

# Evidence-based Orthomolecular Medicine: Principles and Practice

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# What is Evidence-based (Orthomolecular) Medicine?

# What is Evidence-based (Orthomolecular) Medicine?

- EBM is an imperfect, demanding, time-consuming, emotionally distasteful, and immensely useful tool for decision-making
  - Its key feature is that it extracts the therapist as much as possible from bias and emotional distortion
- EBM is widely endorsed by mainstream medicine – as it should be – but everyone loves bias
  - Consequently, EBM is widely misconstrued and misused

# The 3 Steps of EBM

- Obtain and analyze the most reliable scientific evidence, stripped of bias and error
  - Evidence is optimally (but not necessarily) obtained from unbiased well conducted, appropriately interpreted and fairly published RCTs
- Determine the pertinence of the overall evidence, and its pros and cons, to the individual situation
- Develop a treatment plan based on the trustworthiness of evidence, pros and cons, and acceptability to the patient

# Evidence-based Medicine



# EBM Was Developed to Mitigate Bias

- Because bias is everywhere


# Bias

- Overt and conscious bias
  - Bigotry, favouritism, mind-set, prejudice, moralistic tilt, partiality, preference, spin, propaganda
- Unconscious bias
  - Complacent ignorance, self-serving exaggeration and minimization, information filtering, moralistic reasoning, over-simplification, cherry-picking





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A Golden Retriever is running towards the camera on a wooden dock. The dog has a joyful expression with its mouth open and tongue out. In the background, a white boat with a blue cover is docked on the water. The scene is bright and sunny.

Would you want this Golden Retriever to be your doctor?







Thickness of atmosphere

Fraction of brain  
cortical activity  
normally devoted to  
logico-deductive  
reasoning

# Evidence-based Medicine



# Myths about EBM

- EBM is a reliable shortcut to certainty
- EBM simplifies decisions and saves time
- EBM is authoritative
- The evidence tells you what to do

**WRONG**

Bias is so normal, addictive and satisfying that it's virtually everywhere!



*Mundus vult decipi*

# What is Bias?

A self-serving preference to endorse an emotionally satisfying conclusion

It's commonly called "bias" when someone's conclusion is not well supported by a fair assessment of the objective evidence

# Bias in Clinical Investigation

- Technically avoidable bias
  - Poor quality clinical trial design, flawed execution, biased reporting
- Unavoidable bias
  - Despite good-faith attempts to mitigate it
- Cynical bias: cheating
- Unconscious bias



Officials from Kyoto Prefectural University of Medicine apologize at a news conference in Kyoto on July 11, 2013 over revelations its research team manipulated data in a drug study (Toshiyuki Hayashi)

Original Investigation

# Reporting Bias in Clinical Trials Investigating the Efficacy of Second-Generation Antidepressants in the Treatment of Anxiety Disorders

## A Report of 2 Meta-analyses

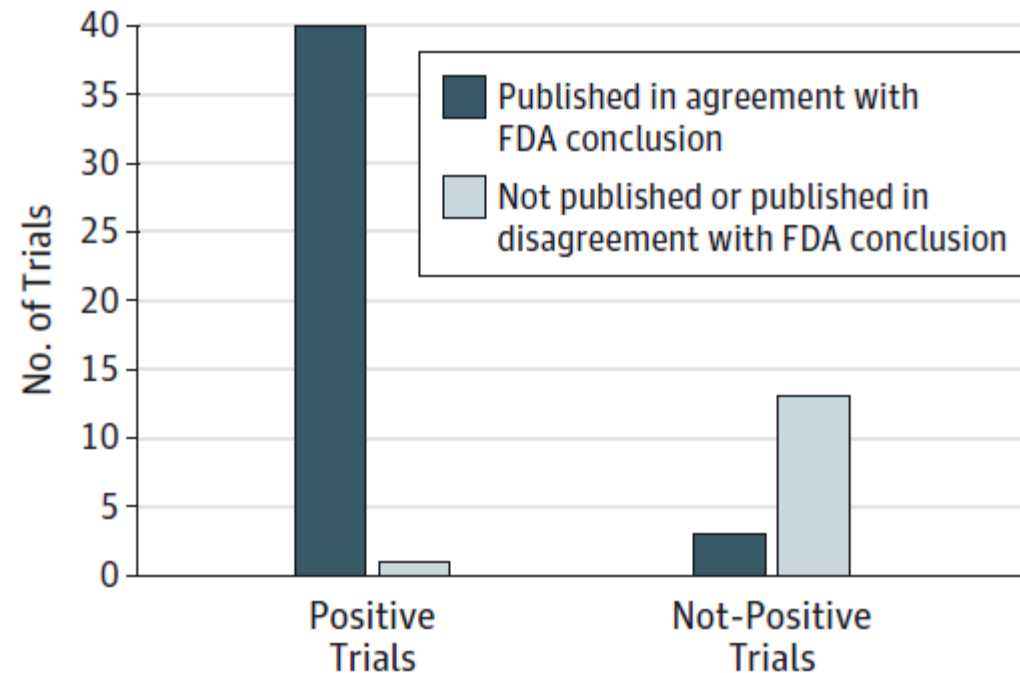
Annelieke M. Roest, PhD; Peter de Jonge, PhD; Craig D. Williams, PharmD; Ymkje Anna de Vries, MSc;  
Robert A. Schoevers, MD, PhD; Erick H. Turner, MD

JAMA Psychiatry 2015

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Figure 1. Reporting Bias in Not-Positive Trials

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FDA indicates US Food and Drug Administration.

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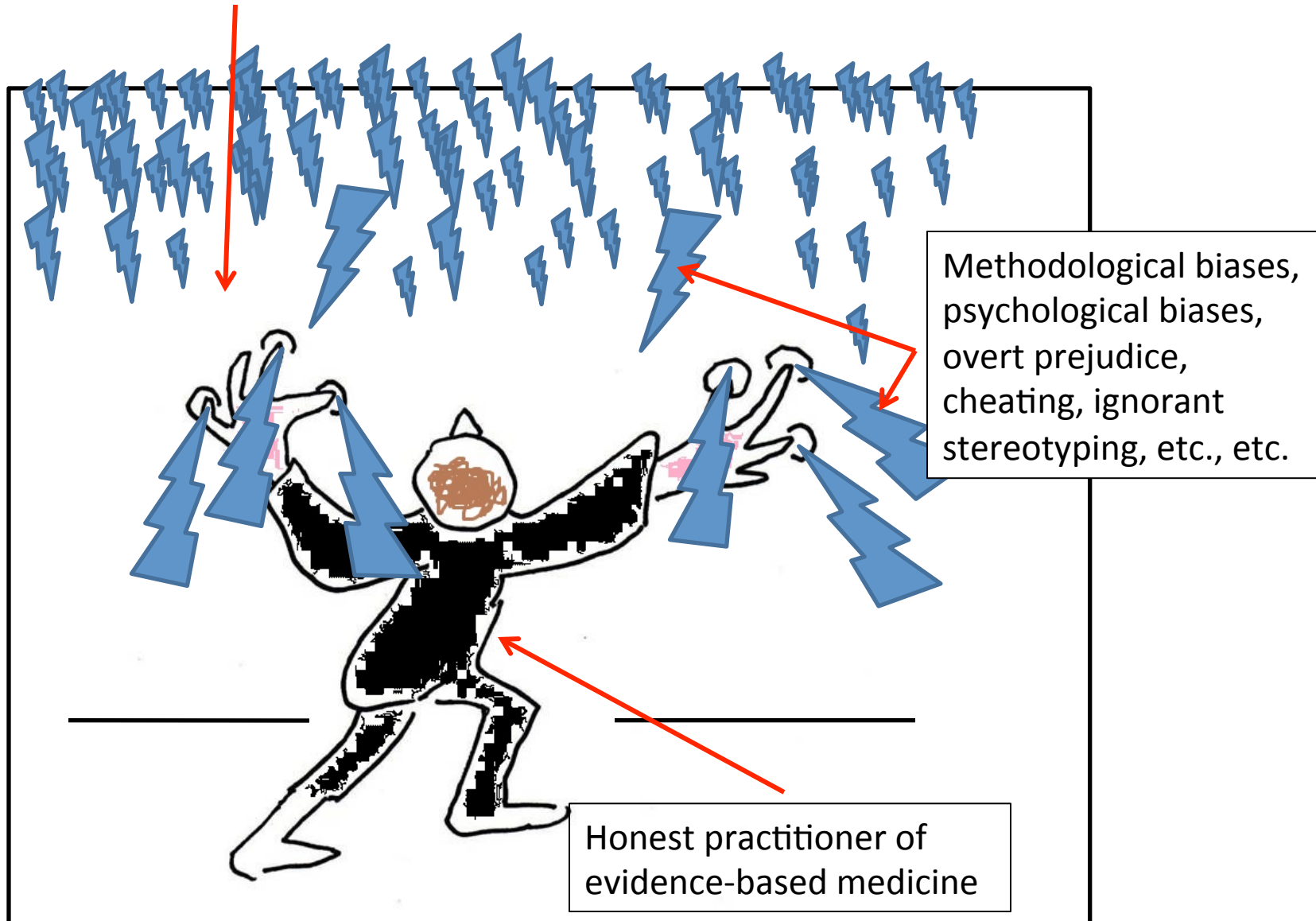
Of what does the practice of evidence-based medicine consist?

Of what does the practice of evidence-based medicine consist?





