Future contribution of the New Zealand veterinary profession to science and science-informed policy

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First of all, thank you for this opportunity to speak to you on behalf of Sir Peter Gluckman and indeed myself.

I must say I feel some affinity with your Association and the veterinary profession having joined MAF's agricultural research division as a pasture entomologist under Peter Pottinger and thereafter tenaciously stuck with all the various upheavals, eventually arriving in AgResearch. I remember well the strong, and not all together, useful distinction between the plant and soil animal divisions when working with MAF directors.

Anyway, the talk I am giving today really has two parts. The first part refers to emerging trends and challenges for science and the contribution that science can make to policy development. In the second half I will be making some comment on the exceptionally valuable role that veterinarians play in New Zealand.

Evidenced-based Policy

In New Zealand, science-informed policy development is central to effective and modern government, and Sir Peter made the need for this plain in his April 2011 paper, *Towards better use of evidence in policy formation: a discussion paper* (http://www.pmcsa.org.nz/wp-content/uploads/Towards-better-use-of-evidence-in-policy-formation.pdf). Indeed, as he notes, there in fact is no real alternative but to use science-based knowledge; without it one is left with an unhelpful conflation of dogma, ideology and political pressure. This can lead to decisions on key matters being made in almost total isolation, or even in denial, of useful knowledge. There is little doubt that the importance of science in policy became very clear in the UK at the time of the CJD crisis. It was the advocacy of Lord Robert May, the then British Chief Scientist that had a major role in resolving what was going on. Regrettably however, the use of science in modern jurisdictions is not axiomatic. One only has to look at what is going on in the United States to see how science and policy formation can become separated, as reflected in the partisan approach to climate change which dominates in American politics even now.

As it happens, what is meant by and expected of science has changed a great deal since the halcyon days of the mid-1960s. Science used to be focused on linear questions that could be answered with typical reductionist precision. For example, how much weight will this bridge take? Are birds descended from dinosaurs? Or when is the next solar eclipse? As a result science was authoritative, definitive and largely accepted by a very different public. In general, science advice at that time was issue-specific, linear and effectively free of various society or individual-based values and beliefs. Such information was able to be provided by an expert to the relevant policy maker without the need for much explanation or context. Indeed such simple reductionalist-based inputs still happen every day in every political process, but as we will see, there is now much more going on as well. The problem is that the relatively small reductionalist component is still taken by many to apply to all science. This is definitely not the case.

You will all recognise that a large chunk of science has undergone very major change, particularly as the biological, environmental and human sciences in their broadest sense have come to dominate. Now science is increasingly having to deal with complex non-linear phenomena. In such complex systems certainty is not possible, as there always remain many unknowns and answers that have to be defined in terms of probabilities and levels of uncertainty. A good example is that of earthquakes and earthquake prediction. There are still enormous gaps in knowledge of tectonic plate boundary earthquakes even though they have been the subject of

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1 The opinions in this article are those of the authors, and do not necessarily reflect the views or policies of the New Zealand Government
intense study. Indeed the Christchurch earthquake was even more complex in that it was not a plate boundary event and therefore represents a much less studied form of earthquake. In spite of these areas of uncertainty, the scientists want to be able to assist the public and policy makers in knowing how the future will unfold. In trying to do this, however, all kinds of other issues can arise, particularly in terms of public communication. The situation is difficult for science as there is the necessity to explain the many uncertainties that abound. Coupled with this there is a tendency for the press to magnify scientific debate and uncertainty in a way that can cause considerable confusion for both the public and politicians. At worst, it can give the impression that scientists don’t know what they are talking about and, in the case of the earthquakes, people like the ‘Moon Man’, Mr Ring, who unequivocally and wrongly predict quakes based on gravitational pull, ludicrously acquire credibility.

This shift from scientific advice based on reductionist precision to the need to handle probabilities and estimates based on various coinciding factors and feedback loops, has caught many people unawares, be they scientists, the public or policy-makers. The problem is centred on the uncertainty; this is definitely not what scientists want to be the outcome of their work and it is certainly not what policy-makers and politicians want to hear about. No doubt a lot of modern veterinary application is also based on this sort of complex science and indeed, you will be more aware of tools being developed to deal with such uncertainty than I.

To top it off, as well as this complex science, there is yet another dimension and that is where people’s value systems strongly affect the debate. Typical examples of this include food security, animal welfare, the use of genetic modification and of course, climate change. These are issues of high public concern and political complexity and are indeed often the matters about which governments turn to science advisors.

