

Petition to THE AMERICAN BOARD OF VETERINARY SPECIALTIES
For PROVISIONAL RECOGNITION
Of a RECOGNIZED VETERINARY SPECIALITY
In VETERINARY BOTANICAL MEDICINE
Under the
AMERICAN COLLEGE OF VETERINARY BOTANICAL MEDICINE (ACVBM)



This document is submitted to petition the American Board of veterinary Specialties (AVBS) and the American Veterinary Medical Association (AVMA) for provisional recognition of Veterinary Botanical Medicine as a Registered Veterinary Speciality (RVS) under the auspices of the American College of Veterinary Botanical Medicine (ACVBM), a Recognized Veterinary Speciality Organization (RVSO).

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The ACVBM was formally established in 2014 following an inaugural meeting regarding its development in 2004 with a sub-committee of the Veterinary Botanical Medicine Association. The Veterinary Botanical Medicine Association has been providing an annual examination and process for industry recognition of veterinary botanical knowledge and skills since 2003. The exam is independent, as VBMA does not offer their own courses or course content. The ACVBM has been incorporated under the laws of the state of Delaware as a non-profit organization. See appendix 1(BYLAWS). The College will serve the international veterinary community and veterinarians from all countries will be invited to apply for board certification through the American College of Veterinary Botanical Medicine.

The American College of Veterinary Botanical Medicine was officially formed to meet the demands of veterinarians practicing and advising on the use of botanical medicine. It reflects the growing public demand for botanical options, increasing use by pet food companies incorporating botanicals, increasing availability of botanicals for animal use, significant research and use by the production animal industries (aquaculture, dairy, swine and poultry) and increasing use and teaching of students by university veterinary colleges faculties. Within the various special interest groups there is also an internal recognition of individual veterinarians having expertise providing teaching, referral services and consultations to other veterinarians. The growth in veterinary interest reflected by the presence of veterinary botanical medicine lectures at most major veterinary conferences and veterinary colleges represents an opportune time to take the ACVBM to the AVBS for consideration.

Our Vision

The American College of Veterinary Botanical Medicine will provide a means to reach diplomate status through maintaining a standard base of post-graduate instruction and examination, offer educational opportunities designed to advance experience and proficiency, and enhance the integration of scientific, clinical, and traditional knowledge into veterinary medicine practice for the greater benefit of the health and well-being of animals.

Our Mission

The mission of the American College of Veterinary Botanical Medicine is to advance the specialty area of veterinary botanical medicine and to increase the proficiency and competence of veterinarians in the use of medicinal plants. It will do this by establishing requirements for certification, promoting professional education (both undergraduate and postgraduate), promoting research and disseminating new knowledge and providing support to the profession.

Statement of Objectives of ACVBM

The ACVBM shall promote the advancement of veterinary practice by identifying to professionals and the public those veterinarians who have voluntarily sought and obtained certification in Veterinary Botanical Medicine.

To accomplish such purposes the ACVBM shall be operated:

- 1) To establish and maintain credentialing, certification and ethical standards for veterinary practitioners who excel in botanical medicine and who shall be titled Diplomates.
- 2) To identify, develop, provide and maintain professional botanical programs, to include but not limited to phytochemistry, phytopharmacology, pharmacognosy, ethnopharmacology, and ethnoveterinary medicine.

- 3) To examine and certify veterinarians as specialists in veterinary botanical medicine and facilitate the continued professional development of the Members of the College through development and administration of continuing education programs
- 4) To promote the improvement of professional practice standards, scientific inquiry and research into the safe and effective use of botanical medicines for prevention, treatment and control of animal diseases to promote a high quality of life for companion animals and to enhance the wellbeing and productivity of livestock and other production animals.
- 5) To collaborate with veterinary colleges and other educational institutions that relate to veterinary medicine to encourage and promote the development of graduate veterinary botanical medicine programs, especially in regard to residency training for clinical practice.
- 6) To identify Diplomates to the public, professionals, other professional organizations and government agencies and other appropriate individuals and bodies.

Distinct and Identifiable Speciality of Veterinary Medicine

Veterinary botanical medicine is a distinct discipline that differs in substance, methodology and philosophy from conventional veterinary medicine.

SUBSTANCE- Botanical Medicines

- While many conventional drugs are derived from plants, a veterinarian who prescribes botanical medicine is using whole herbs in preference to isolated active constituents. The whole herb or extracted herb is complex, containing hundreds of constituents that have complex actions. Archetypal plant constituents (alkaloids, terpenoids and the phenylpropanoid and allied phenolic compounds and their derivatives)¹ that make up the vast majority of pharmacological properties of plants generally come from secondary metabolites (phytochemicals) as opposed to primary metabolites (vitamins, minerals, lipids, proteins and carbohydrates). These secondary metabolites influence and are influenced by ecological interactions between the plant and its environment such as defence, signalling and other chemicals that protect from ultraviolet light, oxidation and other physical stressors. Veterinary herbalists are aware of differences in plant chemistry that may result from the plant's origins.
- Botanical medicine looks at pharmacognosy, not from the perspective of single molecule phytochemical discovery for the development of new drug leads, but rather to validate or understand traditional medicine and how the herbs work. There are essentially two large groups of secondary plant metabolites in terms of their biological/ therapeutic activity²:
 - A smaller group of highly active compounds possessing a high selectivity for cellular targets- these represent only a minority of those commonly used because of potential toxicity. These types of actives are sought after in natural products research as prime candidates for new drug discovery. Many of these are glycosides.
 - A larger group of moderately or weakly acting compounds that interact with a broad range of cellular targets (aka molecular promiscuity). Approximately 90% of all thoroughly described medicinal plants contain broad spectrum phytochemicals with weak or moderate bioactivity.

¹ Croteau R, Kutchan TM, Lewis NG. Natural products (secondary metabolites). In Buchanan BB, Grissem W, Jones RL, eds. Biochemistry and Molecular Biology of Plants USA. American Society of Plant Physiologists 2000.

² Efferth T, Koch E. Chemical interactions between phytochemicals. The multitarget therapeutic concept of phytotherapy. *Curr Drug Targets* 2011; 12(1) 122-132

- That the whole plant is more therapeutic than a constituent is a fundamental principle of botanical medicine supported by research. An example is where three of the major curcuminoids from turmeric (*Curcuma longa*) were investigated for their *in vitro* activity against *Toxocara canis*. Each of the curcuminoids was ineffective on its own, but when used in any combination, two or three of them together was active. The combination of all three demonstrated the highest activity³.
- Veterinary herbalists utilize botanical medicine for many complex conditions where polyvalency and polypharmacy of herbs are used as a botanical strategy. Results of a review revealed that the multi-constituent nature of medicinal herbs makes them particularly suitable for treating complex diseases and offers great potential for exhibiting synergistic actions. The mechanisms underlying synergistic therapeutic actions of herb medicines are: (1) different agents may regulate either the same or different target in various pathways, and therefore cooperate in an agonistic, synergistic way; (2) regulate the enzymes and transporters that are involved in hepatic and intestinal metabolism to improve oral bioavailability; (3) overcome the drug resistance mechanisms of microbial and cancer cells; and (4) eliminate the adverse effects and enhance pharmacological potency of agents by "processing" or by drug-drug interaction⁴.
- Polyvalence is different from synergy and can be defined as a range of biological activities that an extract may exhibit which contribute to the effect observed clinically or *in vivo*⁵. It can occur at three levels:
 - Several types of phytochemicals are present and each exerts a different biological effect
 - Phytochemicals of one chemical type are present that have more than one biological effect relevant to treating disease and or improving the health of the patient
 - Phytochemicals are present that do not affect the cause or the signs of disease but modify the side effects, absorption, distribution, metabolism or excretion of active constituents.
- The form of the herbal medicine also affects bioavailability. Infusions and decoctions extract largely water soluble compounds from plants. Adding saponin-containing herbs to the mix may increase solubility of compounds that may then have better bioavailability. Practitioners need to know what archetypal constituents they are targeting for therapy, to decide the best medicinal form. For example polysaccharides and mucilages are best extracted in aqueous decoctions and infusions rather than in alcohol. Herbs interact with the gut microbiome and interaction studies provide novel mechanistic understandings of the traditional herbs that exhibit poor oral bioavailability⁶. Knowledge of the factors influencing bioavailability is important for more effective use of botanical medicines.

METHODOLOGY- the Practice

- The ACVBM differentiates themselves by interest in the rich knowledge base of traditional botanical medicine use and ethnobotany combined with modern scientific, chemical, toxicological, pharmacological clinical application and research in a practice that could be

³ Kiuchi F, Goto Y, Sugimoto N et al Nematocidal activity of turmeric: synergistic activity action of curcuminoids: Chem Pharm Bull 1993; 41 (9) 1640-1643

⁴ Yang Y¹, Zhang Z², Li S², et al Synergy effects of herb extracts: pharmacokinetics and pharmacodynamic basis. Fitoterapia. 2014 Jan;92:133-47.

⁵ Houghton P Synergy and polyvalence- paradigms to explain the activity of herbal products In: Houghton P, Mukherjee PK eds Evaluation of Herbal Medicinal Products. Perspectives on Quality, Safety and Efficacy 1st Ed London: Pharmaceutical Press 2009

⁶ Feng Chen n, QiWen,JunJiang,Hai-LongLi,Yin-FengTan,Yong-HuiLi,Nian-KaiZeng Could the gut microbiota reconcile the oral bioavailability conundrum of traditional herbs? Journal ofEthnopharmacology179(2016)253–264

appropriately termed rationale phytotherapy to distinguish from colleagues who may only embrace traditional findings or who may eschew scientific findings.

- The term ‘rational phytotherapy’ has come into use over the last two decades- this is an evidence-based system that encourages *in vitro* and *in vivo* studies to explain mechanisms of action, pathophysiology, pharmacokinetics and bioavailability as well as efficacy of botanical medicines.