## The LEAKY WALL of evidence-based medicine



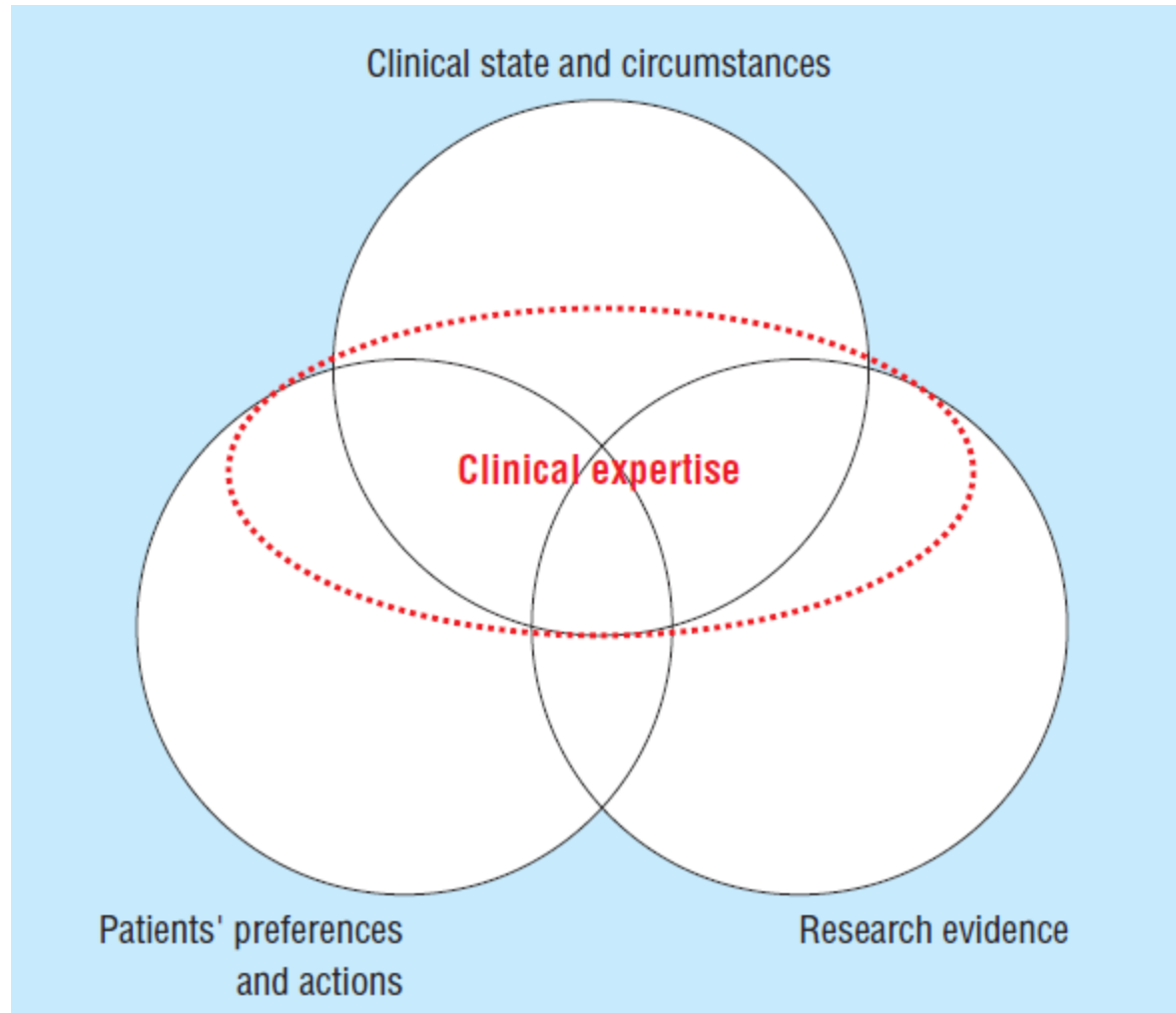
# Misconceptions about EBM

- It's a reliable shortcut to certainty
- It simplifies decisions and saves time
- It's authoritative
- "The evidence tells you what to do"

# Physicians' and patients' choices in evidence based practice

*Evidence does not make decisions, people do*

Haynes RB, Devereaux PJ, Guyatt GH. BMJ 2002;342:1350



Haynes RB, Devereaux PJ, Guyatt GH. BMJ 2002;342:1350



Richard M. Nixon (1913-1994)  
President of the United States 1969-74

# Richard M. Nixon-based Medicine

# Richard M. Nixon-based Medicine

This would be an easy job if you didn't have to  
deal with people

# Temperamental Biases

- Fundamentalist/fanatical/ultra-orthodox bias
  - “There’s no evidence” – when actually there’s lots of evidence, even though flawed or inconclusive
  - The ultra-orthodox bias is applied only to evidence one is emotionally or otherwise motivated to disapprove of
- Flight-of-fancy bias
  - Someone reported it in a test tube and 3 mice, so it’s got to work for all people





# The Streetlight Bias







Facts do not cease to exist because they are ignored





Nutrition

# How do I know anything?

“I see nobody on the road,” said Alice.

“I only wish I had such eyes,” the king remarked in a fretful tone. “To be able to see Nobody! And at that distance too!”

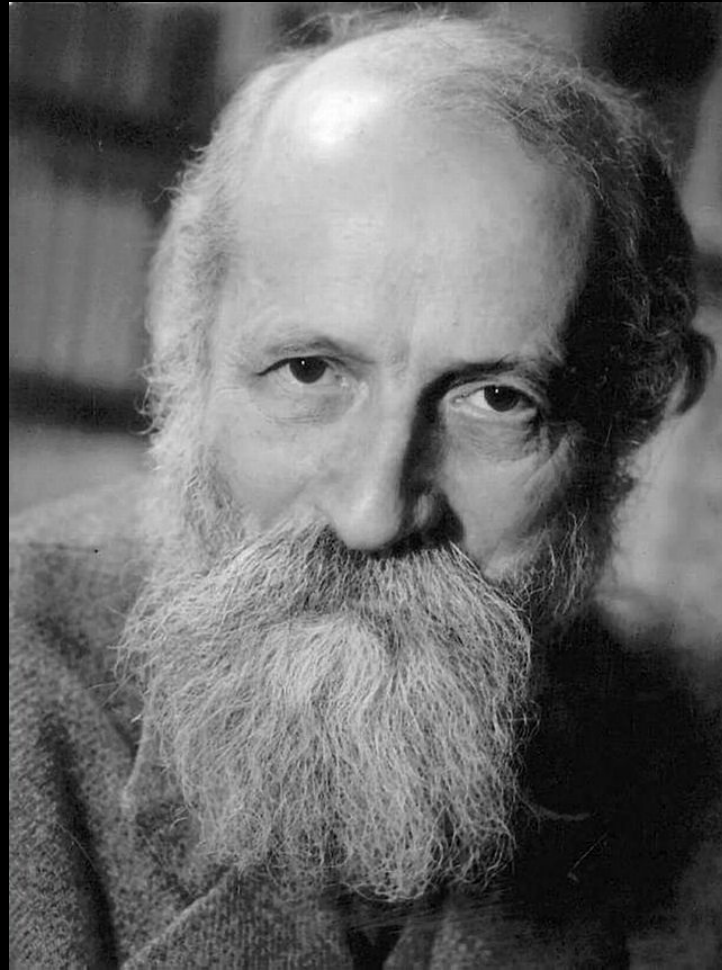
*Through the Looking Glass*

I wouldn't have seen it if I didn't believe it

– Yogi Berra



# Media-based Medicine



Martin Buber (1878-1965)

# Media-based Medicine

- Martin Buber, I and Thou (1925)
  - *Mundus vult decipi*: the world wants to be deceived. The truth is too complex and frightening; the taste for [objective] truth is an acquired taste that few acquire
  - ...there is a hierarchy of deceptions...

- Near the bottom of the ladder is journalism: a steady stream of irresponsible distortions that most people find refreshing although on the morning after, or at least within a week, it will be stale and flat
  - On a higher level we find fictions that men eagerly believe, regardless of the evidence, because they gratify some wish...
  - Near the top of the ladder we encounter curious mixtures of untruth and truth that exert a lasting fascination on the intellectual community...

