

Quackery and Science in Veterinary Education : I do not believe in astrology, because I am a Libra

Marian C. Horzinek

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Introduction

I shall attempt to present an old problem in this essay, focusing on two facets of the same topic:

- The devastation and desolation of our intellectual landscape by irrational ideologies, and
- The challenge for veterinary schools to teach young avid, committed students the difference between belief and knowledge – to prepare them for their professional life, where they should never sell quackery disguised as knowledge to their clients.

This is my credo, as a citizen and a scientist. If we want our profession to gain prestige it should also become a veterinary credo.

Quackery

At your next visit of a veterinary teaching institution you should have a look at the posters, announcements, bulletin boards – particularly the non-official ones, those not authorized by the Dean's Office. You will find a mind-boggling array of 'alternative' cures advertised, mostly as students' initiatives. In human medicine it is even worse: aroma therapy, Aura Soma, Ayurveda, Bach blossom therapy, biofeedback, chakra – just to start the alphabet. What is happening here? Did academia overlook a therapeutic market niche that a dynamic, future-oriented student body has discovered? Is this disconcerting?

It is disconcerting, but not for market economic reasons. In the academic environment we only see the proverbial tip of the iceberg. After a century of firm belief in technological progress, today's disillusioned society wants everything to be 'natural' and 'biological'. We experience a renaissance of mysticism, where quacks, shamans, witch doctors, psychics assume medical authority. Amongst my friends in the Netherlands there is hardly anybody who does not buy homeopathic potions, takes Reiki massage, reads the newspaper horoscopes, or at least touches wood to appease some evil spirit or summon a good one.

My closest friends are from the humanities and from business life and certainly do not constitute a random sample, representative of Dutch society; but neither are they particularly unintelligent. - To this day there are hotels where room 13 does not exist and buildings where elevators do not stop at the 13th floor. Brussels Airlines recently yielded to the superstition of their passengers and added one dot to their logo: Italian and American passengers had objected to the design of the letter 'b', which was composed of 13 red dots. – Superstition is accepted by modern society, it is *de facto* sanctioned – like the 'true' religious creeds; 'to sanction' is from Latin *sancire*, meaning 'ratified by ecclesiastical decree'.

For thousands of years solar eclipses were considered as foreboding big disaster in almost all cultures – in China a dragon was thought to devour the sun, in Japan the wells were covered because the water was considered poisonous during this period. We should not ridicule these beliefs - any belief for that matter – we experience similar convictions daily, apparently our brains are wired that way. What we should do is to identify them as beliefs, to identify any improbable, unproven statement as a belief. The evolutionary advantage of the religious disposition for group formation, bonding and coherence is being investigated by sociobiologists. It is not a matter of intelligence – reason may or may not kick in. The physicist and Nobel laureate Werner Heisenberg had a horseshoe nailed to his front door, and when asked whether he believed in its charms, he is quoted to have said: "...of course not!"; but he

had been told it would bring good luck even if you do not believe in its magic.

It can be expected that students are enticed by the Pied Pipers' tunes of obscurantism – after all, they are still in the process of knowledge acquisition. However, they should learn - or rather: should be taught – the difference between lore and expertise, between faith and science, between a subjective and the objective reality. This is the task of academia, and it is rather a matter of enlightenment than of training; as Plato practiced it with his disciples in the olive grove, the ΑΚΑΔΗΜΙΑ near Athens.

Science

"Knowledge? Do we really understand anything at all?" I hear somebody mutter at a cocktail party, with an air of profoundness, followed by a quote (preferably Shakespeare). Bystanders acclaim the speaker's political correctness, and my remark that he would probably not be standing here without antibiotics and vaccines is graciously ignored. In case you did not notice: I am a professed opponent of science relativism, which surfaces time and again particularly in TV panel discussions. Known as "Cultural Pessimism" (Kulturpessimismus) to German audiences, its sweeping, grandly-formulated, apodictic condemnations of modernity in general, and of science in particular serve the purpose of pleasing New Age audiences. A dubious purpose, but in line with the tenets of the "Science Wars" of the 1990ies, which assert that

- knowledge is a product from negotiations between members of the scientific community
- knowledge, facts and reality are social constructs

and – unbelievable but true:

- natural sciences constitute a minor subdiscipline of the social sciences

(Susan Haak, quoted from Peter Swetly, Vice Rector of Research, Vienna Veterinary University http://www.nt.tuwien.ac.at/nthft/temp/oefg/text/wiss_tag/Beitrag_Swetly.pdf).