This is the application of plant based medicine (supported by science and/or traditional use) to conventional diagnosis, multiple diagnoses and complex cases and to address individual signs and problem lists; or for prevention of disease by protecting organ health and /or optimizing animal health through actions not available with conventional drugs. An example is the use of *Sylibum marianum* as a hepato-protective herb and the source of silibin⁷. Another is *Coriolus versicolor* as a source of immune regulating polysaccharides to potentially improve quality of life in canine patients with hemangiosarcoma⁸;

- Veterinarians using botanical medicine have a patient centered approach, whereby the botanical medicines are selected based on the individual signs and pathophysiology as well as the diagnosis. So that two dogs with diabetes for example, may be treated with two different sets of botanical medicines. Each of the herbs in the formulas may have a phytochemical activity basis, but distinctions in their properties and the overall pattern of the patient (for example an obese patient versus a cachexic patient- a patient with low grade pancreatitis, another without) will be different. Insulin would of course be the mainstay of therapy.
- Safety is paramount. Resources for the safe clinical use of plant extracts do not exist in the field of veterinary pharmacology. Understanding the key safety issues and demonstrating the safe use of herbal therapy is a challenge for the ACVBM. A key issue is that safety cannot be considered in isolation of efficacy and risks must be weighed against benefits for each particular clinical situation, just as with the use of conventional drugs. Therapy is justified only if the benefits outweigh the potential risks in an informed risk benefit analysis. This decision is based on clinical knowledge of the patient’s condition, comorbidities, previous or concurrent treatment, the pathophysiology of the disease, and knowledge of the herbs (phytochemistry, actions, indications, contraindications, dose and herb form) pertinent to the treatment goals.
- Sources of information include:
 - Traditional use. The bewildering variety of ethnoveterinary practices, ethnobotanical uses and folk practices around the world coupled with confounding aspects of cultural, placebo and other non-specific effects make reliable conclusions from any one tradition difficult. Frequently however, traditional use informs research and pharmacological activity is often found to be closely correlated⁹. There are recurring themes in traditional medicine and persistent therapeutic approaches consistent with the use of “archetypal” chemical groups within plants.
 - Collective clinical experience over decades. There is also the clinical experience of veterinary practitioners to consider- thousands of educated veterinary practitioners worldwide prescribe herbal medicines in their work. This has advantages of being in a modern veterinary context. Veterinary practitioners of botanical medicine have written texts and taught other veterinarians to achieve repeatable results within the botanical framework.

⁷ Webster CR, Cooper J. Therapeutic use of cytoprotective agents in canine and feline hepatobiliary disease. Vet Clin North Am Small Anim Pract. 2009 May;39(3):631-52.

⁸ Brown DC, Reetz J. Single agent polysaccharopeptide delays metastases and improves survival in naturally occurring hemangiosarcoma. Evid Based Complement Altern Med Vol 2012, Article ID 384301 8pages

⁹ Gertsch J Botanical drugs, synergy and network pharmacology; forth and back to intelligent mixtures Planta Med 2011; 77(11) 1086-1098

- The third data source is substantial and scientifically sound but maybe not as clinically relevant to veterinary botanical medicine. The available published literature on phytochemistry and preclinical pharmacology (that frequently involve animal models exploiting mice, rats, rabbits and less so cats and dogs) of plant extracts is prolific. There are peer-reviewed journals devoted to the subject. Researchers have no doubt that nature is still the preeminent synthetic chemist and that in plants there are infinite reserves of fascinating constituents with actual and potential effects on health and disease. As such information accumulates it is often easier to better understand traditional uses of plants. They do not however provide confirmation of a clinical effect; experience in practice is that the effect of the whole plant is rarely predicated on the effects of its parts. However such studies help to provide a rationale for the mechanisms of action of a herb.
- There are few well conducted placebo controlled double blind clinical trials on the effects of herbs in veterinary medicine. These are expensive to conduct and present methodological and logistical challenges. However, the evidence is accumulating in human medicine and rising in veterinary medicine.
- No single source can absolutely confirm that herbs are a rational treatment strategy. Therefore, it is appreciated that herbs have been dismissed by many in the profession as the refuge of the uncritical. However, when all the sources of information come together and are integrated with pharmacological insights, something important happens; unique treatment strategies for treating notoriously difficult clinical problems become possible and the desire of the ACVBM is for animals to benefit from the efforts of this group to further develop the field.
- To be a fully effective therapy, it is not enough simply to know about the herbs themselves. Information must also be sought about how and when to use these herbs in response to various therapeutic challenges. Therapeutic approaches are different from those that underpin conventional medicine.
- Practitioners employ a range of strategies depending on the therapeutic goals established for the individual patient, which take into account the diagnosis, pathophysiology, physiology and priorities. The multitarget activities of many herbs can explain the medical application of complex extracts from medicinal plants for health disorders that involve several targets¹⁰. Such as:
 - Promote antioxidation and reduce oxidative stress
 - Increase blood flow to particular tissues and organs
 - Target anti-inflammatory effects to particular tissues
 - Resolve chronic inflammation
 - Halt and prevent degeneration through targeted increases in blood flow
 - Mitigate fibrosis
 - Normalize smooth muscle contraction
 - Provide immune modulation, where immunity is strengthened while destructive inflammatory responses are subdued
 - Provide antimicrobial effects with unlimited distribution and minimal resistance
 - Promote cellular differentiation and control of angiogenesis to induce tumor atrophy
- The treatment framework is derived from a similar process to conventional medicine. The difference is once therapeutic goals have been determined, herbs or combinations of herbs (formulas) are prescribed on the basis of their phytochemistry and actions required to achieve

¹⁰ Wink M Modes of Action of Herbal Medicines and Plant Secondary Metabolites Medicines (Basel) 2015 Sep 8:2(3) 251-286

those goals. Polypharmacy, polyvalency is embraced as a key difference, based on phytotherapeutic principles- such as herb compatibilities (for example herbs high in tannins cannot be mixed successfully with herbs high in alkaloids as they will precipitate), and knowing the tissue targets and research supporting particular herb use. The botanical medicine is prescribed with consideration of form, route of administration, dose, duration and the patient is monitored carefully.

PHILOSOPHY –The perspective on herbs, health and disease

- The universal role of plants in the treatment of disease is exemplified by their use in all the major systems of traditional medicine and ethnomedicine irrespective of their underlying philosophical premise.
- The practitioner of botanical medicine regards the whole formula or whole extract as the “active” component” in the therapeutic context.
- The concept of polyvalent or multifaceted activity of the medicine is central to botanical medicine - in the context of the advantage of chemical complexity -and even a single herbal extract is a natural multi agent medicine that can simultaneously target a range of desirable pharmacological effects.
- The veterinary botanical practitioner prefers not just to prescribe chemically complex herbs, but often administers them in complex formulations, compared to conventional medicine preferring to prescribe a single drug. The practitioner chooses herbs or formulas for a cooperative or facilitating effect between the components to address therapeutic goals.
- Philosophically the veterinary botanical medicine practitioner practices conventional medicine but overlays that practice with the use of botanical medicines in a framework of botanical principles to expand their options for treatment of disease and optimizing health.
- Practitioners appreciate traditional knowledge as just one potential source of information, when coupled with published research and clinical experience, herbs can be prescribed safely and effectively.

Scientific Basis of Proposed Specialty

The World Health Organisation has acknowledged that a form of herbal medicine is practiced in every culture and every country in the world. The 2014-2023 WHO traditional medicine strategy aims to support proactive policies and implementing action plans that strengthen the role traditional medicine plays in keeping populations healthy. The USA collaborates on this strategy providing advice and supporting the strategy¹¹. We recognise the medicinal benefits of plants at a global level. With pressures on antibiotics and disease challenges we expect in years to come, it is even more imperative to embrace the concept of phytotherapy and further develop its science for the benefit of both human and veterinary medicine.

The ACVBM acknowledges the concerns regarding the scientific basis of veterinary botanical medicine. Where there are published scientific and clinical data supporting the overall safety and benefits of many plant medicines, the research might be dismissed as having methodological bias thus being of inferior quality to trials conducted on conventional drugs. A recent quantitative assessment of the reporting of herbal medicine research outlined suggestions for improvements recognising publication bias and

¹¹ WHO Collaborating Centre for Traditional Medicine University of Illinois at Chicago

incomplete reporting of outcomes¹². However to be fair, this is also the case for clinical trials generally, for example in dogs and cats a review of 97 clinical trials uncovered a need for more high-quality studies¹³. And more recently a cross sectional study of veterinary randomised controlled trials of pharmaceutical interventions funded by different sources was examined and it was found that a failure to report primary outcomes, justify sample sizes and the reporting of multiple outcome measures was a common feature in all of the clinical trials (126). The authors suggested that findings may be affected by the source of the funding and that some RCT's provide a weak evidence base and targeted strategies are needed to improve the quality of veterinary RTCs to ensure there is reliable evidence on which to base clinical decisions¹⁴.

Therefore, given the exponential rise in new botanical data, the need to be able to critically evaluate and discriminate the relevance and application of scientific information is more important than ever. We recognise it is equally important to acknowledge that just because a herb has a long traditional use this does not mean there isn't a need for research into new applications and safety issues, particularly in regard to potential interactions with drugs.

'Evidence-based medicine', EBM refers to the conscientious, explicit and judicious use of current best evidence from research for the care of an individual patient. It is suggested that EBM helps veterinarians to make more informed decisions, but it also recognises obstacles to the implementation of EBM such as a lack of high quality patient-centred research, the need for basic understanding of clinical epidemiology by veterinarians, the absence of adequate searching techniques and accessibility to scientific data bases and the inadequacy of EBM tools that can be applied to the busy daily practise of veterinarians¹⁵. EBM is about knowing the evidence behind a therapy, whether it is good evidence or not, and about what data exists in order to make the right decision. By increasing awareness, the ACVBM will help the profession as a whole practice botanical EBM.