# High dose vitamin C intake causes kidney stones

- Editorial in JAMA Internal Medicine, March 11, 2013
  - Swedish population registry data was interrogated to identify all CT scan-diagnosed kidney stones and classify them with respect to high-dose vitamin C intake
  - People who reported taking high-dose vitamin C had twice the rate of kidney stones as non-takers
  - High-dose ascorbic acid would account for an additional risk of 147 new attacks of kidney stones per 100 000, equivalent to one new kidney stone per 680 high-dose users per year. “This is not an insignificant risk.”
  - *But more to the point, is any additional risk worthwhile if high-dose ascorbic acid is not effective?*

# High dose vitamin C intake causes kidney stones

- Letter to the editor JAMA Internal Medicine: July 22, 2013
  - Renal colic symptoms are nonspecific, especially in mild cases
  - Vague nonspecific abdominal/flank pain frequently prompts a CT scan, but as many as 40% of renal stones identified are asymptomatic; an unsurprising fact since 10% of all men have silent renal stones
  - Physicians and the public are repeatedly warned that vitamin C causes kidney stones, even though the evidence is inconclusive
- **INDICATION BIAS**
  - **High-dose vitamin C takers are more likely to be investigated for renal stone than non-takers, thus artificially increasing the number of kidney stone registry entries linked to vitamin C intake**

# References

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- Fletcher RH JAMA Intern Med 2013;173:388-9
- Hoffer LJ JAMA Intern Med 2013;173:1384

# **Multivitamins in the Prevention of Cancer in Men**

The Physicians' Health Study II Randomized Controlled Trial

- Very high quality randomized clinical trial
- 14,641 male physicians
- Median follow up 11.2 years



# Multivitamins in the Prevention of Cancer in Men

The Physicians' Health Study II Randomized Controlled Trial

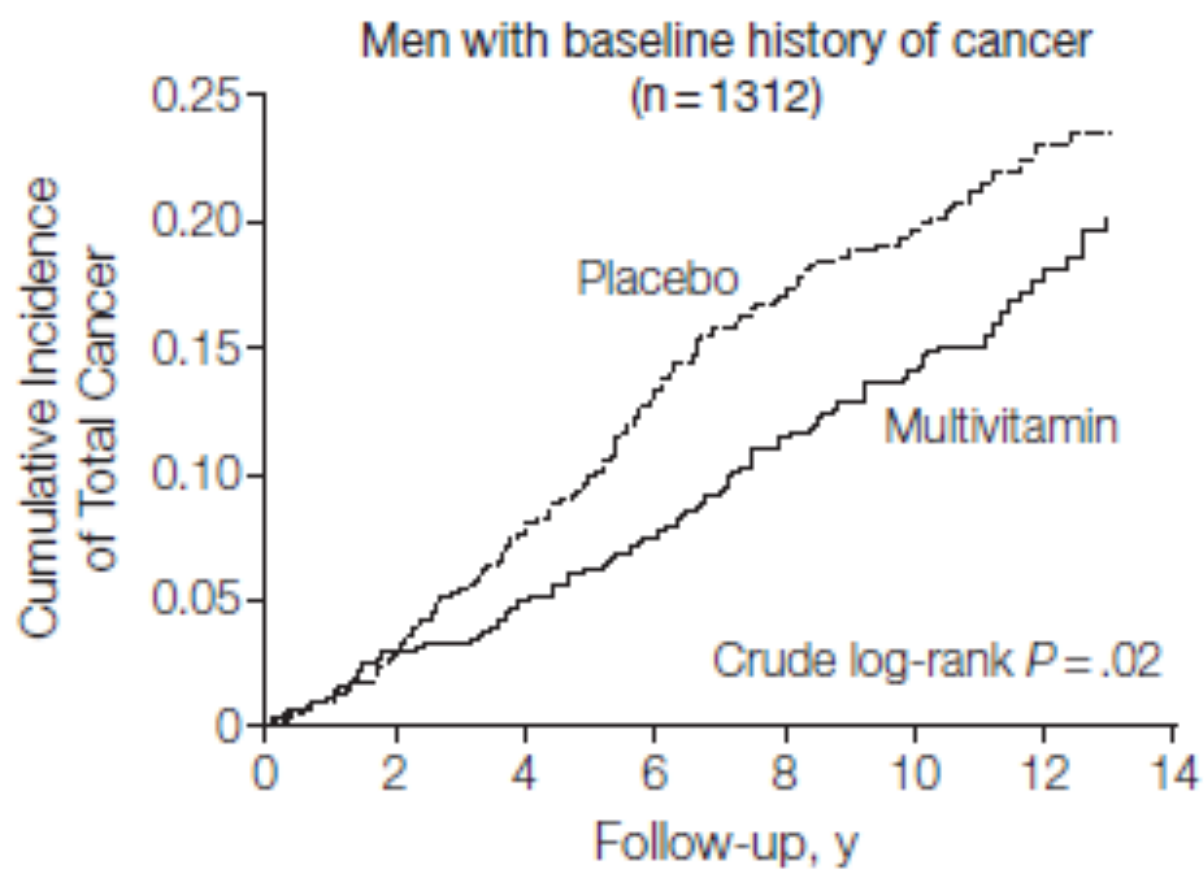
**Conclusion** In this large prevention trial of male physicians, daily multivitamin supplementation modestly but significantly reduced the risk of total cancer.

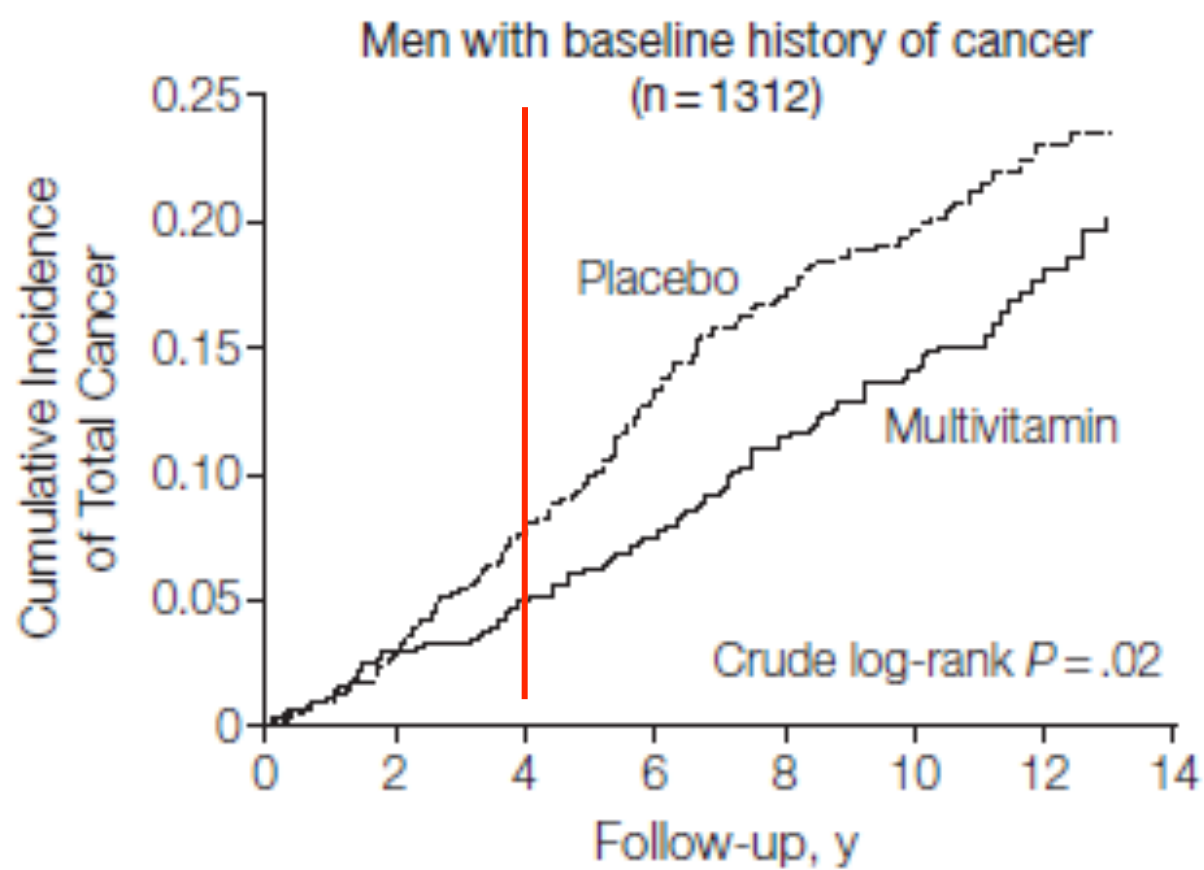
**Trial Registration** [clinicaltrials.gov](http://clinicaltrials.gov) Identifier: NCT00270647

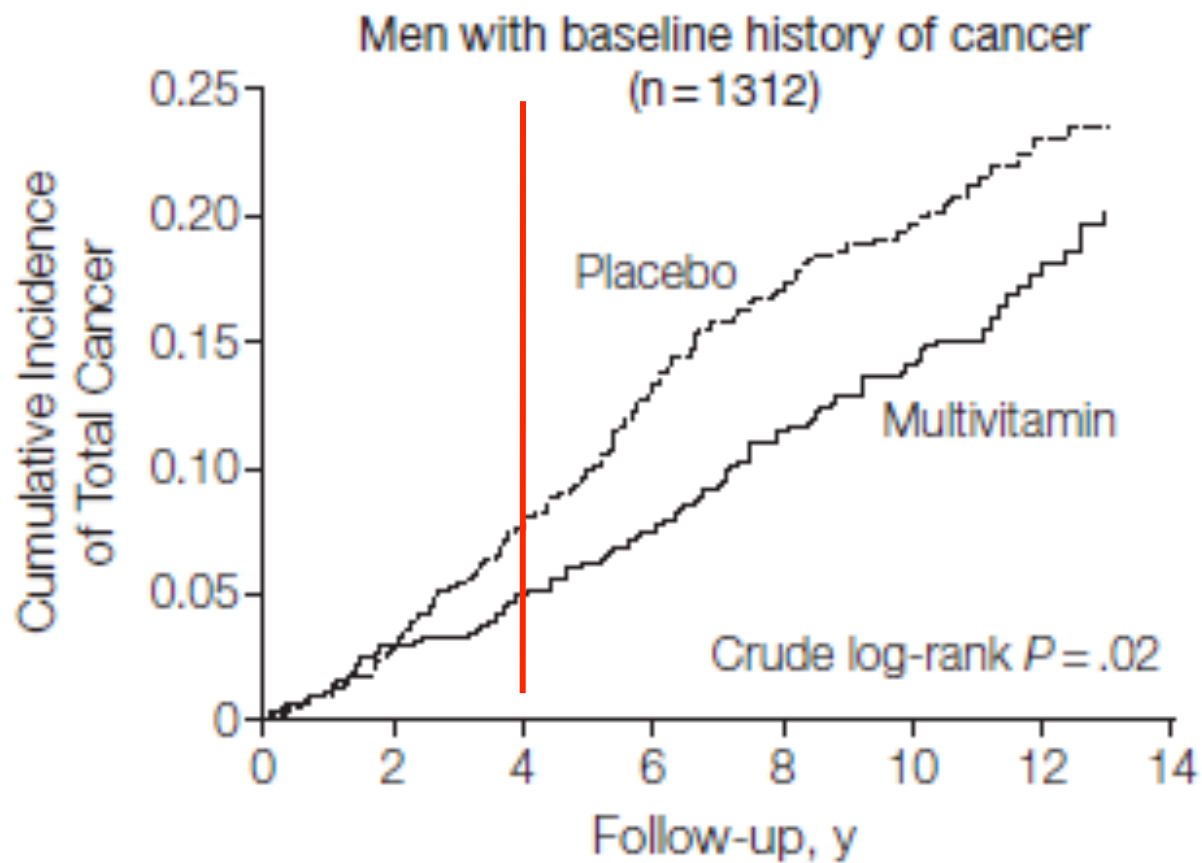
*JAMA*. 2012;308(18):1871-1880

Published online October 17, 2012. doi:10.1001/jama.2012.14641

[www.jama.com](http://www.jama.com)







