ALTERNATIVE MEDICINE - FUNDAMENTAL QUESTIONS OF BELIEF AND LOGIC

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In 1993 I organised a 'special study module' for eight undergraduate medical students on alternative medicine.[1] I had suggested this module in order to explore topics on which I am ignorant rather than select subjects about which 'I am a source of infinite wisdom'.[2] The term 'alternative medicine' refers to forms of therapy which the public use independently of mainstream medical practice, which are claimed to improve health, namely soundness of body and mind, and which are not usually widely available under the NHS. This term is used in preference to 'complementary medicine' which suggests the use of forms of medicine which should not be delivered independently of mainstream medicine. Acupuncture, aromatherapy, herbalism, homeopathy, hypnosis, osteopathy and reflexology were investigated, but not massage, crystal therapy, pyramid therapy, faith healing or colonic irrigation. I then interested myself in other matters until it was pointed out to the universities by a well-known authority[3] that complementary medicine ought, in his (justifiably) not very humble opinion, to be a part of the medical curriculum.

I was therefore approached to organise a further module: 'Looking at the relationship between complementary and alternative medicine, and orthodox medicine.' I agreed to do this somewhat reluctantly for it was obvious that, if the proposed module were to attempt anything further than descriptive accounts, there would be major problems in reconciling some alternative medicine beliefs with scientific approaches.

What follows is the result of my exploration of this minefield.

BELIEFS AND SCIENCE

Evidence is that which may enable differentiation between (1) beliefs without a scientific basis and beliefs that *may* have a scientifically sustainable basis, and (2) beliefs that *may* have a scientific basis and scientific facts (Figure 1).

To obtain evidence it is almost always necessary to question, and students who are not willing to doubt, to question, or to tolerate uncertainty, would have to be advised not to participate in this module. To question requires an open mind (but not open enough such that your brains metaphorically fall out) and a willingness to search for evidence that contradicts one's beliefs or hypotheses. Note that the word 'contradicts' is used in preference to 'confirms': no number of items of evidence can provide absolute confirmation of a belief or hypothesis, but only one contradictory item of evidence can challenge a belief or hypothesis.

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Some definitions:

- **A <u>hypothesis</u> is an open speculation ('It might be that….') put forward to explain a condition, a set of events, etc.**
- **A <u>belief</u> (which may or may not be true) - is a hypothesis that does not have a scientifically sustainable basis but which has a (variable) degree of closure in that other alternatives are discarded by it. ('I intrinsically know that x must equal y.')**
- **<u>Science</u> is an intensely critical way of investigation characterised by the gathering together of evidence, and then (possibly) interpreting evidence and forming logical conclusions.**
- **A <u>scientific fact</u> is an item of information that is based on available evidence(s) that cannot be falsified, e.g. 'The atom can be split'.**

QUESTIONING

Medical students are being trained in what should basically be a doubting scientific discipline which strives to distinguish between beliefs and scientifically sustainable facts, often referred to nowadays as 'evidence based medicine'. The three principle reasons for this are the following:

1. A scientific approach uses doubt and questioning, both of which are driving forces that give rise to newer ideas and more discovery.
2. Scientific verification, although it can never be absolute, is preferable to simply having beliefs, no matter how comforting such beliefs may be.
3. The evidence collated is used to justify actions. People use beliefs or scientific evidence(s) to transcend personal responsibility when taking action. People may believe what they like, but the taking of *actions* on the basis of beliefs for which scientific evidence is lacking can be a fundamental undertaking because the responsibility for such actions can only be shared with those who share such a belief. In contrast, actions taken on the collated scientific evidence should receive general support even from those who do not share identical beliefs.

Critical questioning in this context has a number of adversaries that have to be overcome:

- A belief that something which has not been proved false must be true.