Evidence based medicine however includes not just research, but also incorporates the needs and biases of the client and patient; and the clinical experience of the practitioner; in veterinary botanical medicine this last item has been developed without official support from the veterinary profession and its regulatory bodies, yet is essential to safe and effective practice. Novel therapies are recognised as both necessary to the interests of the individual animals and in the advancement of veterinary science, provided the welfare of the patient is safeguarded and there is fully informed consent from the owner¹⁶. Such practice has been fostered through the publishing of clinical textbooks, hosting of conferences, conducting of research and formation of residencies as well as shared communication channels online and case reports and case series in informal veterinary journals. Formation of the ACVBM acknowledges the professional conduct of veterinary botanical medicine specialists to date, providing a forum where they can come together to share their findings and expertise to other receptive members.

¹² Naumann K¹. A Quantitative Assessment of the Reporting Quality of Herbal Medicine Research: The Road to Improvement. *J Altern Complement Med*. 2017 Sep 15.

¹³ Brown DC¹. Control of selection bias in parallel-group controlled clinical trials in dogs and cats: 97 trials (2000-2005). *J Am Vet Med Assoc*. 2006 Sep 15;229(6):990-3.

¹⁴ Wareham KJ¹, Hyde RM¹, Grindlay D², Brennan ML¹, Dean RS³. Sample size and number of outcome measures of veterinary randomised controlled trials of pharmaceutical interventions funded by different sources, a cross-sectional study. *BMC Vet Res*. 2017 Oct 4;13(1):295.

¹⁵ Vandeweerd JM¹, Kirschvink N, Clegg P, et al Is evidence-based medicine so evident in veterinary research and practice? History, obstacles and perspectives. *Vet J*. 2012 Jan;191(1):28-34.

¹⁶ Yeates J¹, Everitt S, Innes JF, Day MJ Ethical and evidential considerations on the use of novel therapies in veterinary practice. *J Small Anim Pract*. 2013 Mar;54(3):119-23

There is a vast basis of scientific data to support this specialty. The scientific basis of veterinary botanical medicine includes, but is not limited to,

- The pharmacological basis of herbal medicines
 - The practice of botanical medicine incorporates complex substances, some of which are well understood in pharmacologic terms, and some that are more nutritional in action. Botanical medicine focuses on preserving the multimodal character of herbal therapies, resulting in more broad-based clinical benefits. It is the belief of veterinary herbalists that this approach offers benefits that are clearly distinct from the use of single compounds such as the focus from Clinical Pharmacology, or the focus on single nutrients as is studied by the College of Nutrition. While the clinical effects of polypharmacy and drug-nutrient interactions are still poorly understood, the use of herbal therapies with recognized clinical actions provides a better starting point for clinical research.
 - There are over 143000 published journal articles on plant extracts of which there are over 7000 Systematic Reviews or reviews. An example of the extensive work done in one relevant area of animal agriculture can be found in a 2016 review entitled *Herbal Remedies for Coccidiosis Control: A Review of Plants, Compounds, and Anticoccidial Actions.*". This paper details recent advances in the use of anticoccidial phytoextracts and phytocompounds in poultry and the review covers 32 plants and 40 phytocompounds, their biologic actions, mechanisms and prophylactic/therapeutic potential of the compounds¹⁷. Another example can be found in a 2015 review of the possible pharmacologic basis for the action of herbal medicines in the treatment of epilepsy, which indicates that hundreds of plants have been screened for anti-convulsant activity, with dozens of compounds exhibiting anticonvulsant activity equivalent to that of anticonvulsant drugs. These actions have been well characterized at the receptor level. In addition many complex extracts and single plant-derived compounds exhibit antiinflammatory, neuroprotective, and cognition-enhancing activities that may be beneficial in the treatment of epilepsy¹⁸.
Veterinarians need to be aware of herb drug interactions and safety of herbs supported by published literature, including toxicology
- Manufacture, quality control and regulatory aspects of botanical medicines, standardization of products via the United States Pharmacopeia (USP) and National Formulary (NF) guarantees that the active constituent found in a botanical medicine remains at uniform concentration from batch to batch.
- Pharmacognosy
 - The use of medicinal plants in drug discovery is highly emphasized (based on their traditional and safe uses in different folk and traditional medicine systems)¹⁹. Each plant medicine has multiple constituents, each constituent can bind to different targets; this branch of herbal medicine is the systematic science of morphological, chemical, and biological properties along with the history, cultivation, collection, extraction, isolation, bioassaying, quality control and preparation of crude drugs of natural origin. While approximately 25% of the prescription drugs dispensed in the USA contain at least one

¹⁷ Muthamilselvan T, Kuo TF, Wu YC, Yang WC Herbal Remedies for Coccidiosis Control: A Review of Plants, Compounds, and Anticoccidial Actions. Evid Based Complement Alternat Med. 2016;2016:2657981

¹⁸ Sucher N, Carles M A pharmacological basis of herbal mediicnes for epilepsy Epilepsy Behav 2015 Nov 52(PtB) 308-18

¹⁹ Tewari D, Mocan A, {aranov E etal Ethnopharmacological Approaches for Therapy of Jaundice Part 1 Front Pharmacol 2017 Aug 15;8:518

active ingredient of plant origin²⁰ veterinary herbalists do not generally use single active constituents they use whole herbs; empirical herbal medicine use in veterinary medicine has led to research which can produce new treatments including herbal formulas for common conditions such as atopy²¹.

- Zoopharmacognosy
 - Veterinary herbalists must be aware of the traditional uses of plant medicines as these uses are in the public domain and remain the basis for use. In addition, there is clear evidence of “medicine-seeking” by animals in the wild (zoopharmacognosy), that may assist veterinarians who treat wild animals.
- Ethnobotanical and Ethnoveterinary medicine
 - Principles of botanical medicine respect tradition as a source of empirical evidence that informs formal research design. The study of traditional use of plants within a culture is termed ethnobotany, and the study of traditional medicines is known as ethnomedicine, or ethnoveterinary medicine. Research may validate traditional uses. An example of a traditional principle is that of synergy- combining herbs into formulas rather than using single herbs to achieve better patient outcomes²². A recent 2016 Review²³ titled *Favorable results from the use of herbal and plant products in inflammatory bowel disease: evidence from experimental animal studies* stated that in the majority of studies herbal therapy reduced the inflammatory activity of experimental colitis and diminished the levels of many inflammatory indices, including serum cytokines and indices of oxidative stress. The herbs examined in the studies were ones derived from ethnomedical use in humans but applied to animal models where mechanisms of action could be understood.
- Detailed knowledge of plant medicines
 - Veterinary herbalists are skilled in plant taxonomy and identification. This skill is unique to herbalists and important to ensure that the correct species of plant is used in herbal products.
 - Veterinary herbalists have in-depth knowledge of combinations of plant species with their expected therapeutic actions, contraindications, herb drug interactions and dosing. This includes the species, constituents, actions, uses, research, doses and application of each botanical medicine or formula.
 - Veterinarian herbalists understand the dosing of herbs with consideration of the variability in plant medicines and clinical and patient factors affecting dosing of botanical medicines. The herbal medicines are variable in form and concentrations and bioavailability; knowing how to relate research to the form of herb is important for efficacy and safety. This is distinct from use of drugs with more consistent formulations, but also distinct from the science of clinical nutrition where food ingredients are generally safer than herbal drugs.

²⁰ Ahmad I, Aqil F, Owais M. Modern Phytomedicine: Turning Medicinal Plants into Drugs. Weinheim: Wiley-VCH. 2006.

²¹ Schmidt V¹, McEwan N, Volk A, Helps J, Morrell K, Nuttall T. The glucocorticoid sparing efficacy of Phytosol in the management of canine atopic dermatitis. *Vet Dermatol*. 2010 Feb;21(1):96-105.

²² Yang Y, Zhang Z, Li S, Ye X, Li X, He K. Synergy effects of herb extracts: pharmacokinetics and pharmacodynamic basis. *Fitoterapia*. 2014 Jan;92:133-47.

²³ Triantafyllidis JK, Triantafyllidi A, Vagianos C, Papalois A. Favorable results from the use of herbal and plant products in inflammatory bowel disease: evidence from experimental animal studies. *Ann Gastroenterol*. 2016 Jul-Sep;29(3):268-81.

- Ethical and regulatory aspects of practicing botanical medicine including conservation and avoiding endangered species; and avoidance of use of botanical medicines that can be detected in drug testing in performance animals

Relationship to Veterinary Medical Curricula

The basic principles underlying herbal medicine including anatomy, physiology, pathophysiology and pharmacology are taught in the professional curriculum however herbal medicine is often left to electives. A survey of the AVMA-accredited veterinary institutions (Memon and Sprunger, 2011) reported that 16 (47%) out of 34 respondent colleges offered a complementary and alternative medicine (CAVM) course and herbal therapy was one of the most common topics included in the curricula. The 18 colleges without any course in CAVM or Integrative Veterinary Medicine (IVM) reportedly addressed these topics in other courses, and 4 indicated plans to offer a dedicated CAVM course within the next 5 years²⁴. The same survey noted that two-thirds of one school's veterinary graduates encountered clinical situations involving these therapies at least monthly and over 25% experienced them on a weekly or daily basis²⁵.

Since then the University of Florida now includes an integrative veterinary medicine focus; Washington State University has included invited speakers in its CAVM course to expand its training in this area. Louisiana State University has recently hired a faculty member to offer clinical services and teaching in CAVM, and the University of California-Davis expanded a rehabilitation service to include integrative medicine. Colorado State University continues to provide training in CAVM. Faculty members at a number of other accredited institutions without dedicated clinical programs have obtained training including botanical medicine²⁶.