11 year follow up of sophisticated economically secure physicians

# Current Evidence on Healthy Eating

Walter C. Willett<sup>1,3</sup> and Meir J. Stampfer<sup>2,3</sup>

<sup>1</sup>Department of Nutrition, School of Public Health, Harvard University, Boston, Massachusetts 02115; email: walter.willett@channing.harvard.edu

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Ann Rev Public Health 2013

Because intakes of many micronutrients appear marginal for many Americans and few meet all the current dietary guidelines, and because the risks of using an RDA level appear minimal, the use of a daily multiple vitamin, with 1,000 to 2,000 IU of vitamin D, appears rational for many Americans from the perspective of balancing potential benefits and risks.



# Don't Take Your Vitamins *New York Times 6/10/13*

## OPINION

BY PAULA OFFIT

*The chief of the infectious diseases division of the Children's Hospital of Philadelphia and the author of the forthcoming book "Do You Believe in Magic?: The Sense and Nonsense of Alternative Medicine."*

LAST month, Katy Perry shared her secret to good health with her 37 million followers on Twitter. "I'm all about that supplement & vitamin LYFE!" the pop star wrote, posting a snapshot of herself holding up three large bags of pills. There is one disturbing fact about vitamins, however, that Katy didn't mention.

Derived from "vita," meaning life in Latin, vitamins are necessary to convert food into energy. When people don't get enough vitamins, they suffer diseases like scurvy and rickets. The question isn't whether people need vitamins. They do. The questions are how much do they need, and do they get enough in foods?

Nutrition experts argue that people need only the recommended daily allowance — the amount of vitamins found in a routine diet. Vitamin manufacturers argue that a regular diet doesn't contain enough vitamins, and that more is better. Most people assume that, at the very least, excess vitamins can't do any harm. It turns out, however, that scientists have known for years that large quantities of supplemental vitamins can be quite harmful indeed.

In a study published in The New England Journal of Medicine in 1994, 29,000 Finnish men, all smokers, had been given daily vitamin E, beta carotene, both or a placebo. The study found that those who had taken beta carotene for five to eight years were more likely to die from lung cancer or heart disease.

Two years later the same journal published another study on vitamin supplements. In it, 18,000 people who were at an increased risk of lung cancer because of asbestos exposure or smoking received a combination of vitamin A and beta carotene, or a placebo. Investigators stopped the study when they found that the risk of death from lung cancer for those who took the vitamins was 46 percent higher.

Then, in 2004, a review of 14 randomized trials for the Cochrane Database found that the supplemental vitamins A, C, E and beta carotene, and a mineral, selenium, taken to prevent intestinal cancers, actually increased mortality.

Another review, published in 2005 in the Annals of Internal Medicine, found that in 19 trials of nearly 136,000 people,

supplemental vitamin E increased mortality. Also that year, a study of people with vascular disease or diabetes found that vitamin E increased the risk of heart failure. And in 2011, a study published in the Journal of the American Medical Association tied vitamin E supplements to an increased risk of prostate cancer.

can also be found in fruits and vegetables, specifically in selenium, beta carotene and vitamins A, C and E. Some studies have shown that people who eat more fruits and vegetables have a lower incidence of cancer and heart disease and live longer. The logic is obvious. If fruits and vegetables contain antioxidants, and

So why don't we know about this? Why haven't Food and Drug Administration officials made sure we are aware of the dangers? The answer is, they can't.

In December 1972, concerned that people were consuming larger and larger quantities of vitamins, the F.D.A. announced a plan to regulate vitamin supplements containing more than 150 percent of the recommended daily allowance. Vitamin makers would now have to prove that these "megavitamins" were safe before selling them. Not surprisingly, the vitamin industry saw this as a threat, and set out to destroy the bill. In

## When it comes to antioxidants, more is not always better.

the end, it did far more than that.

Industry executives recruited William Proxmire, a Democratic senator from Wisconsin, to introduce a bill preventing the F.D.A. from regulating megavitamins. On Aug. 14, 1974, the hearing began.

Speaking in support of F.D.A. regulation was Marsha Cohen, a lawyer with the Consumers Union. Setting eight cantaloupes in front of her, she said, "You would need to eat eight cantaloupes — a good source of vitamin C — to take in barely 1,000 milligrams of vitamin C. But just these two little pills, easy to swallow, contain the same amount." She warned that if the legislation passed, "one tablet would contain as much vitamin C as all of these cantaloupes, or even twice, thrice or 20 times that amount. And there would be no protective satiety level." Ms. Cohen was pointing out the industry's Achilles' heel: ingesting large quantities of vitamins is unnatural, the opposite of what manufacturers were promoting.

A little more than a month later, Mr. Proxmire's bill passed by a vote of 81 to 10. In 1976, it became law. Decades later, Peter Barton Hutt, chief counsel to the F.D.A., wrote that "it was the most humiliating defeat" in the agency's history.

As a result, consumers don't know that taking megavitamins could increase their risk of cancer and heart disease and shorten their lives; they don't know that they have been suffering too much of a good thing for too long.



SABINE DOWEK

Finally, last year, a Cochrane review found that "beta carotene and vitamin E seem to increase mortality, and so may higher doses of vitamin A."

What explains this connection between supplemental vitamins and increased rates of cancer and mortality? The key word is antioxidants.

Antioxidation vs. oxidation has been billed as a contest between good and evil. It takes place in cellular organelles called mitochondria, where the body converts food to energy — a process that requires oxygen (oxidation). One consequence of oxidation is the generation of atomic scavengers called free radicals (evil). Free radicals can damage DNA, cell membranes and the lining of arteries; not surprisingly, they've been linked to aging, cancer and heart disease.

To neutralize free radicals, the body makes antioxidants (good). Antioxidants

people who eat fruits and vegetables are healthier, than people who take supplemental antioxidants should also be healthier. It hasn't worked out that way.

The likely explanation is that free radicals aren't as evil as advertised. (In fact, people need them to kill bacteria and eliminate new cancer cells.) And when people take large doses of antioxidants in the form of supplemental vitamins, the balance between free radical production and destruction might tip too much in one direction, causing an unnatural state where the immune system is less able to kill harmful invaders. Researchers call this the antioxidant paradox.

Because studies of large doses of supplemental antioxidants haven't clearly supported their use, respected organizations responsible for the public's health do not recommend them for otherwise healthy people.

Dr. John

# Throw your vitamins in the garbage

- “Throw away all vitamins”
- “Stop wasting patients’ money on vitamins”
- “Vitamins are dangerous”
- “We should stop people from doing research on vitamins”

Strong stuff!





# Media-based Medicine

- Oversimplified, dramatic, emotionally powerful message
- Over-generalized, stark, unqualified assertions
- Absence of context/fact/quality checking
- Spin, persuasion, rhetoric
- Almost never acknowledge or correct misstatements, since not “newsworthy”

# The 3 Steps of EBM

1. Obtain and analyse reliable scientific evidence, optimally in the form of average comparative group responses in unbiased, well conducted and analyzed RCTs
2. Determine the pertinence of the general statistical evidence to the situation of a specific patient
3. Coordinate treatment plan with explicit regard for the patient's attitudes, values and preferences

# Step 1

The use of mathematical estimates of the chance of benefit and the risk of harm, derived from high-quality research on population samples, to inform clinical decision-making

– Greenhalgh J Prim Health Care 2012

# Steps 2 & 3

2. Determine the pertinence of the statistical evidence to the situation of a specific patient
3. Coordinate treatment plan with explicit regard for the patient's attitudes, values and preferences

# When the Evidence is Indeterminate

- When the evidence is pertinent and strong
  - Make a strong recommendation  
*“Just do it!”*
- When the evidence is weak and uncertain
  - Can only make a qualified “suggestion”
  - Inform the patient (“off-label” model)
  - Demonstrate respect for and collaboration with patient’s attitude, values and preferences

# When the Evidence is Plausible but Inconclusive

2. Determine the pertinence of the overall general evidence to the situation of the specific patient
3. Summarize the pros/cons/uncertainty of the evidence; balance the overall likelihoods of benefit/harm; make a qualified suggestion compatible with the patient's situation and perspective

