme L-gulono-gamma-lactone-oxidase (GULO) catalyzes the last step in the biosynthesis of ascorbic acid (vitamin C).

The gene is present in all hominoids but is inactivated in them all. It has accumulated numerous inactivating mutations, hence it was inactivated a long time ago: before New World monkeys (Platyrrhini) and Old World monkeys (Catarrhini) diverged 35-45 Mya.

The human gene has retained 5 of the 12 exons. They have numerous mutations, many of which inactivate the gene.
Cats' indifference toward sugar

TAS1R2 has a 247-bp deletion in exon 3 and stop codons in exons 4 and 6 (Li et al., PLoS 2005). Tiger and cheetah have the same mutations.

Thus also lion, panther, lynx and puma in accordance with the evolutionary tree of the cat family (see Yu & Zhang, 2005).

Pseudogenes prove evolution.
Potato
*Solanum tuberosum*

844 Mb
2n = 4x = 48 (autotetraploid)
~39,000 genes in 86% of genome means
~45,000 genes
Woodland strawberry
*Fragaria vesca*

210 Mb, 2n=14
35,000 genes

20 polyploid species arose 1-4 Mya. The two wild octoploids *F. virginiana* and *F. chiloensis* are the progenitors of the cultivated octoploid strawberry *F. x ananassa*.

**24 Fragaria species**
- 13 diploid
- 5 tetraploid
- 1 hexaploid
- 4 octoploid
- 1 decaploid

Garden strawberry
*F. x ananassa*

692 Mb
2n=8X=56
~80% of 35,000x4
≈110,000 genes
Why bother about creationism?

Denial of evolution will have consequences for views on:

- Preservation of biodiversity
- Sustainable development
- Climate change
- Food production
- Plant and animal breeding
- Animal ethics
- Strategies to treat diseases, especially infectious diseases etc.
Trick or Treatment – the Undeniable Facts about Alternative Medicine

Simon Singh and Edzard Ernst (2008)
Placebo = I shall please

Placebo in strict sense is defined as the treatment effect which is not due to the specific features of a treatment method, but rather to the fact that any treatment is carried out (effect is due to expectations from patient, care and concern from physician or therapist).

Placebo must have a physiological correlate.

Nocebo: negative expectations
Joseph Dietl (Austria) treated pneumonia:
Joseph Dietl (Austria) treated pneumonia:

- Bloodletting: 20% died
- Vomiting: 21% died
- No treatment: 7% died

Conclusion: long traditional use of a method does not necessarily mean that it is efficient or even that it works!
Åderlätning
Foto av Nils Keyland
Taget i Marestad, Finland
The greatest pharmacologists rejected treatments that provided no improvement.

Hippocrates (460-370 BCE)

Galenos (129-199)

Paracelsus (1493-1531)

Rudolf Buchheim (1820-1879)

Oswald Schmiedeberg (1838-1921)
Homeopathy

Samuel Hahnemann, 1755-1843
Organon der rationellen Heilkunde, 1810

Two basic principles:
• Like cures like (Similia similibus curentur)
• Potentiation (dilution makes compound more powerful)
Studies of scientifically tested drugs show a consistent relationship between biology, chemistry and physics.

There are no contradictions.

If anybody can prove that homeopathy works:
3 Nobel Prizes
Conclusion: Liquid water essentially loses the memory of persistent correlations in its structure within 50 femtoseconds
Homoeopathy and consumers’ right to know

Sven Ove Hansson
Journal of Internal Medicine, 2013

"There is no ethically acceptable justification for excepting homeopathic products from the consumers' right to know."
What do Prince Charles and homeopathy have in common?
Homeopathy in emergency medicine

(only for those with a sense of humour)

http://www.youtube.com/watch?v=HMGIbOGu8q0

Transcript:
http://amtiskaw.co.uk/homeopathic-a%26e.html
Acupuncture: meridians

No evidence that they exist!
Double-blind placebo needle: neither the acupuncturist nor the patient can tell whether the needle actually pierces the skin.

Takakura & Yajima
BMC Compl Alt Med, 2007

A placebo acupuncture needle with potential for double blinding – a validation study

Takakura & Yajima
Acupunc. Med., 2008
Interpretation: Needle penetration did not confer a specific analgesic advantage over non-penetrating (placebo) application.
Acupuncture in rubber (phantom) arm

Jeungchan Lee et al., PLOS ONE 2014
Youngbyoung Chae et al., Neuroscience Letters 2015

When the rubber hand was fully incorporated with the real body, acupuncture stimulation to the rubber hand resulted in the experience of the DeQi sensation as well as brain activations in the dorsolateral prefrontal cortex (DLPFC), insula, secondary somatosensory cortex (SII), and medial temporal (MT) visual area. The insular activation was associated with the DeQi sensation from the rubber hand.
Do certain countries produce only positive results?
A systematic review of controlled trials
Andrew Vickers et al., 1998

<table>
<thead>
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<th>Country</th>
<th>Total Trials Analyzed</th>
<th>Favoring Test Treatment</th>
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<th>Percentage</th>
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Positive results in randomized controlled trials on acupuncture published in Chinese Journals: A systematic literature review

Yuyi Wang, Liqion Wang, Qianyun Chai and Jianping Liu

Abstract published 2014.