In addition Cornell University provides the DeeDee Arrison Holistic and Integrative Wellness lectures each year to faculty and students that include herbal medicine; North Carolina State University, Texas A&M University, University of Minnesota, University of Montreal, University of Pennsylvania, University of Prince Edward Island and Auburn Veterinary School have specifically included some herbal medicine training or electives for students. It has recently been proposed in 2016 consensus guidelines for an integrative veterinary medicine curriculum within veterinary colleges that botanical medicine including the origins and major systems of herbal therapy, selected evidence based interventions, adverse events, herb drug interactions and supplement evaluation and regulation form part of the curricula for veterinary students²⁷.

Recently a Retrospective Analysis of 5,195 Patient Treatment Sessions in the Integrative Veterinary Medicine Service at the College of Veterinary Medicine, University of Florida demonstrated that 8.3% (431) of patients received herbal medicine in a 400 day period²⁸.

²⁴ Memon, M.A. and Sprunger, L.K. 2011. Survey of colleges and schools of veterinary medicine regarding education in complementary and alternative veterinary medicine. *J. Am. Vet. Med. Assoc.* 239, 619-623.

²⁵ Memon, M.A. and Sprunger, L.K. 2011. Survey of colleges and schools of veterinary medicine regarding education in complementary and alternative veterinary medicine. *J. Am. Vet. Med. Assoc.* 239, 619-623.

²⁶ Memon MA, Shmalberg J, Adair HS et al Integrative veterinary medical education and consensus guidelines for an integrative veterinary medicine curriculum within veterinary colleges *Open Veterinary Journal*, (2016), Vol. 6(1): 44-56

²⁷ Memon MA, Shmalberg J, Adair HS et al Integrative veterinary medical education and consensus guidelines for an integrative veterinary medicine curriculum within veterinary colleges *Open Veterinary Journal*, (2016), Vol. 6(1): 49

²⁸ Shmalberg J, Memon MA A Retrospective Analysis of 5,195 Patient Treatment Sessions in an Integrative Veterinary Medicine Service: Patient Characteristics, Presenting Complaints, and Therapeutic Interventions *Veterinary Medicine International* Volume 2015, Article ID 983621, 11 pages

Members of the Veterinary Botanical Medicine Association and AHVMA were surveyed by the ACVBM organizing committee in 2016 and those members indicated that they provided the following externships for veterinary students from local veterinary schools:

- Cornell University 3 students per year
- Ross Mississippi State 8 students per year
- Ohio State 4 students yearly
- Blue Pearl Georgia Veterinary Specialists 10 interns per year
- Kansas State University 1 student per year
- Virginia Maryland 1 every few years
- University Florida 1 per year
- Iowa State 1 per year
- Ontario Veterinary College 2 per year
- UC Davis 6 students per year
- Oregon State University 2-3 per year
- Purdue and Ross University 1-2 students per year
- Western University 1-2 students per year
- University of Guelph 4th year students 20 per year
- Oklahoma State University 2 students per year
- Mid Western University Arizona 10-12 students per year
- Washington State 1-3 students per year
- Atlantic Veterinary College 1-3 students per year

While the training is basic for veterinary students, advanced training is usually acquired after graduation through the availability of industry recognised courses and post graduate qualifications (see Continuing Education Programs) in herbal medicine or through attendance at conferences offering in-depth coverage of these areas.

Employment of Diplomates

It is estimated that about 100 diplomates will be employed in specialty private practices and integrative practices in the US. In academic institutions, it is estimated that 30 diplomates will be employed in teaching and research positions. In industry, it is anticipated that large pharmaceutical companies and some “natural” pet food companies may employ diplomates as consultants, providing jobs for up to 30 diplomates with a skill set and training distinct from the nutritionists and pharmacologists already working within these companies. As more pet food companies employ herbs as “functional foods”, veterinary herbalists can provide ready information on proper identification, sourcing, clinical effects, sustainability and regulatory aspects of using herbs, subject areas which are not covered in nutrition residencies.

Continuing Education Programs

Current Programs available in Veterinary Herbal Medicine specifically
VIN

- 16 hours Intermediate Herbal Medicine
- 12 hours Introduction to Herbal Medicine
- 10 hours Introduction to Veterinary Chinese Herbal Medicine
- 6 hours Using herbs for Liver and Kidney Disease

Chi

- 150 hour Chinese Veterinary Herbal Medicine Program approved by a majority of state boards, Provides training Veterinary Chinese Herbalist and this contributes towards a Masters degree.

IVAS

- 165 hours Veterinary Chinese Herbal Medicine training
- 500 hours Advanced Veterinary Chinese Herbal Medicine training

CIVT

- 1305 hours Graduate Diploma Veterinary Chinese Herbal Medicine (Grad Dip VCHM) accredited post graduate degree competency based training
- 945 hours Graduate Diploma Veterinary Western Herbal Medicine (Grad Dip VWHM) accredited post graduate degree competency based training
- 500 hours Foundation Course in Western Veterinary Herbal Medicine
- 445 hours Advanced Western Veterinary Herbal Medicine
- 120 hours Foundation Course Veterinary Chinese Herbal Medicine
- 40 hours Getting Started Veterinary Chinese Herbal Medicine Introductory course
- 24 hours Essentials of Western Veterinary Herbal Medicine

Curecore

- 100 hours herbal medicine training

There are conferences and sections within conferences devoted to botanical medicine (The Chi Institute, Veterinary Botanical Medicine Association, AHVMA and American College Veterinary Botanical Medicine). In addition, there are scientific sessions devoted to botanical medicine at the major veterinary medical meetings, such as NAVC, WSAVA, Atlantic Coast Vet Conference, Wild West Veterinary Conference, Western Veterinary Conference, American College Veterinary internal Medicine Forum and American Association of Feline Practitioners. As well Diplomates from many different specialties speak on the use of herbal medicine within their specialties including Oncology, Sports Medicine, Nutrition, Behavior, Dermatology, Exotics, Avian, Internal Medicine, Hospice and Palliative Care, Dairy Cattle and others.

A Sample of Conference titles by Diplomates or academics in the last 5 years that have herbal therapies included in the speakers proceedings:

- **NAVC 2016** Justin Shmalberg, DVM DACVSMR DACVN College of Veterinary Medicine University of Florida, Gainesville, FL Acupuncture and Herbs in Sports Medicine and Rehabilitation
- **NAVC 2016** Theresa DePorter, BS, DVM, DECAWBM, DACVB Use of Nutraceutical and Botanical Therapies To Modify Behavior
- **NAVC 2016** Gary Landsberg BSc, DVM, DACVB, DECAWBM A Behaviorist's Guide To Natural Therapeutics
- **NAVC 2015** Gregory K. Ogilvie, DVM, DACVIM (Internal Medicine, Oncology), DECVIM-CA (Oncology) Top Ten Natural Cancer Therapies: Banerji and Beyond
- **NACV 2015** Douglas J. DeBoer, DVM, DACVD Global Innovations in Dermatology includes a discussion on herbal oils.

- **NAVC 2015** David C. Twedt, DVM, DACVIM Colorado State University Fort Collins, CO Do Supplements Have a Role in the Support of Gastrointestinal and Hepatic Health?
- **Pacific Veterinary Conference 2015** Leah A. Cohn, DVM, PhD, DACVIM (SAIM) Respiratory Diagnostic Testing: Aspirates, Lavage, and More discusses the adjunctive use of Yunnan baiyao.
- **Pacific Veterinary Conference 2015** M. Christine Zink, DVM, PhD, DACVP, DACVSMR, CVSMT Integrative Medicine for the Canine Athlete includes use of herbal therapy.
- **Pacific Veterinary Conference 2015** Michael D. Willard, DVM, MS, DACVIM (SA) Chronic Hepatic Diseases in Dogs discusses silymarin.
- **Atlantic Coast Veterinary Conference 2015** Beth Overley-Adamson, VMD, DACVIM (Oncology) Updates in Oncology discusses reasonable use of integrative medicine.
- **ACVIM 2014** K. Loyd DACVIM etal *In Vitro* Effects of Yunnan Baiyao (Yb) on Coagulation College of Veterinary Medicine, University of Missouri, Columbia, MO, USA, states that YB is a complex herbal remedy used in veterinary medicine to promote hemostasis.
- **ACVIM 2013** S M Boothe DVM, PhD, DACVIM, DACVCP Nutraceuticals and Drug Interactions provide examples of potential herb drug interactions.
- **International Association of Animal Hospice and Palliative Care 2013** Bonnie Wright, DVM, DACVA, cVMA, CVPP, CCRP Pain Management in Hospice and Palliative Care includes herbal supplements.
- **Central Veterinary Conference 2013** Professor Pamela L. Ruegg, DVM, MPVM University of Wisconsin, Madison, WI, USA Treatments Used on Organic Dairy Herds presented information on the use of alternatives including herbal medicines in organic dairy farms.
- **Central Veterinary Conference 2013** - Kansas City Michael O. Childress, DVM, MS, DACVIM Complementary and Alternative Medicine for Veterinary Cancer Patients: What You and Your Clients Should Know discusses herbal medicines.
- **Central Veterinary Conference 2013** - Washington DC Kendall Taney, DVM, DAVDC Fundamentals of Oral Oncology discusses adjunctive therapy with herbs.
- **Veterinary Cancer Society Conference 2013** Dr. Brian Husbands, DVM, Diplomate ACVIM, CVA East Meets West, an Introduction to Integrative Veterinary Oncology
- **NAVC 2013** Gary P. Oswald, DVM, MS, DACVIM (Internal Medicine) rug and Nutraceutical Therapy of Chronic Inflammatory Liver Disease
- **NAVC 2013** Justin Shmalberg, DVM, DACVN College of Veterinary Medicine University of Florida, Gainesville, FL Beyond Yunnan Baiyao: The Safety, Nutritional Considerations, and Efficacy of Chinese Herbal Products