# Vitamins aren't Drugs





Nutrition

# Vitamins are not Drugs

Factor	Drugs	Vitamins
Zero blood level	Normal	Fatal
Time course of effects	Days to years	<b>Days to decades</b>
Therapeutic window	Narrow	Wide
Allergy/side effect risk	Great	Insignificant
Initial dose target	Average effective dose	<b>Recommended safe dose</b>
Biological individuality	Some	<b>Virtually always</b>
Physician education	A lot	Almost none
\$ investment in research	A lot	Almost none
High quality RCT evidence	A lot	<b>Very little</b>

# Vitamins are not Drugs

Enough to safely prevent deficiency



Factor	Drugs	Vitamins
Zero blood level	Normal	Fatal
Time course of effects	Days to years	<b>Days to decades</b>
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# How to Evaluate Vitamin Supplements

- When used as drugs: evaluate as drugs
  - The evaluation method is technically much more complicated and expensive (need longer, larger studies, but who is willing to pay for them?)
  - The burden of proof: prove efficacy
- When used to prevent deficiency states: evaluate their ability to effectively prevent deficiency
  - The evaluation very complicated, as above
  - Safety: is the patient getting sufficient amount?
  - The burden of proof: prove futility

# EB(O)M

- A 70 year old person has nonvalvular atrial fibrillation with a CHADS2 score < 2
  - What stroke prevention treatment should be recommended: warfarin, NOAC, aspirin?
  - What about combination aspirin & vitamin E?

# CHADS2 Score

- C heart failure (1 point)
- H high blood pressure (1 point)
- A age > 75 (1 point)
- D diabetes (1 point)
- S2 previous stroke or TIA (2 points)

# Nonvalvular AF Recommendation

- CHADS2 = 0: annual risk 2%, don't need antithrombotic drug
- CHADS2 = 1: annual risk ~ 3%, consider antithrombotic therapy with aspirin, warfarin or NOAC
- CHADS2 = 2: annual risk ~ 4%, strongly recommend warfarin or NOAC
- CHADS2 > 2: increasingly greater risks

Would adding high-dose vitamin E to low-dose aspirin further reduce the risk of embolic stroke in people with nonvalvular atrial fibrillation?



# New Zealand Farmer Dying of Influenza Pneumonia Attributes Miraculous Recovery to High-dose IV Vitamin C



# July 2009

- A King Country dairy farmer was admitted to Auckland hospital with severe pneumonia due to swine flu. He was kept alive on ECMO. After 3 weeks the family were told that all ICU specialists were in unanimous agreement that the farmer should be removed from ECMO since continuing it would only prolong his inevitable death.

# Professor John Fraser, Head of School of Medical Sciences, University of Auckland:

It is disappointing that the journalist did not attempt to seek expert advice on the reasons why the consultants were unwilling to administer high dose vitamin C.

There is certainly no evidence in the medical literature that this treatment works particularly in severe cases of pneumonia.

The consultants were quite right to resist the use of an unproven treatment, and to their credit they did acquiesce to accommodate the family's wishes because they felt it would do no harm.

In this remarkable case the patient did survive but there is no evidence that this was due to the vitamin C.

# Evidence Regarding IVC in Critical Illness Published Prior to 2009

Schorah CJ, Downing C, Piripitsi A et al. Total vitamin C, ascorbic acid, and dehydroascorbic acid concentrations in plasma of critically ill patients. *Am J Clin Nutr* 1996;63:760-5.

Heyland DK, Dhaliwal R, Suchner U, Berger MM. Antioxidant nutrients: a systematic review of trace elements and vitamins in the critically ill patient. *Intensive Care Med* 2005;31:327-37.

Berger MM, Shenkin A. Update on clinical micronutrient supplementation studies in the critically ill. *Curr Opin Clin Nutr Metab Care* 2006;9:711-6.

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# Relevant Publications in 2009

Wilson JX. Mechanism of action of vitamin C in sepsis: ascorbate modulates redox signaling in endothelium. *Biofactors* 2009;35:5-13.

McClave SA, Martindale RG, Vanek VW et al. Guidelines for the provision and assessment of nutrition support therapy in the adult critically ill patient. *JPEN J Parenter Enteral Nutr* 2009;33:277-316.

# Evidence Supporting IVC in Critical Illness Since 2009

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Reddell L, Cotton BA. Antioxidants and micronutrient supplementation in trauma patients. *Curr Opin Clin Nutr Metab Care* 2012;15:181-7.

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Rodemeister S, Duquesne M, Adolph M, Nohr D, Biesalski HK, Unertl K. Massive and long-lasting decrease in vitamin C plasma levels as a consequence of extracorporeal circulation. *Nutrition* 2014;30:673-8.

# A Daily Multiple Vitamin Taken for 11 Years Reduces Cancer Risk by 8%

- 8% risk reduction is too small to pay attention to
- The result is unexpected & biologically implausible, hence should be discounted and ignored
- Although admittedly of very high quality, this study wasn't 100% perfect, so it can be disregarded
- Since vitamins can be dangerous, we need more high-quality clinical trials than this one to be published to justify the risk and expense of a daily multiple vitamin tablet

# Vitamin C

- Hypovitaminosis C is very common in sick people
- What are the clinical implications?
- We don't actually know, because no one's investigating it...



# Hypovitaminosis C in Hospitalized Patients

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# A Patient Falls on Outstretched Hand



## Complex regional pain syndrome

<http://www.orthobullets.com/basic-science/6095/complex-regional-pain-syndrome-crps>

# Efficacy and Safety of High-dose Vitamin C on Complex Regional Pain Syndrome in Extremity Trauma and Surgery—Systematic Review and Meta-Analysis

Naohiro Shibuya, DPM, MS, FACFAS<sup>1</sup>, Ion M. Humphers, DPM<sup>2</sup>, Monica R. Agarwal, DPM<sup>3</sup>, Daniel C. Jupiter, PhD<sup>4</sup> [The Journal of Foot & Ankle Surgery 52 \(2013\) 62–66](#)

## Testing the Validity of Preventing Complex Regional Pain Syndrome With Vitamin C After Distal Radius Fracture

Sunitha Malay, MPH, Kevin C. Chung, MD [J Hand Surg Am. ♦ Vol. 39, November 2014](#)

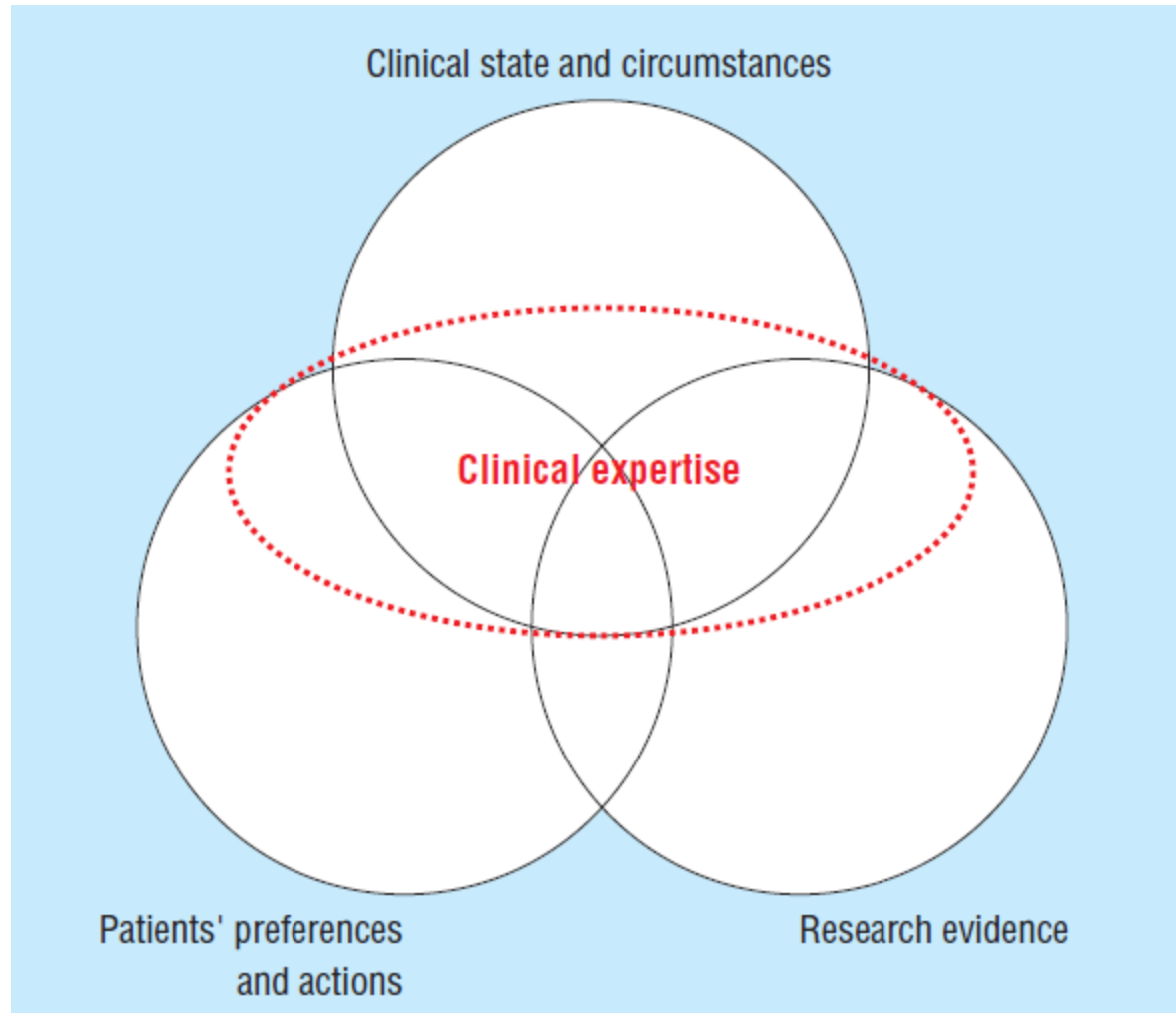
The American Academy of Orthopaedic Surgeons formally recommends the use of vitamin C to prevent complex regional pain syndrome (CRPS) for patients with distal radius fractures (DRFs), on the basis of adequate clinical trial evidence and the low cost and safety of vitamin C

# Vitamin C Supplements

- It's rational and sensible to recommend vitamin C 500 mg once (or twice) daily immediately after a traumatic fracture (or other immobilizing condition, like paralytic stroke) to reduce the risk of CRPS
- For which patients is vitamin C most important?

