

# Veterinarians in Mainstream Biomedical Research: A need of the hour

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## Summary

**The authors opine that in order to strengthen the need based quality research to fulfill unmet challenges; a close interaction and collaboration between veterinary and biomedical scientists are required. The authors discuss the contribution of scientists who were initially trained to be veterinarians and then went on to become accomplished biomedical scientists only to make some ground breaking discoveries that eventually helped ameliorate public and animal health. Furthermore, concerns of trained veterinarian aspiring to become contributors in basic and biomedical sciences are highlighted. The authors make the case that disconnect between researchers coming from basic sciences and veterinary sciences in an ever-expanding field of biomedical science in developing countries is not without consequences. Possible remedies to manage this long-standing problem are enlisted.**

## What triggers to make this opinion?

Arguably, veterinarians belong to a respected profession primarily because of their contribution to protect the global food supply, involvement in uplifting public health and them being the concierge of more species on earth than any other professionals. Due to changing climate and environment that could impend the ecosystem and pose unheard scale of public health challenges, a quality veterinary education must be given utmost importance. This is not to undermine the breadth of education veterinarians receive during their training. Thus, the curriculum for veterinary medicine include imparting education in subjects such as anatomy and physiology and also cover issues relating to the principles and pathobiology of developmental, metabolic, degenerative diseases, the epidemiology and zoonotic diseases and reverse zoonosis etc. More than 60% of the pathogens that infect humans have originated from animals attesting to the fact that knowledge of animals' diseases is critical for managing human disabilities and diseases.

The concept of immunization originated from animal pathogens, a Poxvirus that was known to infect cows and in rever-

ence to that the term vaccine (derived from the word *Vacca* meaning a cow in italic) was coined. Moreover, veterinarians are trained to handle, treat and give care to animals that include domesticated, feral as well as companion animals. Veterinary scientists are well equipped to contribute towards understanding the pathophysiology of diseases in experimental animals, providing compassionate care and technical help when required during the course of such investigations. If such parameters are not considered carefully, the outcome of experimental procedures may be misinterpreted and would have limited if any translational value. However, relegating the contribution of trained veterinary scientists to a mere caregiver would jeopardize the whole concept of mutual collaborations only to significantly halt the progress in biomedical sciences as is explained in the following sections.

## Veterinary Scientists in Biomedical Sciences: What can we learn from past?

Veterinary scientists have contributed immensely to our understanding of the fundamental phenomenon in biology. Although many have not found their names in the elite list of Nobel laureates, a large number of them probably missed such laurels by a whisker. Nonetheless, such scientific contributions have greatly enriched the basic knowledge pot that eventually helped someone else reap the fruit. The only Nobel laureate who is a trained veterinarian is Peter Charles Doherty who shared this prestigious feat with Rolf Zinkernagel in 1996 for the seminal discovery of MHC restriction of cytotoxic CD8+ T cells, an immunocyte that is so critical in fending off intracellular

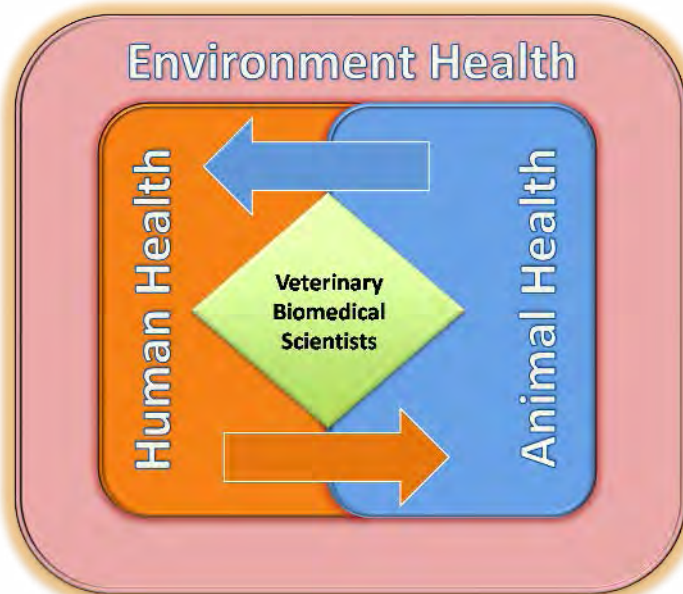
pathogens<sup>1</sup>. The efforts of many other veterinary scientists cannot be considered insignificant by any standard. Bill Hadlow a pioneer on scrapie in 1973 and his suggestion that the causative agent of Kuru, a human disease, is a scrapie-like agents<sup>2</sup>. Although the contribution of Dr Hadlow was relegated to a secondary position but the field as a whole was recognized and eventually claimed two Nobel prizes (Carlton Gajdusek in 1976 and Stanley Prusiner in 1997)<sup>3,4</sup>.