- **NAVC 2013** Assoc. Professor R.M. Clemmons, DVM, PhD SACS/College of Veterinary Medicine University of Florida, Gainesville, FL TCVM Treatment of Intervertebral Disk Disease and Spinal Cord Neoplasia
- **NAVC 2013** Assoc. Professor R.M. Clemmons, DVM, PhD SACS/College of Veterinary Medicine University of Florida, Gainesville, FL CVM Treatment of Megaesophagus
- **ACVIM 2012** Frank M. Andrews, DVM, MS, DACVIM Gastric Ulcers in Horses: Pharmacologic and Management Strategies included a discussion on research on Sea Buckthorn berry extract for the treatment and prevention of gastric ulcers in horses.
- **IAAAM 2012** Bethany M. Doescher et al College of Veterinary Medicine, University of Georgia, Athens, GA, USA Serenin Vet™, A Natural Alternative Supplement, Used as an Adjunct for Marine Mammal Behavior Modification. This supplement includes three major medicinal herbs used in veterinary herbal medicine.
- **64th Convention of the Canadian Veterinary Medical Association, 2012** Assoc Professor Art Ortenburger, DVM Department of Health Management, University of Prince Edward Island, Charlottetown, PE, Canada Integrative Medicine Approach to Common Clinical Problems in Large Animals
- **Western Veterinary Conference 2012** Jacquelin J. Boggs, DVM, MS, DACVIM (LAIM) Complementary, Not Alternative? A Practical Review of Non-Western Medicine
- **Atlantic Coast Veterinary Conference 2011** Kristina R. Vygantas, DVM, DACVO Frequently Asked Questions: Conjunctiva and KCS includes *Calendula officinalis* for conjunctivitis.
- **ACVIM 2011** E. Carothers et al Comparison of a Proprietary Herbal Topical Cream to Silver Sulfadiazine in an Equine Wound Model Department of Clinical Sciences, College of Veterinary Medicine, Mississippi State, MS, USA, in which the topical treatment was effective.
- **ACVIM 2011** Mark E. Peterson, DVM, DACVIM Methimazole, Carbimazole & Alternative Medical Therapies for Feline Hyperthyroidism
- **Western Veterinary Conference 2011** Meri Stratton-Phelps, DVM, MPVM, DACVIM (LAIM), DACVN Making Nutrition A Profitable Part of Your Practice horse food and herbs.
- **Western Veterinary Conference 2011** Francis W.K. Smith Jr., DVM, DACVIM (SAIM & Cardiology) Complementary Therapies for Cardiac Diseases discusses a group of herbal therapies for heart disease.
- **Atlantic Coast Veterinary Conference 2010** Emily D. Levine, DVM, MRCVS, DACVB Noise Fears, Sensitivities, and Phobias includes reference to herbal therapies.
- **Atlantic Coast Veterinary Conference 2010** Michael Willard, DVM, MS, DACVIM Chronic Hepatobiliary Diseases of Dogs includes reference to Milk Thistle.

A Sample of Conference titles discussed by veterinary herbalists in the last 5 years that have herbal therapies included in the speakers proceedings:

- **Western Vet Conference WVC 2016.** Ihor Basko Medical Mushrooms to Treat Cancer
- **Western Vet Conference WVC 2016.** Nancy Scanlan Herbs for Immune System and Cancer
- **Wild West Veterinary Conference 2016** Rob Silver Applications of Cannabinoid Therapies for Geriatric Conditions
- **Wild West Veterinary Conference 2016** Rob Silver Chronic Kidney Disease- an Integrative Approach
- **Wild West Veterinary Conference 2016** Rob Silver Cannabis for Cancer?
- **Wild West Veterinary Conference 2016** Gregg Todd Applying Traditional Chinese Veterinary Medicine in Respiratory Disease Treatment
- **Wild West Veterinary Conference 2016** Gregg Todd The Treatment of Musculoskeletal Disease Utilizing Traditional Chinese Veterinary Medicine.
- **Wild West Veterinary Conference 2016** Gregg Todd How to Approach Dermatological Cases with Traditional Chinese Veterinary Medicine.
- **Wild West Veterinary Conference 2016** Gregg Todd Common behavior patterns: Their Diagnosis and Treatment with Traditional Chinese Veterinary Medicine.
- **NAVC 2016** Huisheng Xie A Severe Atopic Dog, A TCVM Approach
- **NAVC 2016** Huisheng Xie Non-controlled Seizure Dog: A TCVM Approach
- **NYSVC 2016** Barbara Fougere The Evidence Base for Veterinary Herbal Medicine
- **NYSVC 2016** Barbara Fougere Herbal Oncology I
- **NYSVC 2016** Barbara Fougere Herbal Oncology II
- **NAVC 2015** Steve Marsden Integrative Management of Systemic Lupus in a Dog
- **NAVC 2015** Steve Marsden Integrative Management of Musculoskeletal Disorders
- **NAVC 2015** Steve Marsden Integrative Neurology: Disorders of the Back and Hind Limbs
- **WSAVA 2015** X. Huisheng Traditional Chinese Veterinary Medicine for Renal Failure
- **WSAVA 2015** S.H. Xie Traditional Chinese Veterinary Medicine for Itching Dogs
- **WSAVA 2015** B. Fougere How Do Herbs Work? An Introduction to Herbal Modes of Action and Use

- **WSAVA 2015** B. Fougere Veterinary Herbal Medicine - Where's the Evidence?
- **NAVC 2014** Huisheng Xie, DVM, PhD College of Veterinary Medicine University of Florida, Gainesville, FL Treatment of Icterus / Hepatitis
- **NAVC 2014** Huisheng Xie, DVM, PhD College of Veterinary Medicine University of Florida, Gainesville, FL How To Use TCVM for the Treatment of Seizures
- **NAVC 2014** Constance DiNatale, DVM Cancer and Immune Dysfunction
- **NAVC 2014** Constance DiNatale, DVM TCVM Approach To Skin Case
- **NAVC 2014** Nancy Scanlan, DVM How Some "Immune Boosters" Really Work and How Best To Use Them
- **Wild West Veterinary Conference 2013** Gregory Todd he Basic Principles of Cardiology in Traditional Chinese Veterinary Medicine
- **Wild West Veterinary Conference 2013** Gregory Todd Diagnosis and Treatment of Common Gastrointestinal Patterns in Traditional Chinese Veterinary Medicine
- **Western Vet Conference WVC 2013** J. Randy Kidd Herbal Medicines for Animals
- **Am College Vet Internal Med Forum ACVIM 2013.** Martha F. Mallicote Acupuncture and Herbal Medicine Used for Treatment of Anhidrosis

- **UC Davis 2013** Madeline S. Yamate Managing Geriatric Patients with Traditional Chinese Medicine
- **Am Assoc Feline Practitioners AAFP 2012** Steve Marsden Perspectives on Feline Hyperthyroidism: Speculated Pathogenesis & Herbal Treatment
- **Am Assoc Feline Practitioners AAFP 2012** Steve Marsden Herbal Management of Feline Chronic Vomiting & Inflammatory Bowel Disease
- **Am Assoc Feline Practitioners AAFP 2012** Robert J. Silver Introduction to the Clinical Use of Nutraceutical and Botanical Therapies
- **Western Vet Conference WVC 2012** Deborah M. Mitchell TCVM Diagnosis and Treatment of Seizures
- **Western Vet Conference WVC 2012** Deborah M. Mitchell Do the Symptoms Match the Picture? TCVM Approach to Skin Disease
- **Canadian Vet Med Assoc CVMA 2012** Deborah M. Mitchell Integrative Medical Approach to Common Clinical Problems in Small Animals
- **Western Vet Conference WVC 2011** Signe E. Beebe Chinese Medicine Approach to Feline Chronic Renal Failure
- **Western Vet Conference WVC 2011** Signe E. Beebe Chinese Herbs to Treat Endocrine Disorders I and II
- **Western Vet Conference WVC 2011** Signe E. Beebe Integrative Cancer Therapies I and II
- **Wild West Veterinary Conference 2011** Cindy Wallis The Use of Chinese Herbal Medicine to Treat Cancer in Dogs
- **Wild West Veterinary Conference 2011** Cindy Wallis Chinese Herbal Medicine for Inflammatory Bowel Disease
- **Wild West Veterinary Conference 2011** Cindy Wallis How to Use Chinese Herbal Medicine
- **UC Davis 2011** Michael Salewski Performance: Strategies for Animal Athletes

Relationships with Existing RVSOs and the Uniqueness of Veterinary Medicine Specialty.

The ACVBM will be devoted to formalizing and advancing the practice, research and education of veterinary botanical medicine.

The mission of the American College of Veterinary Botanical Medicine is to advance the specialty area of veterinary botanical medicine and to increase the proficiency and competence of veterinarians in the use of medicinal plants by establishing requirements for certification, promoting professional education (both undergraduate and postgraduate), promoting research and disseminating new knowledge to the profession.

The field of veterinary medicine is constantly evolving. The development of veterinary specialties, arise with the accumulation of scientific knowledge in that area. The dramatic increase in botanical medicine

journal publications and public interest over the past ten years provides the impetus for the ACVBM to meet a need for expertise by veterinarians in the application of plant-based medicine.

The demand for other ways of treating challenging conditions is recognised²⁹. Women are often the caretakers, health educators, and decision makers for their families³⁰ including pets, and estimates of complementary and alternative medicine use amongst women range from 36% to 52%^{31, 32, 33} with herbs and vitamins being the most used³⁴. One study reported that 67% of clients gave their pets with cancer herbs and supplements, indicating commonplace use³⁵. This raises concerns about patient safety, including the risk of interactions, adverse effects and inappropriate use.

Veterinarians are being challenged to know more about non-conventional therapies including herbs³⁶. If a veterinarian is not responsive and knowledgeable, owners will likely seek advice from friends, non-professional literature and the Internet³⁷. The ACVBM would be a resource for the profession, providing easily understood, evidence-based information to support open, respectful and informed discussions between veterinarians and clients. This supports our professions standing and maintains healthcare within the framework of veterinary medicine.