# EB(O)M in Your Own Practice

- Find and evaluate the evidence as to its reliability and strength, including both biological and clinical plausibility
- Assess the specific details of the patient's situation
- When the evidence is clear-cut and convincing with regard to benefit/risk, advise strongly
- When the evidence isn't so clear, ensure "informed consent" and make qualified recommendation
- Work in partnership with the patient
- When a treatment is speculative, actively assess its value in real time and be prepared to stop if it isn't working
- Be on the alert to mitigate your personal biases
- Be on the alert to acknowledge your patient's biases and preferences



Haynes RB, Devereaux PJ, Guyatt GH. BMJ 2002;342:1350

# How to Detect and Avoid Emotional Biases in EB(O)M



DAVID D. BURNS, M.D.

REVISED AND UPDATED

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# FEELING GOOD

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# The 10 Cognitive Distortions that Prevent You From Feeling Good

- 1. All-or-nothing thinking
- 2. Overgeneralization
- 3. Mental filter
- 4. Disqualifying the positive
- 5. Jumping to conclusions without adequate information
- 6. Magnification/minimization
- 7. Emotional reasoning
- 8. Should/ought to reasoning
- 9. Labeling and mislabeling
- 10. Personalization\*

# The 10 Cognitive Distortions that Prevent You From Feeling Bad

- 1. All-or-nothing thinking
- 2. Overgeneralization
- 3. Mental filter
- 4. Disqualifying the negative
- 5. Jumping to conclusions without adequate information
- 6. Magnification/minimization
- 7. Emotional reasoning
- 8. Should/ought to reasoning
- 9. Labeling and mislabeling
- 10. Personalization

# The 10 Cognitive Distortions that Protect You From Changing Your Mind

- 1. All-or-nothing thinking
- 2. Overgeneralization
- 3. Mental filter
- 4. Disqualifying what contradicts your bias
- Jumping to conclusions without adequate information
- 6. Magnification/minimization
- 7. Emotional reasoning
- 8. Should/ought to reasoning
- 9. Labeling and mislabeling
- 10. Personalization

# **Cognitive Distortions that Protect You From Changing Your Mind About the Importance of Nutrition**

- 1. All-or-nothing thinking
- 2. Overgeneralization
- 3. Mental filter
- 4. Disqualifying what challenges your bias
- 5. Jumping to conclusions without adequate information
- 6. Magnification/minimization
- 7. Emotional reasoning
- 8. Should/ought to reasoning
- 9. Labeling and mislabeling
- 10. Personalization

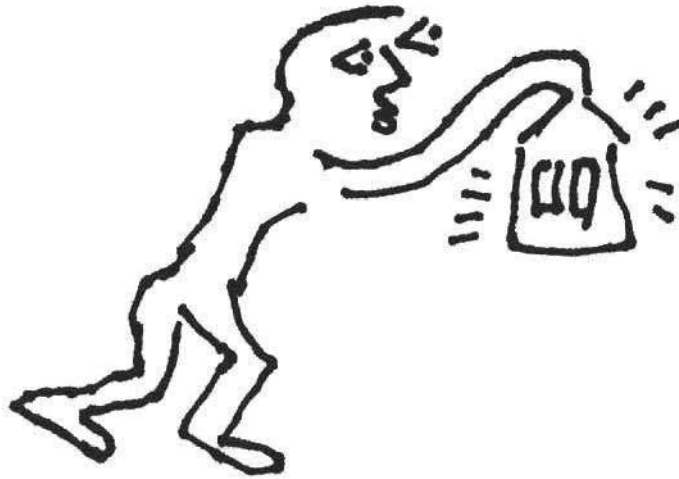
# The Problem of Emotional Uncertainty

- Doctors hate uncertainty: it makes them feel incompetent and it's time-consuming, too
- Patients hate uncertainty, both within themselves and when they perceive it in their doctor

# My Doctor

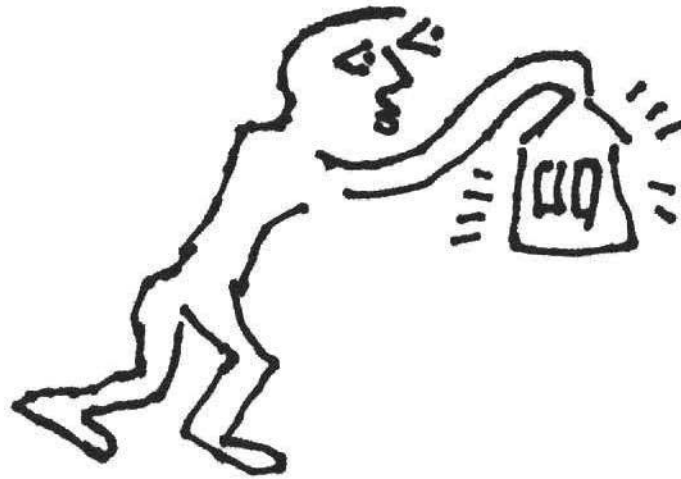


# Evidence-based Medicine





# Evidence-based Medicine is About Uncertainty



# Scientific Conclusions are Provisional

If we knew what we were doing, it wouldn't be called research, would it?