In a recent work, Haak states "...we humans have limited intellectual and other resources: limited intellectual integrity, respect for evidence; limited imaginative powers; limited capacity to reason; and limited sensory reach." She now assumes a middle position in the science wars (which no one is really fighting anymore), conceding that facts are facts, not merely social constructions, that the scientific process is as objective a method as one can get, and that science has achieved success in discovering true things rather than inventing or constructing them. (Susan Haak: *Defending Science-Within Reason: Between Scientism and Cynicism*; Prometheus Books, Amherst N.Y. 2003)

However – there can be no doubt that we live in a period of science antagonism, which is only the other side of the coin of quackery. It offers no comfort to learn that in the USA it is even worse. Colleagues regularly send quotes for my internet journal *Veterinary Sciences Tomorrow* (www.vetscite.org), which refer to the Bush Administration as "Torquemada's modern successors". There is a campaign going on to suppress scientific findings, unmatched in the Western world since the inquisition in the 13th century. Sometimes, rather than suppressing good research results, the administration orders favorable results of their own, in the meanwhile censoring, intimidating and blacklisting *bona fide* scientists. Indeed, so extreme is this campaign that >60 scientists, including 20 Nobel laureates released a statement three years ago, and again on February 18, 2007 that accuses the Bush Administration of deliberately distorting scientific facts "for partisan political ends."

The attitude on this side of the Atlantic may be less of that Texan style, but it is anti-scientific nevertheless, also in the veterinary scene. Standard arguments run like this: "...one scientist says this, the other one says that, so we don't know anything for sure...", or even worse: "...after all, there is a difference between theory and practice... I shall examine both statements.

"...one scientist says this, the other one says that..." is a correct observation, only the conclusion is erroneous. The statement does not express any uncertainty, any arbitrariness, quite on the contrary: it is the force driving scientific progress. Present epistemologic theory is based on the thoughts of two philosophers, the American Thomas Kuhn (1922-1996) and the Austrian/English Sir Karl Popper (1902-1994).

In *The Structure of Scientific Revolutions* (1st. edition University of Chicago Press, 1962),

Thomas S. Kuhn describes science as the result of an interplay between phases of normal, daily, continuous research routine and sudden revolutions of insight, which result in paradigm changes. The paradigms of theories that are separated by a revolution are "incommensurable", i.e. they cannot be measured with the same gauge - like the geocentric with the heliocentric view of our solar system, Aristoteles' physics with Gallileo's, and - closer to our subject - humoral pathology as Hippokrates has preconceived it with the medical insights since the Renaissance. Indeed: "...one scientist says this (before the revolution), the other one says that..." (after the revolution).

Kuhn's rather historical approach should be viewed together with Popper's proposals, which are at the core of modern research work. Veterinary students should not only have heard about them in passing, they should have been intrinsically educated in Popper's world of thought. His "critical rationalism" defines science as the methodic approach through conjectures and refutations - coarsely paraphrased: of trial and error. It must be the researcher's ambition to generalize and refine his hypotheses and theories, to underpin them with experimental evidence. And the ambition is not to corroborate them, but to find out about their weaknesses, so they can be replaced by other, better hypotheses and theories. Popper is not interested in the verification of presumed regularities in accumulated data, he rather intends to falsify hypotheses that had been formulated through a process of deduction. Consequently, experiments must be designed with the objective to disprove, not to prove. Only theories that continue to defy falsification offer a chance to reflect objective reality. And again: "...one scientist says this (before falsification), the other one says that..." (after falsification). This is what distinguishes science from ideology: the tentative nature of insight, the continuous pursuit, the corrective measures. - Incidentally: both Kuhn's and Popper's ideas are still valid, and can be found in the philosophical literature, in many flavors and variants.