Veterinarians should have access to education about botanical medicine in their undergraduate, vocational and further education to provide advice to clients. Botanical medicine has a scientific basis and veterinarians should be informed of the level of scientific evidence for both benefits and adverse reactions, including potential herb drug interactions. The ACVBM and its Diplomates can serve the profession by acting as a resource for education, information and guidelines for the veterinary profession.

Botanical medicine overlaps and integrates with many specialties as herbs can fill therapeutic “holes” in the veterinarian’s treatment armamentarium. While some of these traditional tonics and alteratives have recognized activities, such as antioxidation or microbiome support, some are still not well enough understood to classify them in a physiologic or pharmacologic sense. Herbal antimicrobials are being investigated as alternatives to conventional antibiotics due to increasing antimicrobial resistance. The use of herbs is especially intriguing where clinical proof of efficacy predates our understanding of disease

²⁹ Budgin JB, Flaherty MJ. Alternative therapies in veterinary dermatology. *Vet Clin North Am Small Anim Pract* 2013;43:189–204

³⁰ The Commonwealth Fund. In: Falik M, editor; Collins K, editor. *The Commonwealth Fund Survey of Women's Health: Selected facts on U.S. women's health*. Baltimore, MD: Johns Hopkins University Press; 1996.

³¹ Upchurch DM, Chyu L. Use of complementary and alternative medicine among American women. *Womens Health Issues*. 2005;15:5.

³² Upchurch DM, Chyu L, Greendale GA, et al. Use of complementary and alternative medicine among American women: Findings from the National Health Interview Survey, 2002. *J Womens Health*. 2007;16:102.

³³ Kronenberg F, Cushman LF, Wade C, Kalmuss D, Chao MT. Women's use of complementary and alternative medicine: Results of a national, multi-ethnic study in the U.S. *Am J Public Health*. 2006;96:1236

³⁴ Upchurch DM, Chyu L, Greendale GA, et al. Use of complementary and alternative medicine among American women: Findings from the National Health Interview Survey, 2002. *J Womens Health*. 2007;16:102.

³⁵ Lana SE, Kogan LR, Crump KA et al. The use of complementary and alternative therapies in dogs and cats with cancer. *J Am Anim Hosp Assoc* 2006; 42:361-5

³⁶ Memon MA, Sprunger LK. Survey of colleges and schools of veterinary medicine regarding education in complementary and alternative veterinary medicine. *J Am Vet Med Assoc* 2011;239:619–23.

³⁷ Radatic D, Barges J Evidence –based Integrative Medicine in Clinical Veterinary Oncology. *Vet Clin Small Anim* 44 (2014) 831-853.

pathophysiology, illustrated in a recent review showing herbs and plant therapy are efficacious for IBD in human patients³⁸.

Specialists in canine, feline, and avian practices encounter questions about herbal therapies from their clients frequently. Among veterinarians who offer botanical medicine, herbs are recommended for patients also being concurrently treated by oncologists, internists, surgeons, physical therapy/rehabilitation and reproductive specialists, ophthalmologists, cardiologists, neurologists, behaviorists and dermatologists. Dairy, beef, swine, poultry and food animal specialists may depend upon herbal therapies for the treatment of animals raised for organic food. Plant-based medicines impact the practice of anesthesiology, pharmacology and toxicology and even comprise some of the training for these specialties. Herbal therapies hold potential in the treatment of infectious disease, and therefore impact the bacteriology/mycology, microbiology, parasitology and immunology specialties, as well. Similar to Clinical Nutrition and Clinical Pharmacology, Botanical Medicine may be employed by any other practice area, but not to its fullest safety and efficacy potential.

However, while botanical medicine overlaps many other specialties, the depth of knowledge required of a specialist in phytopharmacology, phytomedicine, raw material identification, and environmental conditions and sustainability is not covered by any of these. Even the College of Clinical Pharmacology, which might be the closest relation of all the specialties, would concentrate on only a subset of the mechanisms by which herbs work without concern for sourcing, ecological considerations or multimodal affects. There are tens of thousands of medicinal plants described in the herbal medicine literature, likely overshadowing the conventional drug pharmacopeia by orders of magnitude. Pharmacology focuses on isolation of a single constituent to characterize and use therapeutically. By contrast, herbalists advocate for the complex actions initiated when a plant or plant extract containing hundreds of compounds with polypharmacy and biological polyvalency are used. In addition, the discovery process for drugs and herbs differs widely. New drugs are more often designed through the theoretical knowledge of physiologic mechanisms as they are by accident. The effective use of herbal medicine often requires knowledge of their ethnomedical uses - or familiarity with the culture and medical system that popularized the use of a medicinal plant. Ethnobotanical medicine is a specific subspecialty with increasing numbers of peer reviewed publications, and could be supported and explored adequately only if herbal medicine stands alone as a specialty.

No other specialty possesses the unique set of skills and knowledge required by botanical medicine practice. If botanical medicine became a subspecialty of pharmacology or any other RVS, too much additional knowledge and experience would be required of diplomat. An even larger concern is the dilutional effects that training in the other RVS plus herbal medicine would have on the practice of herbal medicine.

There are relationships and commonalities between veterinary botanical medicine and the following RVSOs:

American Board of Veterinary Toxicology: Toxicologists are familiar with toxic principles of plants. Botanical medicine specialists, who are necessary to provide complementary information on plant use and abuse, also consider many of the plants that are considered toxic by toxicologists as therapeutic. Herbal medicine specialists will be more informed on dosing that “makes the medicine or the poison”. The botanical medicine diplomate can also provide information on botanical support for animals that are

³⁸ Triantafyllidi A, Xanthos T, Papalois A, Triantafyllidis JK Herbal and plant therapy in patients with inflammatory bowel disease. *Ann Gastroenterol.* 2015 Apr-Jun;28(2):210-220..

poisoned such as *Silybum marianum* for amanita poisoning and also provide input into reducing the toxicity of certain drugs- such as *Silybum marianum* providing a protective effect against gentamycin induced toxicity.

American College of Laboratory Animal Medicine: There exists a large body of literature examining the effects of herbal medicines in experimental animals, and research in animal models is fundamental to human studies in herbal medicine. The botanical medicine diplomate can advise on suitable dosages of herbs and plant constituents and appropriate herbs the conditions being investigated based on herbal medicine principles and ethnobotanical information.

American College of Poultry Veterinarians: There is increasing research on the use of herbs and plant extracts in poultry production although most poultry veterinarians do not identify with herbal medicine use. The botanical medicine diplomate can act as an interface between industry research and clinical medicine and advice on potential treatment of diseases, prevention of disease and also in treatment of backyard chickens.

American College of Theriogenologists: Reproduction and fertility is an area of specific research in human herbal medicine and increasing publication in veterinary medicine. This is represented by Dr Reed Holyoak DVM, PhD, DACT Professor of Theriogenology, OK State Univ who incorporates botanical medicine in the treatment of reproductive and fertility issues in horses. He teaches veterinarians in the use of plants, but as in every other facet of medicine, this is a mere introduction to a larger field that requires additional training in order to make competent use of it.

American College of Veterinary Anesthesia and Analgesia. Some herbs have the potential to interact with anaesthesia. With increasing use of herbs by the public the botanical medicine diplomate can advise on use, research topics and the benefits of using some herbs in conjunction with anesthesia as well as input into the potential for herbs and plant extracts such as cannabis for analgesia. The botanical medicine diplomat would serve as a resource to anesthesiologists and veterinarians as pet owners continue to find and administer new over the counter herbal supplements to their animals.

American College of Veterinary Behavior: Because herbal remedies are already available to the public, veterinarians are frequently consulted about the value of herbal anxiolytics, sedatives, and antidepressants even while lay dog trainers recommend them routinely. The botanical medicine diplomate can support veterinary behaviourists in having more in-depth knowledge about these over-the-counter remedies and how they will interact with pharmacologic interventions. The veterinary botanical specialist may also advise or be involved in research on herbs and plant extracts that have potential use in a number of clinical conditions associated with behavioural issues. Veterinarians are already utilising herbal training to inform research directions for companies investigating herbal alternatives to drugs for companion animals.

American College of Veterinary Clinical Pharmacology: An important basis of herbal medicine is the pharmacology and mechanisms of actions of plants and plant extracts, however they differ from drugs in their complexity, and in the underlying ethnomedical knowledge base used to initiate study of them. The botanical medicine diplomate can provide context to client and referring veterinarian inquiries, from both the ethnomedical and pharmacologic perspectives. The botanical medicine specialist might also collaborate with veterinary clinical pharmacologists on research design, herb-drug-nutrient interactions and other clinical issues. In addition, the botanical medicine specialist can help pharmacology researchers determine botanical substitutes with similar or different pharmacologic activity in cases where an initial plant choice is unavailable or considered endangered.

American College of Veterinary Dermatology: Studies have stated that people seek complementary and alternative therapies for (among other things) relief of chronic discomfort, and chronic dermatologic disorders (especially allergies)³⁹ that prove difficult to resolve comprise a major proportion of cases seen by general practitioners and Dermatology specialists. Veterinary herbalists are presented with a large proportion of chronic dermatological conditions that are poorly responsive to conventional treatment or where pet owners seek other options. Many herbs and formulas have the potential to improve patient quality of life and the herbal medicine diplomate can be involved in directing research in this area and working together on challenging cases. Some diplomate dermatologists have been trained in herbal medicine.

American College of Veterinary Internal Medicine: Metabolic diseases are common in equine and small animals. The herbal medicine diplomate will be trained to apply herbal medicine strategies and integrative medicine for chronic metabolic disorders where conventional treatment may not be successful or where herbal medicine can augment medication or protect from side effects or sequelae of the disorder. Botanical medicine diplomats would act as important consultants in the design of clinical trials that incorporate herbal therapies.

American College of Veterinary Nutrition: Functional foods including herbal medicines are being employed in therapeutic diets and products in veterinary medicine. The herbal medicine diplomate will be able to advise on suitable herbs to meet therapeutic needs in product development in the pet food industry and also provide advice on the addition of herbs to veterinary nutritionist-formulated diets and diet plans to benefit the patient therapeutically.