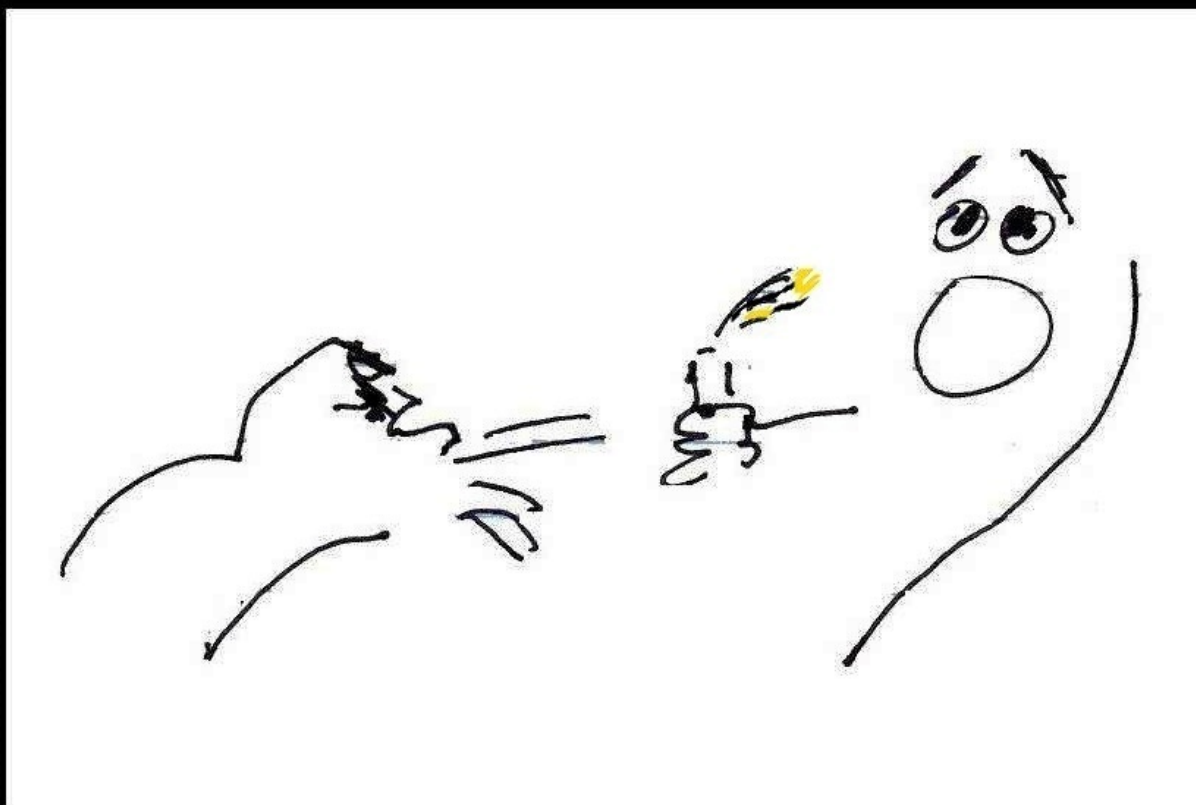
– Albert Einstein

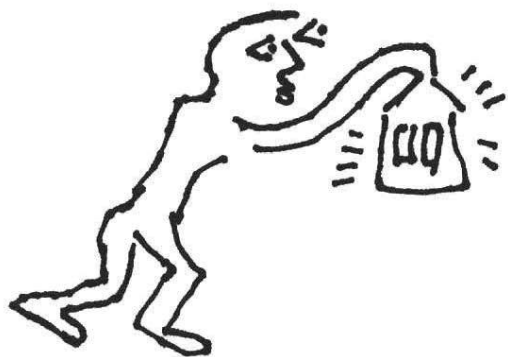
Intellectual Uncertainty

is not

Emotional Uncertainty







# Ignorance

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graph TD; Ignorance --> Curiosity; Ignorance --> Anxiety; Curiosity --> Investigation; Curiosity --> Understanding; Curiosity --> Wisdom; Anxiety --> Passion; Anxiety --> Bias; Anxiety --> Bigotry; Anxiety --> Indifference;
```

Curiosity

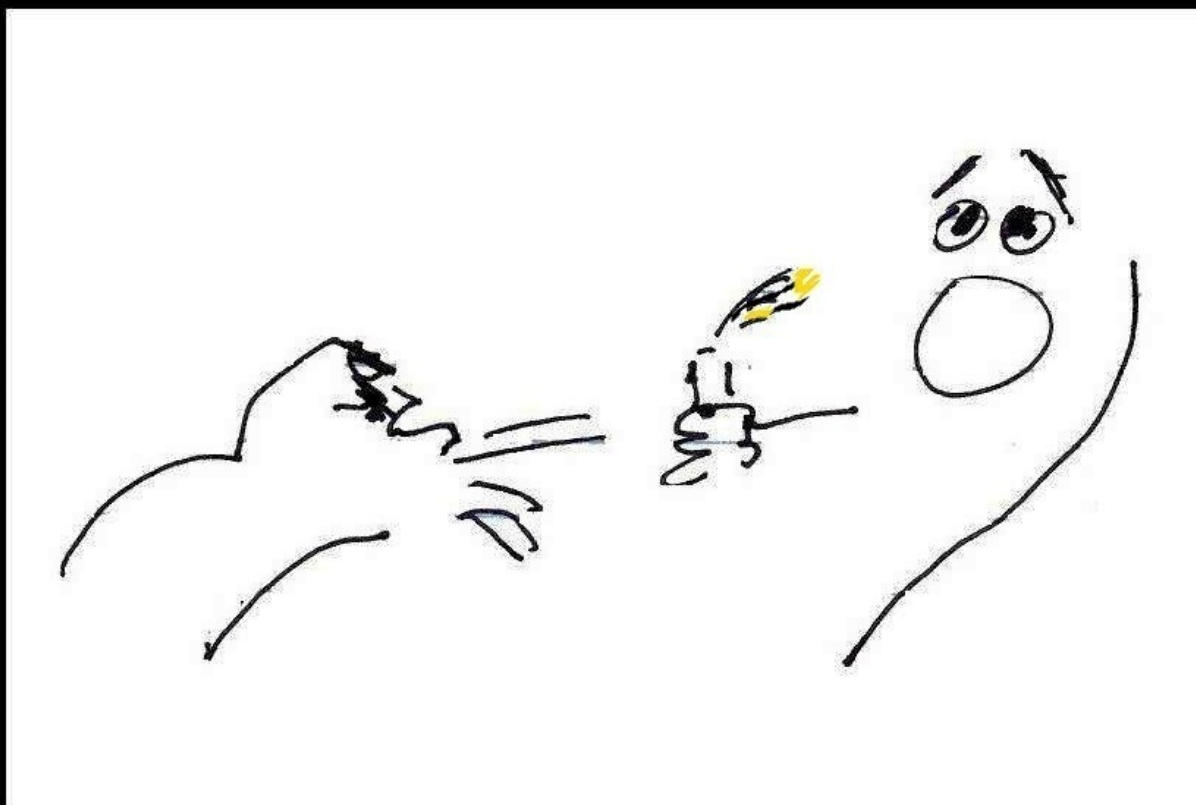
Anxiety

Investigation  
Understanding  
Wisdom

Passion, Bias,  
Bigotry  
Indifference



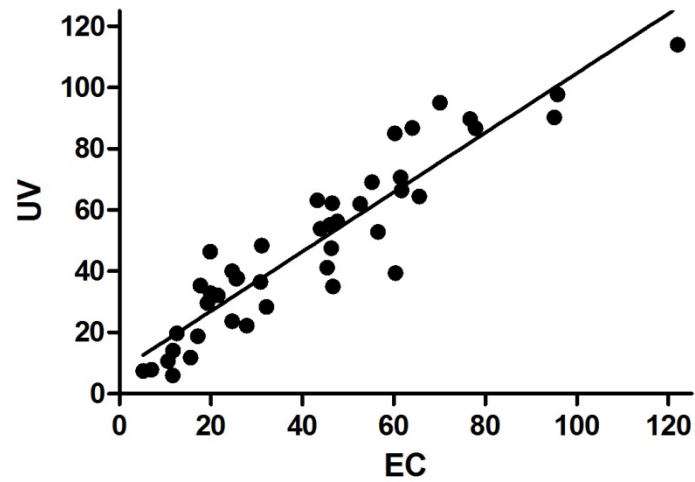




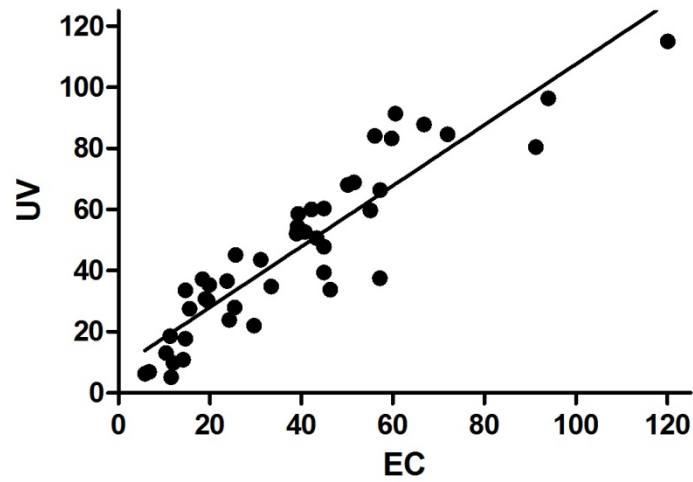


# Research at the Lady Davis Institute JGH, Montreal

- Plasma vitamin C concentrations are very difficult to measure reliably
- Current state-of-the-art method is HPLC separation with electrochemical detection
- But it's time-consuming and very tricky; rarely available in Canada
- Is there an easier way to measure vitamin C?



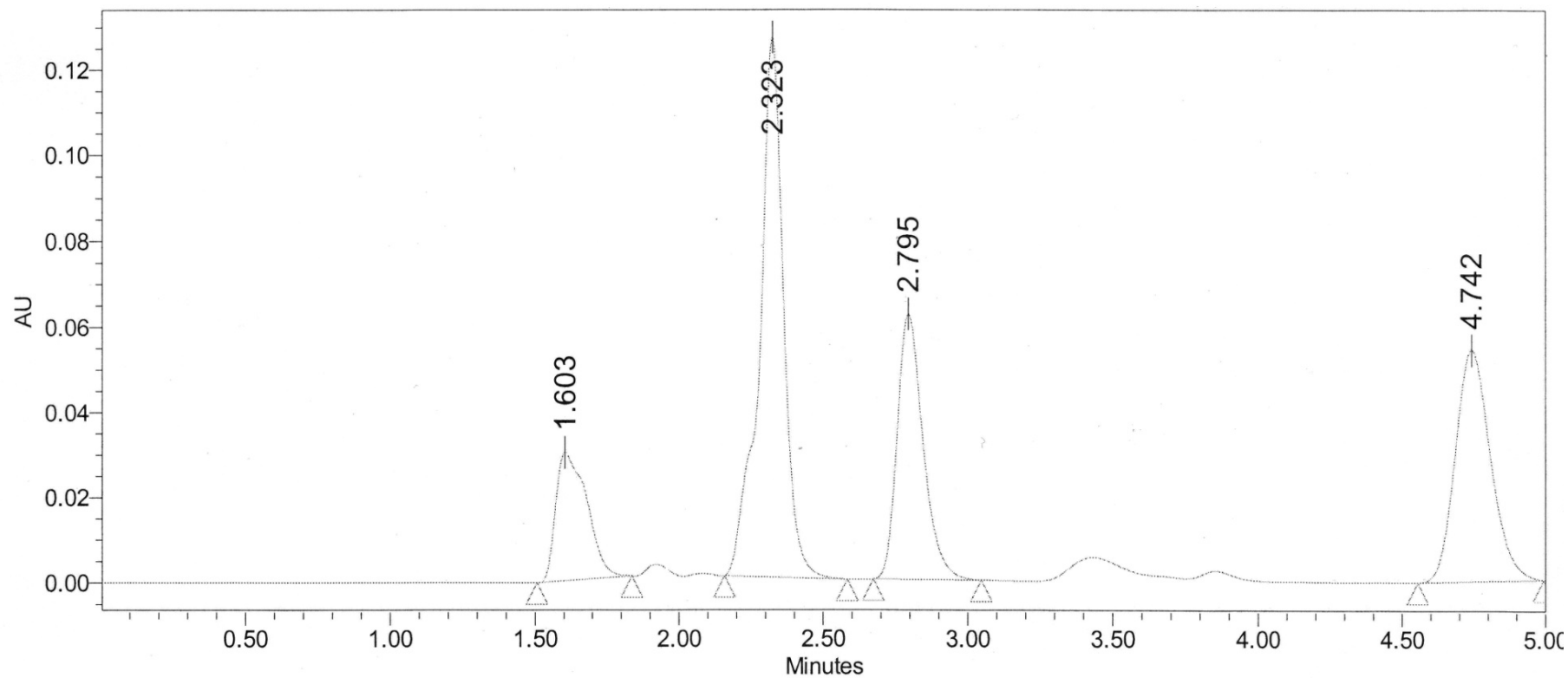
Total vitamin C



Ascorbate

Robitaille L, Hoffer LJ: unpublished data

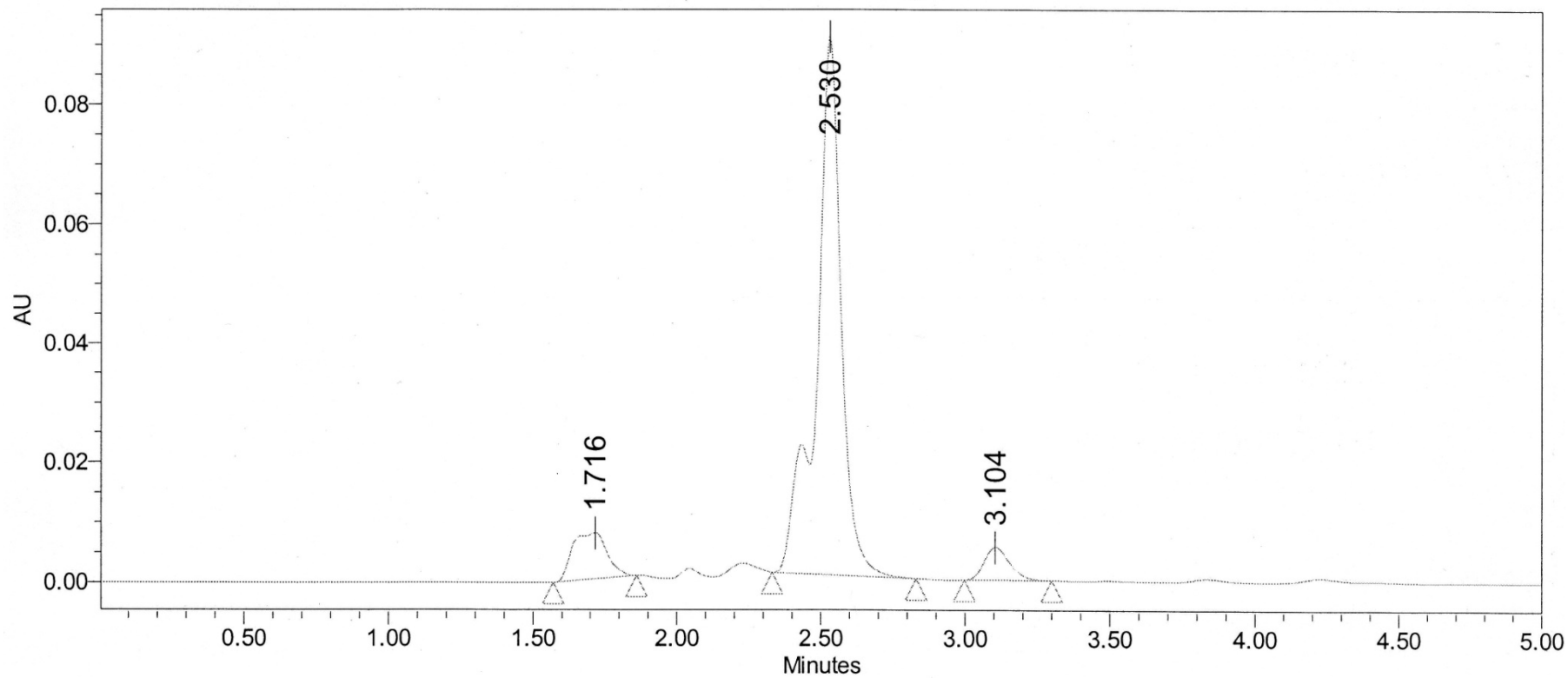