840 RCT with a total of 72,000 patients.
838 trials (99.8%) reported positive results.

726 of the trials compared acupuncture with conventional treatment.
641 trials (88.3%) found the acupuncture was superior.

85 trials (11.7%) found no significant difference between acupuncture and conventional treatment.
Nevertheless the authors concluded positive results for acupuncture.

Conclusion: Publication bias may be a major issue for acupuncture published in Chinese journals.
Quantum medicine, energy medicine, bioresonance, etc.

Instruments for measurements, diagnosis and therapy ("biofeedback" etc.)

SCIO/QXCI: Quantum Xrroid
Inventor: Prof Bill Nelson

Critical evaluation of QXCI: http://www.quackwatch.org/01QuackeryRelatedTopics/Tests/xrroid.html

EPFX Quantum
Biofeedback Device
(The Quantum Alliance)
http://www.qxci.biz/content/view/63/120/

DDFAO (MEDI.L.D, Paris)
Introspect Oberon
LIFE System (Quantum Life)

QRS (Quantron Resonance System)
Novato Medic AB, Gnosjö

Critical evaluation of QXCI: http://www.quackwatch.org/01QuackeryRelatedTopics/Tests/xrroid.html
Bicom – Life Cooperation, Allergikliniken, Hedemora

No scientific/clinical evidence that it works!
Novafon/Novasonic

Emits intrasound to reduce pain.

Novasonic emits sound in the range 100 – 10,000 Hz to induce pain relief and stimulation of tissues.

Used to treat:
- bone fractures
- sinusitis
- compressed disks
- migraine headache
- sciatic nerve pain
- muscle pain
- nerve pain
- wounds
Novafon

"Mixed, stable frequencies in the range 20 – ca 15.000 Hz"

Deep tissue treatment
Increases blood flow
Speeds up wound healing
Removes cellular debris faster

"stimulation results in an immediate and demonstrable tightening of the cell-wall membranes, leading to increased blood circulation and improved metabolism"

Novafon founding director 1980: Ford Carruthers
Headquarters in Skottland
Manufactured in Denmark

100.000 sold in the UK
16.000 sold every year n thei UK by Boots.
The NOrdic countries: 220.000 sold up to 2006.
Unskilled and Unaware of It - How Difficulties in Recognizing One's Own Incompetence Lead to Inflated Self-Assessments

Justin Kruger and David Dunning
Journal of Personality and Social Psychology
December 1999 Vol. 77(6) 1121-1134
Figure 2. Perceived logical reasoning ability and test performance as a function of actual test performance (Study 2).
Strategy for informing people who have been misinformed.

John Cook
Univ of Queensland
Stephan Lewandowsky
School of Psychology, Univ of Western Australia
Univ. of Bristol, UK

Debunking myths is a pedagogical challenge.

Unless great care is taken, one may in fact consolidate the myth rather than debunk it.

To avoid this "backfire effect", three simple pieces of advice should be followed.
- Present core facts
- Explicit warnings before describing myth
- Provide correct explanations that replace the myth

- Use graphics (if possible)
Humbleness

Receive new information with an open mind
but not not with an empty mind

Receive new information with an open mind
but not so open that your brains fall out

James Oberg
The burden of proof is upon the claimant, i.e., on the person who puts forth a new and surprising idea that goes against established knowledge.

Extraordinary claims require extraordinary evidence.
Two important limits/shortcomings of the human brain

Psychology
(limited perception, bias/prejudice, inaccurate memories, etc.)

No natural sense for statistics
Skeptical links

Skeptical Inquirer: csicop.org/si/
The Skeptic's dictionary: skepdic.com/

Vetenskap och Folkbildning: www.vof.se
Dan Larhammar: http://www.neuro.uu.se/forskning/Farmakologi/

Quackwatch: quackwatch.com
The Quack Page: ucl.ac.uk/Pharmacology/dc-bits/quack.html
Healthcare reality check: hcrc.org/

Mats Reimer's blogg
http://www.dagensmedicin.se/blogg/

Mats Reimer är barndistriktsläkare i Mölnlycke.