American College of Veterinary Ophthalmology: Diseases which are refractory to conventional medicine or progressive in nature can be attenuated by herbal medicines and plant extracts. A botanical medicine diplomate can advise on research and treatment on challenging cases and product development. Some therapeutic products containing herbs have been developed by a ACVO Diplomate Dr Carmen Colitz, DVM, PhD.

American College of Veterinary Preventive Medicine: In the field of production animals, environmental health, and antibiotic resistance, the botanical medicine diplomate can provide advice on research, potential for residues and appropriate herb use to improve public health and food safety especially in the areas of organic production.

American College of Veterinary Sports Medicine and Rehabilitation: The botanical medicine diplomate can advise on appropriate herbal medicine use to support rehabilitation of patients and for avoiding herb and plant extract doping of performance animals.

American College of Zoological Medicine: The botanical medicine diplomate can advise on appropriate treatment strategies for challenging cases in zoo medicine. Herbal medicine diplomats will be familiar with the zoopharmacologic, ethnoveterinary and ethnobotanical research related to the animal's geographic and cultural background, providing potentially more scientifically supported herbal therapies.

American College Veterinary Emergency & Critical Care: The botanical medicine diplomate can provide advice on integrative treatment of critical care cases where options may be limited such as acute liver and

³⁹ Tumpang MA, Ramli NA, Hussain Z Phytomedicines are efficient complementary therapies for the treatment of atopic dermatitis: A review of mechanistic insight and recent updates. *Curr Drug Targets* 2017 Sep 13

kidney failure that may benefit from the addition of botanical medicine. The formula Yunnan baiyao is already being used in critical care practice and warrants further research⁴⁰.

American Veterinary Dental College: A number of veterinary dental products contain essential oils and herb extracts and research in human dentistry includes research on herbs often using dogs as models. Having the link between botanical medicine and dentistry might accelerate preventative medicine in one of the most common disorders of small animals.

INDUSTRY AND PROFESSIONAL SUPPORT

A brief internet search will show that the number of companies offering herbal remedies for every animal condition is rapidly expanding. The vast majority of these companies, owned by lay entrepreneurs, are supported by no veterinary knowledge at all. The establishment of a veterinary botanical medicine specialty will serve to highlight the role of veterinarians in the medical treatment of animals, whether the medication is OTC or prescription. The establishment of this specialty will address the growing interest, demand and use of alternatives and adjuncts to conventional drugs in production animals, equines and small animals coupled with the recognition that herbal medicine offers a substantial scope of pharmacological actions and benefits in addition to conventional medicine for challenging medical issues. The herbal medicine diplomate must have an expanded understanding in the areas including, but not limited, to principles of herbal medicine (whether ethnomedical or scientific principles are being used in decision-making); the herbs (pharmacology, the correct portion of the plant that has medicinal properties, preparation, manufacture, indications, palatability, application, compatibilities with other herbs, herb drug interactions, contraindications, dosing); therapeutic strategies, herbal nutrition, phytopharmacology and this is in addition to basic knowledge of traditional medical and surgical veterinary problems.

In a survey conducted in 2016 by the ACVBM organising committee to approximately 800 members of AHVMA and 240 members of VBMA, 103 veterinarians responded (9.9%).

- 86% had been referred a clinical case from a veterinarian in the past 12 months.
- 72% of respondents had been referred between 10 and more than 50 cases over the past 12 months.
- 45% of respondents had been referred between 1 and more than 50 clinical cases from a board certified specialist in various fields for herbal medicine treatment in the past 12 months.
- 96% of veterinary herbalists had provided advice to a veterinarian on the use of herbs in the past 12 months.
- 40% had consulted to between 10 and 50 veterinarians over the past 12 months.
- 70% of the advice to other veterinarians covered case management, herb choice, herb dose and herb drug interactions.
- 34% of respondents provided a training service or internship for veterinary students.
- 55% of veterinarians had formal training in Western or Chinese herbal medicine.
- 22% of respondents had provided advice/ consulting to industry and pharma on use of herbs, product formulation or safety.

⁴⁰ Murphy LA, Panek CM, Bianco D, Nakamura RK Use of Yunnan Baiyao and epsilon aminocaproic acid in dogs with right atrial masses and pericardial effusion. J Vet Emerg Crit Care (San Antonio). 2016 Sep 26

The ACVBM Organising committee has received support for this petition from a selection of academics at veterinary schools; diplomates in private specialist practices, veterinary students, organic dairy industry boards and members of the general public (See Appendix XI & III).

ACVBM BYLAWS

The Bylaws (**Appendix I**) were prepared according to the guidelines in the *ABVS Criteria for Establishment of a Veterinary Specialty Organization*. Specific entities required in the Bylaws include information on the following:

I. Name of the organization is the American College of Veterinary Botanical Medicine (ACVBM). The ACVBM has been incorporated under the laws of the State of Delaware as a not-for-profit, tax-exempt organization for the purposes set forth herein, and in the Certificate of Incorporation. The corporation has no members.

II. The statement of objectives and limitations.

III Board of Directors- authority, composition, terms of office

IV Meetings, elections

V Officers

VI Executive Director

VII Diplomates and Membership categories, including duties, privileges and methods of selection for each category, are detailed in the Bylaws.

VIII Governance

IX Committees

X Admission to ACVBM Speciality training program including details on eligibility for candidacy.

XI ACVBM Speciality Training Programs including Standard Residency Trainign Program and Alternate Residency Training Program. This is detailed under Appendix 4 Residency Program

XII Diplomate Examination and Certification. This is detailed under Appendix 6 Outline of Proposed Examination and under Appendix 4 Residency Program

XIII Indemnification

XIV Amendments

XV Adoption of Bylaws

XVI American Board of Veterinary Specialities Representative

Organization of ACVBM Specialty

The organizing committee has selected the following committee structure and membership to undertake its functions. Further information is found under **Appendix I Bylaws** and **Appendix II Policies and Procedures**.

- Executive committee
- Nominating/ Membership committee
- Credentials And Residency Committee
- Examination Committee
- Appeals Committee

Establishment of an organizing committee

Eligibility criteria for members of the organizing committee were chosen as having acknowledged expertise in veterinary botanical medicine and as recognised educators and practitioners of botanical medicine. According to the bylaws of the AVMA, committee members had to fulfill at least one of the following criteria:

- Be a professor of this specialty in a college or department of veterinary medicine
- Be an author of important publications resulting from research or practice in this specialty
- Have at least 10 years experience in this specialty and, by teaching, research, or practice, have contributed substantially to the development of the specialty
- Have advanced training in the specialty and have demonstrated competency through teaching, research, or practice in the specialty to which more than fifty (50%) or more of the individual's professional time is devoted

Original committee members were identified by nomination, that generated the names of 22 candidates. Candidates were discussed and contacted. The consensus was that 16 individuals would be sufficient to provide a diverse range of expertise in small and large animal botanical medicine. It was also determined that the organizing committee should include both practicing and academic veterinarians and diplomates who practice botanical medicine from diverse geographical areas. Over the past 12 months we have expanded the committee to 20, comprised of 8 Diplomates with interests in botanical medicine and 12 veterinary herbalists. The committee is comprised of:

Organising Committee:

1. Signe Beebe Current President Elect ACVBM
2. Erin Bannick DVM, DACVIM (Oncology)
3. Ihor Basko Current Chairperson of the ACVBM
4. Joe Castro DVM, ECFVG, PhD, Diplomate American Board Veterinary practitioners; Diplomate American Board Veterinary Surgery
5. Carmen Colitz DVM, PhD, Diplomate ACVO
6. Curtis Wells Dewey DVM Diplomate - ACVIM (Neurology) Diplomate - ACVS
7. Connie DiNatale Past President
8. Barbara Fougere Current President of the ACVBM
9. Joyce Harman Vice President the ACVBM
10. Reed Holyoak DVM MS PhD Diplomate ACT
11. Hubert Karreman
12. Cynthia Lankenau Secretary/Treasurer of the ACVBM
13. Steve Marsden Board member of the ACVBM

14. Richard Palmquist Board member
15. Donna Raditic DVM DACVN
16. Nancy Scanlan
17. Justin Shmalberg DVM Diplomate ACVN Diplomate ACVSMR
18. Rob Silver
19. Susan Wynn DVM, DACVN advisor to the ACVBM Board
20. Huisheng Xie Board member of the ACVBM

Standards for admission to membership ACVBM

(Abridged from Bylaws (Appendix I) and Policies and Procedures (Appendix II))

a. The ACVBM will examine only veterinarians who:

- Are a graduate of a college of veterinary medicine accredited by the AVMA; or possess a certificate issued by the Commission for Foreign Veterinary Graduates (ECFVG) or are legally qualified to practice veterinary medicine in some state, province, territory, or possession of the United States, Canada, or other country
- Are licensed to practice veterinary medicine
- Meet the education, training, and experience requirements established by the ACVBM
- Demonstrate unquestionable moral character and ethical professional behavior

b. The ACVBM will certify only those veterinarians who have met established training and/or experience requirements and attained acceptable scores on comprehensive examinations administered by the ACVBM, demonstrating their fitness and ability to practice the specialty.

Other Policies and Procedures:

Requirements for training and experience and prerequisites for examination

The eligibility requirements and experience prerequisites for taking the examination have been based on those of other established RVSOs.

Approved routes through education, training, and experience to qualify candidates for examination (See Appendix IV)

There will be two routes for satisfying the credentials requirements: a standard residency training path and an alternative residency training path.

1. **STANDARD RESIDENCY TRAINING PATH:** Minimum 3 years residency under guidance of ACVBM mentor or a PhD in a field related to botanical medicine and one (1) peer reviewed/refereed publication.