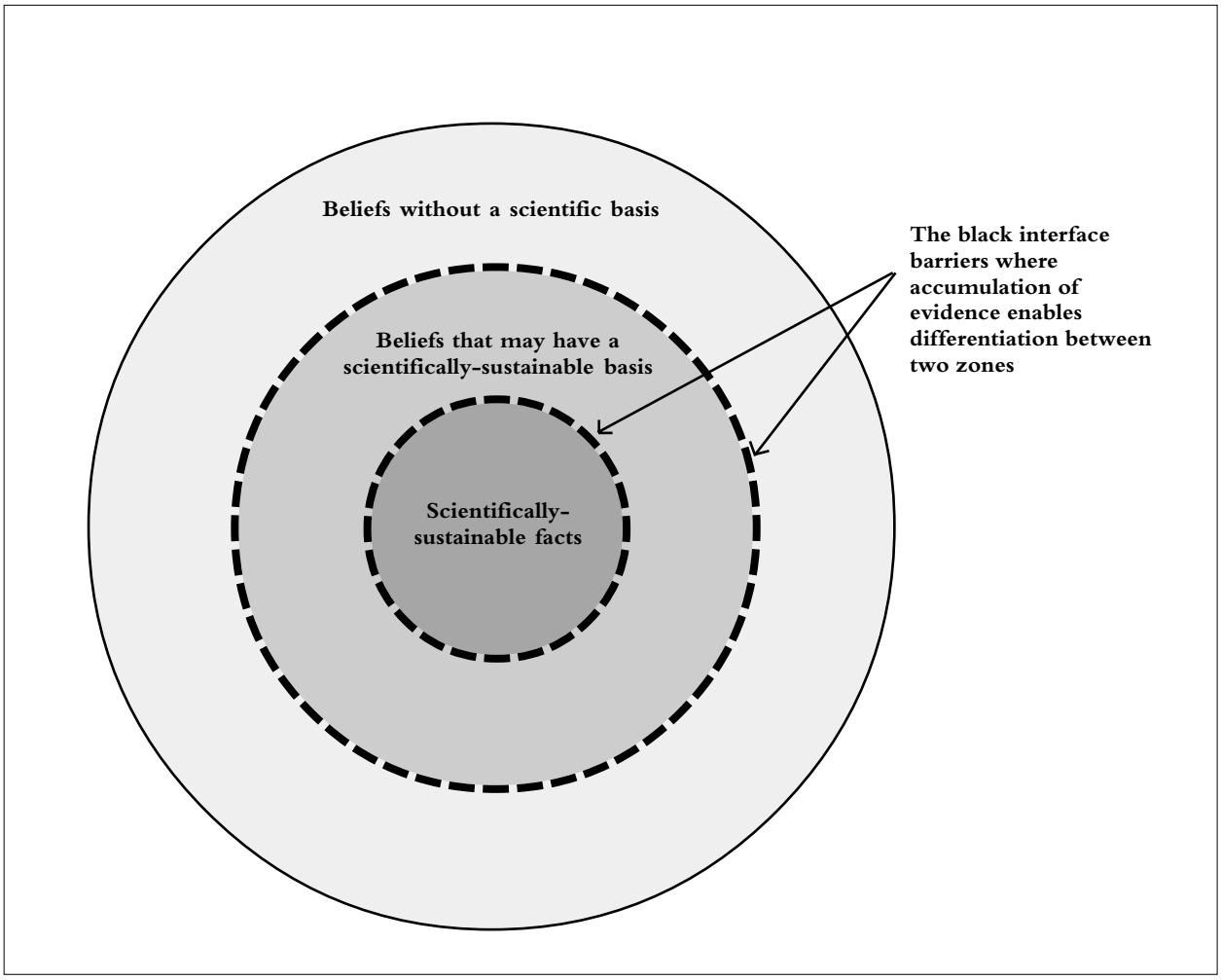

FIGURE 1
The relationship between beliefs and scientific facts. 'Circles of evidence' rippling from a central factual core. Notice that the differentiating lines between each category are not unbroken.

- A belief that something that has not been proved true is probably false.
- An assumption that answers to your questions are correct or the only answers.
- An acceptance of the conventional wisdom. Be aware that scientific evidence for conventional wisdom is often lacking. 'Everyone knows that this is true, so why waste time confirming it?'
- The adoption of a *laissez-faire* philosophy - 'If it works why bother how it works.'
- A belief in 'authorities' because of their status: because a particular pundit had expressed a particular opinion, it must therefore be so.
- An acceptance of special pleading: 'It is not given to us to understand.'
- Allowing your intelligence to be insulted, if you are asked to accept any of the above.

DIFFERENTIATING POWER OF EVIDENCE

The above suggests it is possible to differentiate between beliefs and scientifically-based facts. Although extremes of each are irreconcilable *(*e.g. *I believe* the moon is made of green cheese, but you *know*, [have scientific evidence] it is made of rock), the task of science is to obtain evidence that clarifies grey areas between beliefs (which science terms hypotheses) and scientifically sustainable facts (Figure 1).