When public values are combined with complex science we finish up with what is often known as ‘post-normal science’ and this is indeed a very long way from the old simple days of linearity when you could ‘ask a scientist’. Unsurprisingly, very often the answer today begins with the well-known words ‘well it depends’.

Coinciding with this shift from linear to complex to post-normal science has been the huge increase in public access to web-based information, albeit of varying quality and reliability. This has resulted in greater expectation by the public to participate in decisions, even when they involve arcane science and technology. Things get particularly messy when probability issues around risk arise, and this has been very apparent throughout the Canterbury earthquakes. Overall there has been a shift from an authoritative position of science and scientists to one in which many other voices are also heard and considered; again this has its complexities.

Of course the scientific processes around obtaining results and interpreting any set of observations must, as much as possible, be value-free, for that is core to scientific integrity. But even this cannot be entirely value-free. In terms of policy advice, there remains the need for judgment on how much uncertainty is acceptable when using knowledge as the basis of an action or policy. In this case values do not compete with or replace evidence, but rather it is necessary to determine the importance of the inevitable inductive gaps left by patchy evidence. In other words, the key question becomes: when is a particular body of scientific work adequately ‘sound’ to serve as the basis of policy? How much evidence is sufficient and how reliable are those studies that underpin the evidence? In these circumstances, particular attention needs to be given to the question: what are the risks associated with an erroneous conclusion in either direction? These are the challenges governments and their advisors must deal with.

Lastly, with reference to the use of science, there can be what is often an unavoidable intertwining of values with knowledge. In this case science unfortunately can become the proxy for a values debate which essentially has nothing to do with science. Absolutely the most current example of such proxy scientific debate is the pseudo-scientific argument about anthropogenic climate change. While there are real knowledge gaps, most of that debate is not really about the existence of climate change at all – rather it being used as a proxy for a values debate about economics and intergenerational equity. As scientists get sucked into such debates, they can turn into advocates and risk losing public trust. The climate change example seems quite straightforward but other examples are less so. Take genetically modified food; here the problem is confounded by what risk means to different people. This tension is often handled by anodyne reference to the ‘precautionary principle’. That said, the precautionary principle is easily misunderstood. It is actually an approach to the management of estimated risks in situations of scientific uncertainty. It must not be confused with the elimination of all risk, or become an excuse for doing nothing. The precautionary principle promotes the concept of taking precautionary steps to evaluate any danger and search for the means to manage it. Precaution designates an active, open, conditional and reversible approach which rests on a deepening of knowledge. However, consideration of the components in this way is always going to be subjective and values-driven.
So there are two rather divergent demands. On the one hand, as an advanced nation there is the inexorable need to adhere to the precepts outlined in the *Towards better use of evidence in policy formation: a discussion document* and on the other, science advice has entered the messy age of post-normal deliberation based on complex science. Partly as a result of these circumstances, this country’s departments are moving towards a configuration based on the UK model. In the UK there is a Government Chief Scientific Adviser (GCSA), John Beddington who is the personal adviser on science and technology-related activities and policies to the Prime Minister and the Cabinet. As of 2011, every individual British government department had appointed its own departmental Chief Scientific Adviser (CSA). The GCSA has no formal management responsibility for these departmental CSAs. However, the GCSA and departmental CSAs sit on a Chief Scientific Adviser’s Committee (CSAC) which provides a forum for the discussion of science issues in a cross-departmental context. New Zealand is currently developing a similar approach with MPI in the process of appointing a part-time Departmental Chief Advisor and other Ministries and Departments are likely to be following suit. It is anticipated that these advisors will work with the New Zealand Prime Minister’s Chief Science Advisor in a way that is similar to that in the UK.

**Veterinary science**

It is against the background that I have just described that I will now say a few words about the world of veterinary medicine and its science base. This could be interesting because you are the specialists, not me. First of all I must say your Conference Programme is commendably broad; I am especially taken by such things as animal dentistry and how to help owners when dealing with bereavement of whatever it is that has passed away. Thus I doubt that I am going to hit all of the bases.

I apologise that much of what follows is directed towards farm livestock management rather than companion animals. This is in part because the myriad of types of companion animals, rather than any feeling I have that they do not matter. Nothing could be further from the truth. I did do a bit of work on dog health and was horrified by the number of diseases that can affect our dogs, starting with rabies at the top and thereafter followed by dreadful sounding things like heart-worm.