In the field of infectious biology and immunology, the contributions of veterinary scientists have been second to none. To name a few, Smith and Kilbourne's demonstration in 1893 that insects could transmit Texas Cattle fever is arguably an unparalleled contribution that paved way for deciphering the pathogenesis of innumerable infectious diseases that still pose a challenge to humanity world over<sup>5</sup>. Sir Arnold Theiler and his disciple W.O. Neitz delineated the life cycle of many protozoal and tick-borne viral diseases such as anaplasmosis<sup>6</sup>. They also developed several useful viral vaccines such as for smallpox.

The contribution of many veterinary scientists such as Peter Biggs, Graham Purchase and Richard Witter to the field of cancer biology and in developing successful vaccine against Marek's disease virus, the causative agent of neoplastic disease in chickens, has been an incredible contribution<sup>7</sup>. Dr Josh Fidler's contribution to cancer metastasis and its molecular mechanisms is unparalleled<sup>8</sup>. The

identification of first animal virus, the foot and mouth disease virus (FMDV) by Loeffler and Frosch in 1898 is a very significant discovery<sup>9</sup>. The FMDV still remains a major animal health problem that cause huge burden on national exchequer especially in developing countries such as those in Indian subcontinents. Dr Walter Plowright developed a Tissue Culture Rinderpest Virus vaccine (TCRV) against Rinderpest virus and owing to his efforts in vaccine contribution. Rinderpest remains the only disease after smallpox that has been eradicated from the face of the planet. Food and Agriculture Organization (FAO) recognized Dr Plowright's contribution for assuaging human hunger<sup>10</sup>.

Dr Daniel Salmon isolated and identified the causative agent for a debilitating disease, salmonellosis<sup>11</sup>. Dr Robin A Coomb developed an agglutination-based test for autoimmune anaemia that is named after him as Coomb's test<sup>12</sup>. The contribution of Dr Jim Schofield for discovering dicumarol a widely used anti-coagulant in medicine<sup>13</sup> and Dr Ralph Brinster in mammalian transgenesis and cloning is well recognized<sup>14</sup>. For his contribution Dr Brinster was awarded with National Science Medal in 2010.



Many other prominent veterinarians who became scientist have contributed immensely in our understanding of biological phenomena. Therefore, many unsung heroes of veterinary profession who made a mark in biomedical and veterinary research field and the development of useful remedies for diseases affecting mankind and animals, like those mentioned earlier, benefitted from a broad and balanced education. However in national scenario the role/ contribution of veterinary scientist in the advancement of biological science directly, leaves much to be desired or appreciated.

We do have some notable contributions in vaccines and cloning of animals from within India. For example, the use of in vitro fertilization (IVF) or the embryo transfer technology and somatic cell nucleus transfer (SCNT) for the first time to produce buffalo (and goat) were performed at National Dairy Research Institute (NDRI), Karnal<sup>15</sup> and some useful vaccines as well as diagnostics have been developed at Indian Veterinary Research institute, Izzatnagar<sup>16</sup>. These technologies are touted as a means of not only uplifting the livelihood of farmers by enhancing animal productivity but also for having a translational value to biomedical and veterinary sciences as a whole and can be applied to correct genetic disorders as well as production of disease resistant animals.