QUALITY OF EVIDENCE

What then is *acceptable* science-based evidence that enables us to distinguish between beliefs and scientifically sustainable evidence? The evidence must:

- be confirmed by others acting independently, and perhaps after having carried out their own separate investigation designed in a different way.
- comprise a sufficient number of well-documented observations: anecdotal 'evidence' is unacceptable, and should be reserved for hypothesis generation.
- withstand substantive debate and repeated attempts at contradiction. *Indeed contradictory factual evidence should have been sought and not found.*
- have an underlying logical explanation. Explanations may contain many links but if *only one* such link is tenuous then either the explanation is partially or wholly wrong, or the evidence is suspect.

There must be a realisation that some evidence is dynamic, and evidence obtained at one time or at one place may not apply at other times and in other places. HIV management is a classic example: guidelines are based on assumptions which are assembled from evidence obtained at different times, at different places, with different risk-groups who have different variants of HIV, and with different racial and genetic backgrounds.

Some practitioners of alternative medicine will fail to answer satisfactorily all these criteria for acceptable evidence. This does not mean that their beliefs are worthless, but it does mean that we should continue to doubt and question, and keep on with a demand for evidence gathering before taking action. In practical terms, good evidence should be accrued and be sufficiently robust if we are to ask the government to spend our money on alternative medicine.

Question. What should you say when no evidence has been collected or the collated evidence is not scientifically evaluable?
Answer. 'I do not know.'
Question. What action should you take?
Answer. None, but try to get evidence.

PROBLEMS WITH INTERPRETATION OF EVIDENCE

Once evidence is available there are several errors that can be made which, if undetected, may result in a belief to be regarded as a fact, perhaps erronously.

- **Gullibility error:** Everyone tends to observe what they expect or, in retrospect, think they have observed what subsequent reflection suggests they ought to have observed.

- **Inductive reasoning error:** The inferring *of* general principles *from* particular instances, may be misleading.

- **Deductive reasoning error:** The inferring *of* particular instances *from* general principles, may be similarly misleading.

- **Word error:** Assuming that words mean the same to others as they mean to you: a strict definition of terms should occur *ab initio*.

- **Sincerity error:** Substitution of sincerity for evidence may occur, sometimes inadvertently. The sincerity of the interpreters of evidence should be irrelevant and this is important, indeed very important. Millions of people have died on the basis of sincerely-held beliefs, for which there was no evidence, e.g. 125 individually for each word in Hitler's *Mein Kampf*.

- **Conformity error:** Even if a lot of people believe in something - perhaps with certainty - this does not make it necessarily true.

- **Availability error:** The most memorable occurrence affects judgement. 'Halo error' occurs when readily available 'good' observations outweigh less readily available counterbalancing 'bad' observations.

- **Cause and effect error:** Failure to realise that exposure to the cause should always precede the effect. Retrospective identification of patterns among a large number of observations is risky. Observation should be used to generate a hypothesis and then this is tested specifically. Some associations will emerge by chance, if a large number of different observations are systematically compared.

- **Restricted reasoning error:** Reasoning *from* effect *to* cause using one pathway without considering other possibilities.

- **Self confidence error:** Expressed in the arrogant statement: 'There is no other explanation'.

- **Association error:** Assuming that association is the same as correlation. There are many varieties of this particular error:

  a) **Primacy error:** Assessment of later material is affected by prior exposure.

  b) **Unrepresentative error:** Conclusions are reached from anecdotal, related and unrepresentative observations. 'I had a patient once who...and therefore I now....'

  c) **Assuming significance error:** Concluding that evidence is significant when it is only caused by chance.

  d) **Coincidence error:** Coincidences are bound to happen as a purely statistical phenomenon. Striking they may be, but significant they may not be: even random numbers tables contain totally meaningless but seemingly non-random sequences.

  e) **Total logic failure error:** The setting out of syllogisms which do not pass the scrutiny of logic, for example: 'A high proportion of patients given AZT for AIDS die; therefore AZT is harmful'.

  f) **Ignoring evidence error:** Inconvenient or irritating evidences are conveniently forgotten or judged irrelevant or as unrepresentative aberrations.

  g) **Confusion error:** Failure to exclude evidence that is irrelevant and thus confusing. Differentiation between 'confusion error' and 'ignoring evidence error' may be difficult.

  h) **Focusing error:** Attention is restricted to positive findings.

  i) **Analysis failure error:** Collected evidence suggests that there is no correlation but a subgroup might show a correlation.

  j) **Confounding error.** Failure to realise that there may be confounding factors in which the association is not between two entities, but rather that both share a common cause, e.g. a high alcohol intake is associated with a higher rate of lung cancer: alcoholism is not associated causatively with lung cancer but both are associated with smoking.