**Veterinary connection to policy**

Based on current thinking around the role of science and evidence in policy, your highly specialised community of capability has been making, and will undoubtedly continue to make, a very major contribution to New Zealand. Your profession has a great deal to contribute to the country’s reputation and development. You are obviously well aware as for example, I understand that your association is already actively engaged in policy-linked considerations such as:

- Integrating better with the Primary Growth Partnership programmes, particularly in the dairy and meat sectors.
- Developing a scholarship/bonding scheme to encourage vets to remain in rural areas; I understand that less than 10 percent of your colleagues in countries such as Canada and the USA are involved in on-farm practice.
- Engaging in a curriculum review to ensure that new recruits to the profession continue to maintain a strong competence in agriculture and livestock production, as well as skills for dealing with companion animals.
- Engaging with the Minister for Primary Industries on legislation relevant to the profession such as the current review of the Animal Welfare Act.
- Working with the Veterinary Council of New Zealand on the recent review of the Veterinary Code of Professional Conduct.

Considering the dairy sector alone, I appreciate that there are numerous animal health related issues that people in your profession have to attend to. I also understand that you are dealing with continually moving targets. For example, in the pursuit of ever-increasing efficiency of milk and milk solids production, the breeding involved has inevitably led to challenges with regard to other important animal traits such as fertility and susceptibility to disease. Furthermore, I am told by friends in DairyNZ that, as well as some welfare considerations, such specialisation of breeds is producing serious wastage issues whereby, after being reared for a couple of years and completing one or two lactations, the cows then fail to become pregnant and are either carried over for a year or culled. The economic implications of this are obvious, but in addition, these empty cows, as I think they are called, also contribute to the cumulative total of greenhouse gas emission to little economic effect. Again, as well as the farmers and the stock managers themselves, you vets are easily the most important observers of such trends and as scientists you are able to identify and report on such trends. I would suggest that it would...
be most useful if your profession could continue to find ways to pool and interpret such trend data and work with animal health researchers to develop scientific publications. Indeed, I understand there is already significant collaboration going on in a number of fields in animal health area, but there remains many more opportunities for co-operative work between veterinarians and researchers to contribute to and inform public policy. You as a professional group within the science community in New Zealand do and can play such a critical role in all of this.

**Defence of New Zealand’s reputation**

It will not be news to you to hear that New Zealand simply must protect its environmental credentials if it is to continue to lay claim to its position as a pre-eminent and reliable producer of animal-based products, particularly dairy and meat. That Asian and other markets put such a premium on our production system has been evidenced repeatedly by their enthusiasm for accessing New Zealand raw materials for baby foods etc. and indeed farms. This has been particularly so after food scares such as the Sanlu catastrophe.

Such reputational protection is not particularly easy because economic and technical drivers are inevitably requiring the intensification of this country’s land-based sectors. With such activity comes all of the interacting complexity of stock damage to the riparian fringes, sediment run-off, soil compaction, ever-increasing fertiliser use, weed and pest impacts and soaring freshwater extraction for irrigation. It is such components that are contributing significantly to the serious down-grading of the country’s water quality and pastoral ecosystems. As well as badly needing integrated scientific investigation for the informed development of solutions, questions are now also being raised around the decision-making processes themselves for appropriate land use. This must take in the necessity for conservation of biodiversity and landscapes and so on. Ultimately such questions have to be dealt with in terms of who is it that makes critical land-use decisions, what data should be used and how individual property rights are to be accommodated. The required background research in these areas is slow, long term and expensive but there is no real alternative. It must also be appreciated that research in one ecosystem does not necessarily translate into useful understanding of another. Nothing contrasts more than the irrigated and porous Chertsey silt loams in Canterbury with the rain-fed volcanic Tirau soils of the Waikato.

Neither do I think that any of you would need to be convinced that animal welfare is another important issue and is a lurking threat to our markets. Welfare is a sitter for the imposition of non-tariff barriers and is doubtlessly being taken very seriously, especially in Europe, typically by the very exacting supermarket chains.

Overall, it would seem to me that animal welfare really is a bundle of issues including:

- The removal of shelterbelts leading to animal exposure (occurring in the interest of scale of production using massive irrigators etc).
- Determining how farmers can best deal with sick or injured animals beyond ignoring the problem. Many are reluctant to humanely kill such animals etc.
- The induction of calving amongst dairy cattle.
- Dealing with the presence of heavy infestations of gut parasites and anthelmintic resistance.
- The tail docking of animals.
- Stress during transport and slaughter.
- The use of pig harrowing crates.
- The apparent misery of battery hens.
- Broiler chicken selection that has been such that the breeds can barely walk.