All this may seem a little anemic, but it does reflect the current practice of research. Some 25 years ago we discovered a new virus in a horse at the Veterinary School in Berne/Switzerland - Marianne Weiss, a biologist, the late Franz Steck, a veterinary virologist and myself (Weiss, M., Steck, F. and Horzinek, M.C. 1983. Purification and partial characterization of a new enveloped RNA virus - Berne virus). J.gen.Virol. 64, 1849-1858). This is not particularly exciting, new viruses can be found everywhere, it is just a matter of patience, and in most cases they are variants of well-known pathogens. However, Berne virus had a property hitherto unknown to science: in the electron microscope it looked like a biconcave disk, like a nano-erythrocyte. Further analyses showed that it was serologically unrelated to known equine viruses, that it possessed a unique protein composition, and that it employed a novel strategy of RNA transcription. I became convinced: this was an important discovery.

Not unexpectedly, this conviction was not shared by the editors of several scientific journals, to which I submitted manuscripts for publication. They all came back, with reviewers' comments ranging from cool rejection to cold scorn. However, every referee gave reasons for his scorcher, asked questions, suggested additional experiments, inquired about the controls, discussed possible artifacts, aired his doubts. In Utrecht we subsequently addressed each and every point, and performed the suggested and additional experiments: all of them Popperian attempts at falsification. We only got the same results, and at the long last they appeared in press. Berne virus became the prototype of a new genus (Horzinek, M.C. and Weiss, M. 1984. Toroviridae: a taxonomic proposal. Zbl.Vet.Med.B. 31, 649 659.) and stood at the cradle of the new Order Nidovirales, the second in viral taxonomy (Vries-AAF de; Horzinek-MC; Rottier-PJM; Groot-RJ de. The genome organization of the Nidovirales: similarities and differences between arteri-, toro-, and coronaviruses. Sem-Virology 8: 33-47), which revolutionized insight into viral transcription mechanisms: a Kuhnian paradigm shift. The *Coronaviridae* family with SARS virus as its most prominent representative, and elusive Feline Infectious Peritonitis virus are in this cluster.

"...one scientist says this, the other one says that..." reflects the traditions and customs of the culture in science - you do not make any scientific statement airily, gratuitously, without good reasons. You have good reasons for this, your opponent has good reasons for that, and the scientific world eagerly follows the falsification attempts from both sides. The survival is for the fittest, but both adversaries have good reasons for regarding this as more plausible than that.

I should finally disclose the source of my quote: it was the answer given by a recently appointed professor, after her talk, in reaction to a query from a veterinary audience - with a

shrug. This is inexcusable, of course. In such a situation, there is only one of three possible negative answers:

1. "...I do not know..."
2. "...it is unknown to science, has not been explored, not been published..."
3. "...one scientist says A, the other one says B; based on my expertise, argument A appears more plausible to me, for the following reasons..."

Perhaps the colleague should be reminded of the etymology of the word "professor"- it is from Latin *profiteri*, meaning to profess, to identify, to commit oneself.

I had promised above to address that other inane statement: "...there is a difference between theory and practice..." I hardly ever hear it from scientists, rather from practitioners, as an implicit justification of veterinary measures that are evidently wrong, but are nevertheless taken. In other words: measures that disregard the *state of the art* – which is defined as the highest level of development of a device, technique, or scientific field achieved at present. In the medical professions, it is the *standard of care*, a set of rules adopted on the basis of scientific evidence and expert opinion; they must be followed, if only to avoid malpractice suits. In industry research, the GLP (good laboratory practice) and GCP (good clinical practice) acronyms refer to internationally recognized rules for performing clinical studies, which take ethical, legal and scientific aspects into consideration (for Germany: Clinical Trials Directive 2001/20/EG). For the daily veterinary practice, it should be a matter of course that any intervention, any measure is preceded by a rationale, any therapy or prophylaxis by a diagnosis.