SPECIFIC PROBLEMS WITH ALTERNATIVE MEDICINE

Patient satisfaction with alternative medicine regimens is high. At least five branches of alternative medicine, namely acupuncture, aromatherapy, herbal medicine, homeopathy and osteopathy, adopt a holistic approach, i.e. remedies which may vary from patient to patient and which are individually tailored after in-depth assessments of diet, exercise, state of mind and other less definable factors in the individual patient to be treated. Unfortunately the results induced by alternative medicine, especially those brought about by holistic approaches, such as well-being, are almost entirely subjective and it is difficult to assess them in whole or in part. That an intervention makes people feel well does not imply that the intervention has a direct and specific effect on a specific condition. Far less should we infer that an intervention which makes people feel better is necessarily one that should be labeled as a medical intervention or a medicine. If I am donated £10,000, I will definitely feel better, but such monetary gifts cannot be seriously considered as medication.

An evaluation of the large number of alternative medicine interventions poses several problems. These are often marketed without safety trials (which may be irrelevant if there is no scientific basis on which to expect adverse effects), and with strong claims of therapeutic effects. Challenge to these claims usually evokes suggestions that scientific medicine should investigate alternative medicine - but the lack of a scientific explanation of certain alternative medicine interventions would be likely to render such potential investigation a waste of time and money.

Some may ask, if alternative medicine works, does the mechanism matter? The answer is a resounding 'Yes, it matters very much', *if there are to be further developments*. The lack of a scientific basis may be the reason why some alternative medicines are stuck in ancient times and have not progressed or evolved in centuries. The excuse being that it is 'the knowledge of ancients' passed on by lore and tradition. If, say, all homeopathy had a scientific basis then evidence should have been sought that would enable us to dismantle the current relative megadosage pharmacology.

Some alternative medicines have been successfully and appropriately incorporated into mainstream medicine; drugs such as digoxin and quinine spring to mind.

PROBLEMS WITH THE SCIENTIFIC APPROACH

- **Evidence is based on observations.** We do not all experience the same world of evidence, or at least experience it in an identical fashion: some of us are colour-blind, some of us are tone-deaf, some of us are dyslexic; *all of us* experience events after they have happened.

- **Beliefs may be scientifically true but evidence for this may be unobtainable.** More commonly, science can only provide degrees of approximation or quantification of uncertainty; still it is a start.

- **Reductionism error.** It may not be possible to reduce every complex situation to its pieces by concentrating on the pathways from effect to cause. Reducing a thing to its components may give no idea of its function as a whole.

- **Medical science may not, indeed usually does not, provide absolute answers.** We often use statistical techniques to call the odds of what we choose to accept as acceptable evidence.

SHARED PROBLEMS WITH THE SCIENTIFIC APPROACH AND BELIEFS

Some scientifically-based evidences on further investigations turn out to have been beliefs, and some beliefs turn out to be scientifically-based, but only once they have been investigated.

Both beliefs and the scientific approach presuppose that a hairy bipedal life-form, living on one planet, circulating around one of 100 billion stars, in one amongst an estimated billion galaxies, can identify ultimate truths. This is literally arrogance on a cosmic scale. Beliefs offer certainty and (almost invariably) reassurance. In contrast the scientific approach presupposes that, by repetitively asking 'Why?', ultimate questions can be answered. This is incorrect.

The ultimate question for both beliefs and the scientific approach is 'What happened at the instant of creation, the Big Bang?' Sciences such as physics and astronomy have knowledge of what happened just after the Big Bang, which is constantly being re-shaped and re-examined, but no-one can know what happened at the instant of creation when, as scientists *believe,* everything was made out of nothing.[4] We can only have untestable theories as there will be no evidence that could be tested - how could there be if there was nothing there at the instant of creation?

So both the scientific and belief approach share the last (actually first) laugh. At the instant of the Big Bang, science and belief are equally valid and the only Answer to the Ultimate Question becomes 'Why not?', and one evidence for 'Why not' is reading this!

REFERENCES

1 Alternative Medicine - an investigation by a team of first year medical students. *Edinburgh Medicine* 1994; **75:**8-9.

2 'Megalomaniacal nonsense' JBW personal communication.

3 Prince Charles, 1997. Buckingham Palace, London.

4 Davis P. What happened before the Big Bang? In: How things are. Brockman J, Matson K (eds). 1995, Weidenfeld and Nicolson.