In spite of all these mixed evaluations we are of the opinion that in countries like India where resources are limited, a major emphasis should be on setting our priorities right and tackling them head on. Concerted and collaborative efforts of both veterinary and biomedical scientists could immensely help achieve these goals.

## A shifting outlook of veterinarians towards biological research

In past few decades particularly in national context things have changed for good primarily due to not so scintillating scientific environment in rest of the world. This has well placed India as a nation to take advantage of such a global scenario as many of the best and brightest scientists trained in world renowned laboratories are choosing to come home to start their scientific careers. However, a myopic vision at this stage would be counterproductive. We advocate that many of these global transformations can be effectively exploited locally provided we set our priorities right and create conducive environment not only for basic research and education but also for translation research. This requires building bridges and initiating concerted efforts to make optimal use of the uniquely placed lot of veterinary research scientists. Current scenario in most veterinary institutions represents fewer faculty members than in previous times who can describe themselves as principally involved in research (i.e. committing 80% or more of their time). Although available external funds have increased in biomedical research and veterinary sciences in a segregated manner but efforts in promoting collaborative programs that involve basic biological scientists as well as veterinary scientists are lacking. Consequently, the share of national funds, particularly for biomedical research, awarded to scientists at veterinary schools and veterinarians employed in basic science and research institutes is limited. Adding to this bleak scenario are the cutbacks and sequestrations of budget in such programs along with decision makers

who in most instances only know how to disagree about most matters.

Some other challenges are perhaps equally if not more alarming and are as follows. The underlying philosophy of most veterinary schools is now heavily orientated to clinical practice, especially companion animal health, rather than food animals. Few clinicians even bother or have the time to do research and even fewer who are inclined to take up problems at the interface of veterinary and biomedical sciences. In addition, the research preferences on “animal models” rather than on animals are given too much priority. This is anybody’s guess how many studies performed on animal models eventually are relevant to animals and humans who do not have the luxury to live in segregated clean environments<sup>17</sup>. This is for the same reason most vaccines and therapies perform much better in developed world as compared to those in developing countries like India. Of course there are some exceptions here too. Using Arabian foals rather than SCID mice to study human immunodeficiency disease, makes for a hard sell as does using equine, feline and bovine retroviral diseases to model HIV<sup>17</sup>. This is not always for reasons of superiority of the well-beloved mouse, it is because we have missed the boat and failed to develop reagents, tools and further well-established and relevant disease models in companion animals and/or livestock.

One needs to ask a question, are we to cure “models” or real animals and humans, can we be contented with the phrase “cured-in mice/models” or ever bother to extend those investigations in relevant population. Impact factor rather than impact of research paper is given way too much leverage. Following a bandwagon without critically thinking the impact has become trendy. To make things worse if someone musters courage to work on such issues, the reviewers,

members of the task force and not to forget animal ethics groups would have all their guns blazing at the proposer. This scenario needs to be looked at seriously should our aim is to do something real and meaningful that has intrinsic value as well as extrinsic rewards.

Another troubling development has been the emergence of “**for profit**” colleges that focus on teaching and deemphasize the intellectual inquisitiveness of a university experience. The model has appeal to state/national governments since the “for profit” schools request no support. The replacement of live faculty with videos of star performers at more famous institutions delivering their lectures and demonstrating their expert technology would hardly provide desirable outcomes. We have to be aware of the fact that knowledge is not static and we need to excite our trainees to retain a thirst for new knowledge and better ways of executing their chosen profession. In so doing they need to know how to resolve controversies and realize that new information gathered from the internet may neither be correct nor superior. In our opinion persons involved in research are those most likely to foster a continual thirst for knowledge and understanding mentality.