In theory, there is no difference between theory and practice. But, in practice, there is (pun intended). Thus many a cat will get her leukemia shot without having been tested for FeLV antigen in her blood before. Every vet student knows that a viremic animal cannot be immunized; nevertheless, this is common and ubiquitous. After all, the test is about as expensive as the vaccine, and so you rather inject than take a blood sample, which also may be a tedious procedure. In this reasoning, the veterinary surgeon follows the 'practical' ideas of the lay client and refrains from defending a solid scientific theory. There are two possible verdicts:

- Either the vet knows that the vaccine does not work in a viremic animal and sells it nevertheless – which is unethical
- Or the vet believes that the vaccine will work in a viremic animal and sells it therefore – which is quackery

Education

Which of these thoughts could and perhaps should be channeled into veterinary education? To eventually end up in the curriculum? I am concerned about an aspect called "Bildung" in Germany, a term nonexistent in Dutch and neither in English. There are approximations to encompass the intellectual, social, economic and political/civic purposes of education, but "Bildung" in Wilhelm von Humboldt's view is more than that, it is "...the stimulation of all human capacities so they unfold as the world is acculturated, leading to a self-determined individuality and personality..." (my translation from a Wikipedia quote).

I should like to limit the discussion to some aspects that follow from the above topics. None of them has formally entered the academic scene, but this is also true for high school education, which ignores vital issues like partner choice, childrearing, conflict resolution, compromise, tolerance in its teachings. Millennia ago Seneca (54 BC - 39 AD) observed '*non scholae sed vitae discimus*' (we learn not in school but for life), and it indeed appears that in both environments the curricula rather address what the teachers are familiar with than what the students lack.

I should like to discuss criticism, dialogue and 'innumeracy'.

Criticism

Because science progresses through Popperian falsification attempts – *ergo* through analysis, comment and critique – one should learn how to deal with them, actively as well as passively. Accepting criticism is a lifelong agonizing process, and some never manage to deal with it. The critic, on the other hand, has a bad image, mostly due to the way criticism is

offered. Critics may not wisely restraint themselves, may get carried away by feelings of superiority, may start an *argumentatio ad hominem*, ignoring the fact that the writing and not the writer should be judged. I would expect those veterinary teaching institutions worldwide that carry the 'sciences' epithet to particularly address the criticism aspect, but this assumption is wrong. They also produce vets, with veterinarians' personalities – a profile quite different from that of a scientist. The animal doctor and his/her client should entertain a relationship of trust, with emphasis on expertise and empathy; in every case there is a singular health problem that needs to be solved by a person of unquestionable, self-assured, likable authority. The scientist, on the other hand, is looking for the open discourse, does not take anything for granted, is the perpetual, neurotic, self-centered disbeliever.

How can this disparity be reconciled? I think by teaching both science and medicine at the same institution, but for different recipients, according to one's inclinations and talents. Some six years ago in Utrecht we had introduced a core curriculum (for all students), followed by separate paths for companion and farm animals, for veterinary public health, for regulatory tasks and – indeed – for researchers. This became redundant after introduction of the bachelor/master principle, but there will be a honors path for the budding scientist also in the Bologna program. It can be expected - it is hoped - that the physical proximity of students with different ambitions will result in their mutual understanding. An uncritical clinician is as big a disaster as an authoritarian scientist.

Dialogue

I shall never forget an incident I experienced as an intern in a practice in Germany. The conceited spouse of a Federal Judge asked the veterinary surgeon whether the intended therapy would really help her dog, and if another one would not be preferable. This she should not have done. The vet felt challenged, his competence contested. A wild exchange of tirades followed, and only the colleague's regained balance allowed for a passable leave of the client, which, of course, was lost for this practice. The reason: an unsatisfactory conversation.

Criticism and dialogue are interrelated, but also the latter is not formally taught in veterinary schools. It is perhaps considered unnecessary, and the curriculum is jam-packed anyway. Everybody is a communication genius by default, and incompetence in this field – should it ever occur – can be compensated by veterinary proficiency. Can it really? Since Daniel Goleman's bestseller *Emotional Intelligence* (Bantam Books, New York 1996) the psychology of interpersonal relationships is taken seriously also by industry, and expensive training courses in active listening, role-playing, sensitivity training etc. flourish.

All of us would rather talk than listen. We occupy a territory of sound and defend it against any intruder. I can think of reasons why this habit must be controlled: the other person, the client for that matter, probably also prefers talking to listening, and the vet needs the information - volunteered or requested – for the anamnesis.