On all of these matters veterinarians have the training and expertise to provide advice and inform government science policy on these challenging animal welfare issues. With reference to this, I am aware that the veterinary profession contributes significantly to the work of the government advisory committees concerned with animal welfare and animal ethics.

With specific regard to the dairy industry, there is an issue around the nutritional status of the national herd under pasture feeding regimes. That milk production can be greatly increased by better feed offers both a route to increased productivity but might also suggest that currently there may not be optimal nutrition of the national dairy herd; hence this is a place where science can both improve welfare and productivity. An abiding point about all of these welfare aspects is that they are wide open to subjectivity. However, science can help to identify what are stressful situations so that more objective conclusions can be reached by the public as well as professional participants, trade negotiators and policy developers.
Biosecurity and zoonotics

Along with such considerations of animal welfare is the related and frequently vexed issue of biosecurity. Once again, the veterinary community has an immediate and very important role in terms of expert surveillance. This is vital. New Zealand trade and travel have nearly doubled in the last 10 years and our markets and trading partners are continually diversifying. As a result of such trends New Zealand is open to invasion by unwanted and destructive exotic organisms, including some very threatening zoonotic diseases.

The dangers of this are of course being accentuated by the intensification of production systems leading to increased risks of contagion. Similarly, climate change is ramping up the spectre of the arrival of disease-bearing invertebrate vectors such as the midge Culicoides imicola and other culicoids that spread the bluetongue virus in ruminants. Vigilance, surveillance and systematic reporting is essential to combating such scourges and again your profession is at the centre of this.

Neither of course is biosecurity concern restricted only to economic considerations, there are abiding threats to our companion and work animals. Going back to my inexpert commentary on dogs, I congratulate you and your colleagues on the progress you have made with farm-dog diseases. It seems that hydatids and sheep measles are no longer anything like the threat that they were. I must say I was wondering where those terrible hydatids dosing strips had gone. But, needless to say, biosecurity threats abound. For example, I have just learned of a tick species that injects holocyclotoxin toxin into dogs that inhibits neuronal acetylcholine activity and paralyses and kills them. This to me sounds rather similar to the effects of organophosphate pesticides. Neither are we ever out of the woods with other diseases with the potential to mutate and become more virulent or infectious. The enormous biosecurity threats to our avifauna remain, be they domestic or indigenous.

One way that New Zealand has chosen to protect its biosecurity is via the development of import health standards that need to be fulfilled before material can be imported. However, while such standards are based squarely on science this is typically complex science and is again based on risk and probabilities. As a result, you will all no doubt be well acquainted with the heated debates about how what science there is should be interpreted. Related to this there have been lengthy debates around exactly how the precautionary principle should be applied and this has been fuelled by the WTO trade-drivers for free trade.

The example biosecurity threat, foot-and-mouth disease, continues to haunt as indicated by MPI’s recently completed Exercise Taurus 2012 which involved a whole-of-government biosecurity response to a simulated outbreak of foot-and-mouth disease.

Thus, animal biosecurity is undoubtedly a national imperative for New Zealand and this has been responded to by the recently-established National Biosecurity Capability Network whereby AsureQuality Ltd has been selected by MAF to build and manage a network of resources to respond to biosecurity emergencies. The system is aimed at ensuring the selection and deployment of the best capability for responding to a biosecurity emergency, thus ensuring effective and efficient biosecurity responses.

In all of this biosecurity planning, analysis and preparation, there lies a sort of irony. New Zealand is almost uniquely concerned with biosecurity but is also utterly dependent on free trade. Ninety percent of the country’s primary industry products are exported and there is constant monitoring of foreign currency exchange rates. Loss of access to markets through diplomatic mishaps, tariff barriers, non-tariff barriers and currency fluctuations alike can be catastrophic. For this reason New Zealand unswervingly supports WTO-based free trade, FTAs, regional trade initiatives etc. Yet at the same time, New Zealand must get its trading partners to adhere to easily misunderstood biosecurity compliance requirements that may be seen at the very least to be inconvenient. Excellent veterinary science and science interpretation have been essential to New Zealand leadership in the development of the necessary international biosecurity conventions. Diplomats, trade negotiators and science has worked together to provide effective advocacy resulting in things like the 16 pages of carefully-crafted prose that makes up the **Application of Sanitary and Phytosanitary Measures (known as SPS) negotiated during the Uruguay Round of the General Agreement on Tariffs and Trade** and **signed in early 1995**.