### Auto-Scaled Chromatogram



100  $\mu\text{mol/L}$  ascorbate

Robitaille L, Hoffer LJ: unpublished data

### Auto-Scaled Chromatogram



10.6  $\mu\text{mol/L}$  ascorbate

Robitaille L, Hoffer LJ: unpublished data

# The Value of Social Action

One person with a belief is a social power equal to ninety-nine who have only interests  
– John Stuart Mill

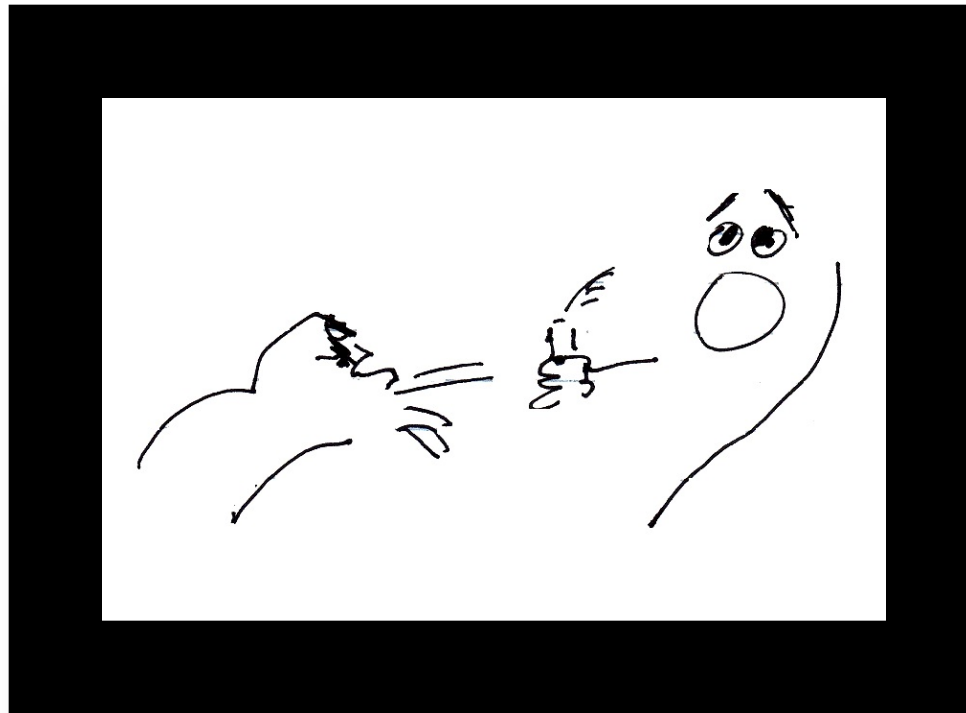
The reasonable man adapts himself to the world; the unreasonable man persists in trying to adapt the world to himself.  
Therefore, all progress depends on the unreasonable man  
– George Bernard Shaw

# The Value of Social Action

The free man... believes in destiny and  
believes that it has need of him  
– Martin Buber

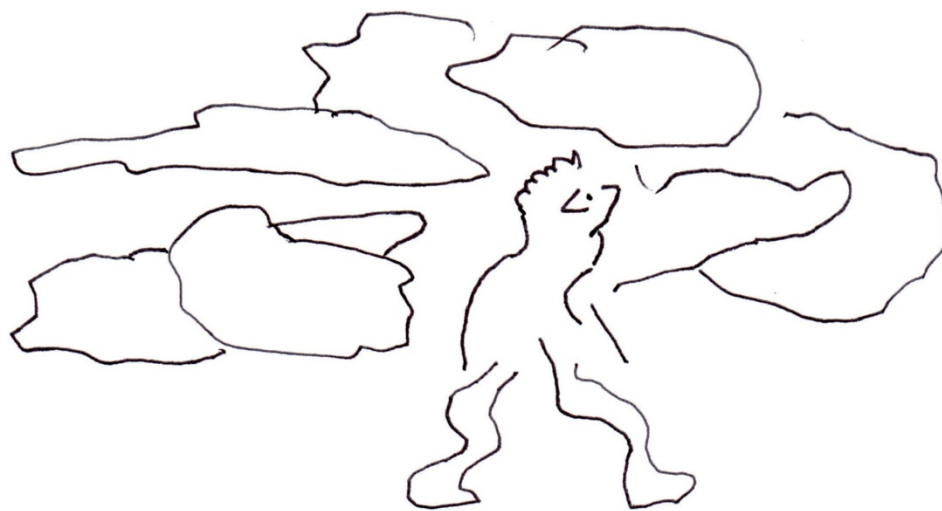


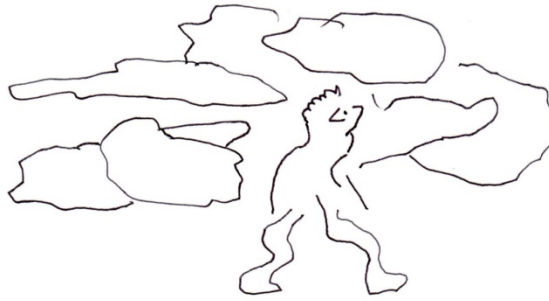
# Does Intellectual Uncertainty Require Emotional Uncertainty?



I am never lost, because I don't know where I'm going

Ikkyu (1394 - 1481)





These slowly drifting clouds, so unsatisfactory.  
What dream walkers men become.

Awakened from my dreams,  
I hear the one true thing:  
Black rain on the roof of Fukakusa Temple

Dogen (1200 - 1253)





# Acknowledgement

- Lotte and John Hecht Memorial Foundation