Active listening would be an essential skill to acquire. I first learned about 'Parent's Effectiveness Training' in California, when I tried to become a better father. If you really want to know what is biting your offspring, you should hear them out, encourage them to present their problems, without judging, let alone denouncing. The vertical parent-child rapport makes it difficult, as I know from experience. It is also true for the veterinarian-client relationship, which should be cooperative and partner-like. The pet owner consults her vet like a patient consults the physician, and in both cases a concern – an emotion – superimposes the rational decision to visit a clinic. There is only one way to address this feeling, the dialogue. Modern technology offers many means of communication, but there is no digital alternative to a face-to-face exchange, where not only factual information is transmitted but also sympathy expressed, prospects explained, comfort given. Apart from talent, this requires knowledge and experience. The aptitude for dialogue is as important for dealing with clients as it is for communicating with the colleague in the neighboring village, with the researcher in the lab next door.

'Innumeracy'

When, long ago, my father took me for a walk and we passed a corn field, he would ask me questions like: how many 2-kg loafs could be baked, if the harvest from this field (of known surface) was 25 hundredweights per hectare, taking losses from milling into account? To his

disappointment, I could not do this, I never mastered mental arithmetics and grew up with the self image of a mathematical moron. My choice of veterinary medicine seemed to offer the best prospects of avoiding similar frustrations, of never having to deal with numbers. Far from it! I went into research, and my first studies on classical swine fever virus were aimed at determining its physical properties, its buoyant density and sedimentation coefficient, its size and mass. The avalanche of data had to be processed, first with mechanical calculators, later using IBM mainframes with punch card computing. To my surprise, I was able to learn this, and it even was fun. Today, my favorite weekend passtime is to try new software and to write short programs. Mental arithmetics, however, I still cannot do.

'Innumeracy' is the term coined by John Allen Poulos, a prominent mathematics professor in Philadelphia, and the title of a very informative and entertaining book (Innumeracy: Mathematical Illiteracy and Its Consequences; Hill & Wang, 1988). It is mainly about the assessment of probabilities. My favorite argument against telepathy: in view of the general lack of ideas, there is a great chance that two people think the same...

Quackery likes to employ arithmetic tricks to 'prove' something, because chances are that most readers are mathematically illiterate. Just as an example: there are many publications about hidden divine codes in the bible, and special significance is attributed to the number 7. However, if you would take every 7th letter from any text as voluminous as that of the bible, any word will surface sooner or later, from 'quackery' to 'science'. The hit rate is higher than if you had taken a dice with as many faces as there are letters in the respective language. This is due to the fact that their relative frequency in a real book mirrors the frequency of letters in possible search terms. Which is plausible: since the letter 'z' is rarest (0.074%), neither random English texts nor random English search terms will contain many z's.

The human mind has difficulties in handling rare events, as well as very large and very small dimensions. We cannot imagine the expansion of the universe, and many have difficulties in accepting the Darwinian evolution of vertebrates – the interplay of variation and fixation, of mutation and selection. Our yardstick for time is the year, the generation, the historical era. However, I would not have any difficulty in showing evolution of a virus in cell culture within a week – because every virus particle produces a million offspring virions in six hours.

Though statistics and biometrics are taught in most veterinary school, I do not think they have resulted in much insight into probabilities. Time and again I am surprised when objective science is put on a par with personal experience. I do not want to belabour the point, but it should be common knowledge in the 21st century that experience has the tendency to cumulate, that selective observations can skew the picture of reality, that repeated findings of a desired phenomenon may transform conjecture into certainty, and finally into a creed. This is what students should learn, and practicing veterinarians should remember.

Epilogue

We are making a mistake in veterinary education and in professional life when we attribute a superior role to actions, manipulations, interventions, and use knowledge but as a scientific fig leaf. Once veterinary medicine has learned to sell insight – in addition to the admittedly demanding physical procedures – it will eventually lose that farmyard smell. And veterinary surgeons will send an invoice just for a consultation, as an intellectual service rendered, like any lawyer, consultant, broker, censor, psychologist, counselor...