Veterinary students have fewer role models in research to emulate, which we believe would negatively impact on the quality of education. We believe that a veterinary education needs to retain and extend research since this helps maintain the necessary intellectualism that our practicing colleagues require. Ideally, our trainees should be ambassadors of science and dispellers of medical myths (such as vaccines cause autism, alternative medicine is better than medicine and because we have failed to deliver on many promises these are high times to look for alternatives). Let's face it, where we have not made

extraordinary progress, problems are more complex than envisaged at the outset. Some examples include chronic infections, emerging acute but devastating infections of various kinds, degenerative and neurological diseases and cancers of various kinds etc. This further attests to the fact that our training in veterinary medical science can be a superb preparation for individuals to excel in all areas of biomedicine and related activities. Nevertheless changes are needed if the research veterinarian is not to become a dodo and our students both in veterinary and biomedical institutions receive an unbalanced education.

## Remedial measures to reverse the trend

In past many veterinarians have made their presence felt in various disciplines of biomedical sciences particularly in a global scenario but we are presented with a different situation now. The negative trend, wherein trained veterinarians are opting out of biomedical sciences or are trying to find a niche in a secluded environment that comprises of veterinary colleges and schools as well as veterinary research institutes may not abode well for the research community as a whole. This would create hindrance in effectively improving the quality of both human and animal health. We may feel contented currently realizing that to some extent these two communities of scientists are being brought together thanks to the efforts of policy makers and executors probably with fixed ulterior motives. But this has to be a work in progress for prolonged period as has been the trend in western world until recently. However, if the concerns of this uniquely placed limited lot are not handled appropriately, the situation may be worse in long run because of the migration and adoption of forced options to consider science as

a secondary profession. Following measures may be relevant.

### A. Vanquishing the PhD program for trained veterinarians

Probably this is one of the most important issues that needs to be given due consideration and therefore we dwell on it in some length. Upon completion of a curriculum diligently (probably a little refined one), that consists of 5 or more years, hardly there is any need for those aspiring to become scientists to get into masters and Ph.D programs. This is unnecessary for a trained veterinarian already saturated with scientific phenomenology, medicine and some philosophy. Most students already know how to read and to seek the council of persons who know more than them. They just do not need a second doctorate and should be content with only one, like the majority of their MBBS or MD cousins. As for the combined veterinary graduation with PhD: not appealing at all and would cause no more than a state of fatigue that repels any idea of doing more research training and suppresses latent creativity. Yet more training is needed to provide the necessary survival skills and network of contacts to launch a continuously funded independent research program as a new faculty member.

We should encourage our newly minted Vets and probably MBBS with an interest in research to forgo the PhD and enter directly into a postdoctoral situation in renowned national laboratories or those in the western world that does cutting edge productive research on a subject that interests them. This could be at a medical research institute or in an institute where heavy hitters in science are willing to nurture their scientific curiosity and creativity. If for no other reason, being part of a successful research environment will heighten a person's enthusiasm to continue as a research scientist. What one needs to

master in today's competitive world of research is the use of contemporary technology applied to accessible and meaningful problems. This should result in publications in reputable journals likely to be read by members of a panel that reviews research proposals.

Along the way, one needs the opportunity to meet and network with a wide range of researchers who may be able to help start and maintain one's career in the future. However where undertaking a higher degree or a PhD for a veterinarian (or physicians) could be a good idea, it is for those who are planning to change their careers after a long stint in practice or clinicians in an academic environment. They may need to relearn how to learn in earnest. Moreover, returnees may have little to offer to a productive research laboratory if they request to become a postdoctoral fellow. Specific programs to cater to financial liabilities of those willing to make a transition in biomedical research in their postdoctoral pursuit must be initiated by councils and agencies at national level to support such endeavors. With all necessary wherewithal available to these agencies, we think this exercise is entirely doable. However an open mindedness is required here too.

## **B. Other concerns of veterinary professionals for opting a career in mainstream research and possible remedial measures:**

Coming back to specific, the veterinarians invest considerable time and energy in acquiring skills that no other biomedical scientist has and therefore the compensatory measures should be in place. In authors' opinion following remedial measures could be taken to bridge the gap between two communities.