The threat posed by possible zoonotic diseases is ominous and once again the veterinary community has an incontrovertible role to play. Certainly, there is a fear that more-and-more diseases are coming ‘out of the bush’ as the bush is cleared or as humans live more closely with their livestock. Viruses certainly seem to be jumping ship from animals to humans all over the world and it has been estimated that 70% of emerging human diseases originate in animals. These include pretty horrifying diseases such as the Hendra virus in Australia, SARS (from civets in China), Ebola fever (from primates in Africa) and Nipah virus (from pigs in Malaysia). What is notable is that all of these diseases originated in bats and yet these animals are immune to the diseases. I earnestly believe...
that the CSIRO Livestock Industries administered Australian Animal Health Laboratory (AAHL) in Geelong (Victoria) is of great importance to New Zealand biosecurity and public health by intercepting, identifying and dealing with all kinds of threats from the tropical north. The value of your contribution in terms of surveillance and reporting goes without saying, as it is so utterly essential to the maintenance of this country’s vital animal-based industry. All you have to think of is BSE and foot and mouth disease and all of this becomes so obvious.

Resistence management in animal remedies and alternative approaches to veterinary science

I think that you in the veterinary profession, exactly as those in the medical profession, have obvious responsibility for avoiding or at least minimising drug resistance when dealing with recurring infectious diseases in livestock. This must include the perennial battle to maintain the efficacy of antibiotic remedies and the avoidance of much-feared resistant strains such as ‘golden staph’. Also, I believe that my friend and colleague David Leathwick, is making good progress working with the veterinary profession and the industry on how to minimise the onset of anthelmintic resistance of gut nematodes through careful stock and grazing management. In all cases, irrespective of the appearance of new generations of therapeutics, the obligation to maintain efficacy is really clear.

Related to this I think that you also have cause to disabuse a large section of the public that fervently believes that New Zealand broiler chickens are somehow ‘pumped up with antibiotics and growth hormones’. Actually, I believe that this sort of rumour partly contributes to the existence of livestock managers of various persuasions heavily steeped in the various mores of biodynamics, holism and similar. With such orientation come various ‘alternative’ veterinary remedies. I am not really in a position to comment definitively on the value of such preparations, but I would say that, as in medicine, it must be determined that they do no harm and that they exhibit proven value. I suppose there is no placebo effect in animals. Neither should such supplements displace effective remedies. Note also has to be taken of herd immunity in organic production settings. Overall, if good science-based veterinary practice criteria are ignored, there is then the danger of epidemics and damage to this country’s reputation off shore.

Veterinary communication and advice

Clearly the provision of advice, or technology transfer, is an essential role for vets. The application of their skills is hugely in the national interest. For example, there are undoubted contributions that vets and their colleagues make in whole farm health-planning thereby reducing the need for expensive and sometimes unsuccessful veterinary interventions once things have gone wrong. However, I understand that many farmers still labour under a perception that vets are a cost that, at best, has to be tolerated. I therefore applaud the work that you and your Association are doing with industry organisations to change the mindset of the farming community to make more effective use of veterinary expertise to prevent animal health and welfare issues and consequently improving livestock production and farm productivity.

Against this background, I believe that the PGP scheme is being used to good effect and is now helping to back-fill the still obvious void that was left with the sudden abolition of the Advisory Services 20 years ago.

I have no doubt that, as a community, those of you associated with veterinary science know far more about the state of animal health on the country’s farms than anyone else. Because of this, I believe that you have a major role to play in the collection of clinical data and data that may indicate emerging problems for New Zealand. I am not sure how systematic current activity is, but such information, along with clinical observation, must go a very long way in providing the evidence needed for good policy. Clearly, New Zealand vets have a central role in the pursuit of New Zealand evidence-based policy as outlined by Sir Peter Gluckman. It is such input by New Zealand vets that is so important to the trade advantage needed to accommodate the country’s small size and remoteness. As just emphasised, the key element in this must be New Zealand’s integrity and trust-worthiness as a quality food producer.

Conclusion

Undoubtedly, with the emphasis of using scientific evidence to inform policy, New Zealand’s veterinarians and their related professions have a great deal to offer. This is in terms of the collection and collation of data revealing trends around animal health, in providing the assurance around animal health and welfare, and the provision of the vigilance needed to deal expeditiously with a myriad of biosecurity threats.

Finally, I would like to thank a number of you, including colleagues from MPI for generously highlighting some of the areas I have discussed. Thank you very much for providing the opportunity to contribute to this conference.