► Setting maximum age limit criteria for including (or excluding) rarely placed lot of scientists, therefore appropriate relaxation in the age limit

should be provided. This is because of the obvious reasons that these trained professionals invest more time in their basic training owing to the length and breadth of curriculum and thus end up prolonging the initiation of their research career as independent investigators.

► The contribution of contemporary scientist in veterinary or biomedical institute is valued and appreciated by providing needed perks and allowances in some governmental institutions, a uniform policy should be put into place so that there exist no discrepancy between different systems. This would provide a fair atmosphere and reduce the intermigration of these scientists from one place to the other which in national scenario could lead to only delay and abandonment of initiated research programs.

► Those professionals who are employed in animal facilities or clinics in academic or research institutes may be encouraged to initiate collaboration with basic scientist and carry out their independent projects provided their primary responsibilities are not compromised. The institute/s should treat them at par with other faculty or staff in terms of a human resource and a scientific contributor. This initiative would clearly have positive impact on promoting and addressing the unresolved scientific questions.

► The courses that are at the interface of basic, biomedical and veterinary sciences need to be offered to students in initial years of their academic pursuit. This would only give a broader perspective to future researchers to embark upon the ideas or questions that need resolve to improve human and animal health. The best personnel to offer such courses are the trained veterinarians and the medical professionals who therefore should be engaged in meaningful ways.

## **Administrators and lawmakers need to have vision**

Our administrators within veterinary colleges, the university administration, other academic institutions and funding agencies need to be convinced that retaining and even boosting support for research by both basic scientists and veterinary as well as biomedical scientists is a viable concept and needs to be promoted. That research has value and merits a larger place in the veterinary and biomedical programs than it enjoys at present needs to be realized. Rather than following "do-it all-together", administration needs to help identify current or potential strengths and build on this base. New areas could be added as and when a need is realized. When this is done, new research professionals should be those who give a strong indication of future potential. Such professionals need substantial help up-front such as start-up funds and relief from other demanding activities.

Pedagogical value is another and perhaps the most important attribute researchers bring to the discussion. Veterinarians need to be perpetual students when it comes to understanding how the body works and can be repaired when it goes amiss. Experts familiar with the moving edge of science, medicine and agriculture should be able to convey the excitement of discovery and interpret the information more accurately than busy generalists. Recruitment needs to be fastidious, attracting only individuals with an excellent track record and likely to flourish. Putting staff and trainees in different boxes based on their backgrounds would do injustice to all and hence an embracing attitude would be more rewarding. Trainees should be given ample opportunity to see if the research life is really for

them. Having some short programs such as summer or winter programs would be valuable to provide students with exposure to active research programs. Such programs have to be well administered and accountable since there is a tendency for students to be attracted to programs that may sound appealing, but have no track record of research productivity and publications. Nothing is more seductive to an open-minded student pondering a research career than achieving some success and seeing their name in print. Successful contemporary research usually requires an environment that includes others with similar or complementing interests with whom the researcher can interact. A laxity in active research programs would do more harm than help. The situation is compounded when the research infrastructure is in decay, as is happening in many institutions. Therefore, research faculty need to be encouraged to network extensively and proactively, attend meetings and to take sabbatical leaves, especially when their current research activity is beginning to dwindle.

## Conclusions

A quality veterinary education should be considered as a wonderful asset. Veterinary graduates should be provided with a broad knowledge base that ensure them navigate through and live interdisciplinary concepts in many health-related, agricultural and environmental fields. Quality researcher as faculty who can emphasize the discovery aspects of our education to go along with didactic skills needed for the practice of the profession need to be retained and supported so that they provide an intellectually challenging environment to trainees in their area of interest. Being exposed to research-oriented faculty at all phases of their education is likely to foster a flexible mindset, wooing some into research, and providing all with the open-mindedness and self-confidence to tackle and solve problems in a changing and challenging world.

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