2. **ALTERNATIVE RESIDENCY TRAINING PATH:** Minimum 3 years experience in practice with greater than 50% time devoted to botanical medicine and 1 peer reviewed/refereed publication

Candidates must submit a completed application form from the ACVBM, a copy of their current veterinary license, curriculum vitae, three letters of reference, ACVBM Master Log of Activities and one (1) peer-reviewed/refereed publication (See **Appendix IV** Residency Guidelines for full details).

Experience requirements relevant to the objectives of the ACVBM specialty

Candidates will not be required to have a waiting period between formal training and eligibility to sit for the examination.

Certificates attesting to diplomate status

Certificates will be issued indicating that the individual is a diplomate of the American College of Veterinary Botanical Medicine. The certificates will not be time limited.

Establish a formal appeal procedure for candidates in case of an adverse decision by the ACVBM (See Appendix II Policies and Procedures)

Provision of special training beyond the professional veterinary degree to enhance the ability of candidates to meet certification requirements and to maintain the competence of diplomates.

Botanical medicine training is available through industry recognised courses and post graduate qualifications in herbal medicine or through attendance at conferences offering in-depth coverage of these areas. The Education Committee will work toward expanding and enriching existing programs, including CE opportunities offered. The establishment of new residencies in botanical medicine will be a priority.

Scope of activities

The ACVBM will avoid agreements or contracts that lead to activities outside the scope of the stated objectives.

Contents of Constitution, Bylaws and Policies and Procedures Documents

The ACVBM will notify the ABVS of any and all changes to the Bylaws and *Policies and Procedures* documents at the time of the next annual report.

Incorporation of ACVBM

The ACVBM has legal incorporation as a not-for-profit educational organization within the state of Delaware with tax exemption under section 501 (C)(3) or 501 (C) (6) of the Internal Revenue Service Code.

Criteria for recognition of ACVBM

1. Improvement in veterinary services provided to the public

Veterinary Botanical Medicine is concerned with the diagnosis, treatment and health maintenance, or health improvement of animals using specialized knowledge of botanical medicines and principles. Botanical medicines include plant preparations (dried, powdered, tinctures, glyceextracts, vinegars, wines, pills, salves, oils, teas, granules) and extracts such as essential oils, or constituents as well as combinations or formulas. These are applied to conditions and health maintenance across the production animal industry and companion animals for a number of reasons including:

- alternatives to growth promoters and antibiotics and anthelmintics in the face of resistance issues
- growing consumer demand for organic produce

- human health and environmental concerns about chemical and drug use and residues in livestock, in aquaculture and poultry and on companion animals
- treatment options for animals that are refractory to conventional care, suffering drug related side effects or where conventional options have a low evidence base or safety concerns
- the rising demand by companion animal owners and some organic producers for botanical medicines as a preferred method of treatment

The need for palliative treatments in the growing field of animal palliative care and hospice. The public is exposed to a plethora of herbal suggestions on the Internet, many of which are ineffective and some that may be harmful, for their animals' health, as consumers take it upon themselves to fill the gap in the current veterinary profession paradigm. Were veterinarians in a position of having absolutely no knowledge of herbal medicine, the absence of a veterinary botanical medicine college that could provide safe answers to the public might be excusable; but now that veterinarians have discovered botanical medicines that safeguard animal well-being while responsibly filling a demonstrated public need, the veterinary profession has an obligation to provide such a college, where the needs of the public and their animals can be prioritized.

Safety of patients is paramount. The ACVBM can help guide policy and regulation and advise on appropriate use of botanical medicines based on product quality, efficacy and safety. Currently members of the ACVBM have been involved in product development, research and regulation, and with the College accepted by the Profession, this will give more strength to the profession's involvement in ensuring animal safety from an informed perspective. The discussion on medical cannabis for example is one where some ACVBM members have substantial expertise.

Diplomates can also offer referral service for clients seeking integrative botanical medicine approaches to help solve complex health problems. They can explain the level of evidence of botanical treatment protocols and help clients make an informed choice. The goal of an integrative approach is to enhance overall health, prevent disease, and to alleviate debilitating symptoms that often affect patients with chronic disease.

Expertise in veterinary botanical medicine meets a growing consumer demand from animal owners and producers. It has a substantial evidence base compared to some other integrative and complementary therapies. The benefits of botanical medicines for improving animal health and providing evidence of these reasons are emphasized under the following section.

Companion Animals

Trends identified in the ACVBM White Paper 2016⁴¹, from data supplied by the National Animal Supplement Council (NASC) show an enormous growth in the popularity of herbs used on the treatment of companion animals:

- **Canine Data:** Total administrations of the top 25 herbal ingredients for dogs was 42,087,369 in 1999, the first year of tabulating this data. The number of administrations grew over the 17 years recorded to 244,797,878 administrations, estimated for the year 2015. This represents 500% growth.
- **Equine Data:** Total administrations of the top 25 herbal ingredients for horses was 8,385,566 for 1999, the first year of recording this data. This value increased in 17 years of data recording to 42,476,440 administrations estimated by the end of 2015. This is also a 500%

⁴¹ Silber R, Bookout B, Karreman H Documentation of Trends in the Public Acceptance of Botanical Therapies: Consumer Buying Patterns, Patterns of Use and Industry Correlates 2016 January Organizing Committee Report-SeeAppendix X

growth in number of administrations.

- **Feline Data:** Total administrations of the top 25 herbal ingredients for 1999 for cats was 5,638,172 and was expected to increase to 81,495,270 by the end of 2015. Although cats are experiencing a down turn in number of visits to their veterinarians, the number of administrations of the top 25 herbal ingredients increased 14.5 times during this 17 year period being monitored.
- **Combined Data:** Total administrations of the top 25 herbal ingredients for Dogs, Cats and Horses combined for 1999 was 56,111,107. This value increased over 17 years to an estimated 368,769,588 by the end of 2015. This is a 650% increase in the administrations of these top 25 herbal ingredients, which implies a similar increase in use of these herbal supplements in all species measured.

This 2016 white paper suggests that with the growth of interest in herbal medicine among veterinarians and consumers, most animal supplement companies are in need of scientifically-derived information regarding the safety, herb-drug interactions, and clinical applications regarding herbal therapies in veterinary species, that could be facilitated by the establishment of the ACVBM.

Bovine Practice and Organic Production

The growth in interest of bovine (AABP) practitioners toward complementary and alternative medicine was investigated between 2006 and 2010 using surveys⁴². Approximately 80% of the veterinarians were interested in evidence-based alternative therapies, and in particular for the treatment of mastitis. From 2006 to 2010 interest increased significantly ($p < 0.01$) in alternative treatment approaches for calf diarrhea, metritis, infertility, pneumonia and digital dermatitis/foot rot. In general veterinarians with organic clients were more interested in these alternative non-drug therapies than those veterinarians without organic clients. They were particularly interested in treatments with a rational pharmacological basis. The majority of evidence-based complementary and alternative therapies are based on botanical remedies. This survey of the growth of bovine veterinarians' interest in CAVM between 2006 and 2010 supports the need for the establishment of a College of Veterinary Botanical Medicine as a resource for these veterinarians to better establish the science that underlies these therapies. For industry, the graduation of Board-certified veterinarians with scientific and clinical expertise in botanical medicine and phytopharmacology will be invaluable as companies develop and bring evidence-based botanical products to the marketplace to address the needs of these bovine practitioners and their clients.

Letters (Appendix XII) from the Midwest Organic Dairy Producers Association and the Northeast Organic Dairy Producers Alliance (representing 836 organic dairy producers in the Eastern US) express their enthusiastic support for the creation of the ACVBM. They also expressed that many of their producers are not served by veterinarians with interest or skills in botanical/ holistic medicine. They state that the ACVBM could provide information and experience to support regular veterinarians.

- Trends in Consumer Use of Herbal Therapies for Pets
- The American Pet Products Association National Pet Owners Survey 2015- 2016

The APPA survey was mined for data regarding the trends in the use of herbal supplements by pet owners of dogs, cats and horses.

- **The percentage of dogs and cats given medications** of any kind increased to 77% over the

⁴² Sorge US, Bastan A, Karreman H Interest of Bovine Practitioner in Complementary and Alternative Veterinary medicine in 2006 and 2010) College of Veterinary Medicine, Dept. Veterinary Population Medicine, University of Minnesota, Saint Paul, MN 55108 Advance Research in Agriculture and Veterinary Science vol2(1&2)2015

past 12 months. 10 years ago this was 52%, indicating a trend toward better acceptance of administration of medications, and better palatability strategies. More than 90% of horses have been administered medication or supplements this past year.

- **The percentage of pets receiving dietary supplements** excluding vitamins was 12% for dogs (9.3 million dogs), 6% for cats (5.15 million cats), and 5% for horses (375,000 horses).

Consumers source their dietary supplements from the following outlets: *(Multiple response question, therefore total may exceed 100%)*

1. **Dogs:** from Veterinarian (28%), Internet (22%), Pet chain superstore (16%), Pet store independent (13%), Discount/Mass marketing (16%) Hardware store (6%), Other (6%)
2. **Cats:** from Veterinarian (17%); Pet chain super store (25%); Internet (17%); Grocery store (17%); Discount Mass marketing (25%)
3. **Horses:** from Internet (33%); Veterinarian (25%); Feed store (17%) Tack shop (8%) Other (17%)

Consumers source their information about dietary supplements from the following outlets: *(Multiple response questions, therefore total may exceed 100%)*

1. **Dogs:** from Veterinarian (65%), Internet (44%), Friends & Relatives (28%); past experience (32%); Pet store personnel (16%), Television (12%); Groomer (15%)
 2. **Cats:** from Veterinarian (47%); Internet (42%); Friends & Relatives (33%); past experience (35%); Pet store personnel (13%); Television (10%); Other (8%)
 3. **Horses:** from Veterinarian (73%); Internet (48%); past experience (60%); Breed club and societies (17%); Feed store personnel (25%), Farrier/Trainer (50%) Other
- Analysis of Survey Data
 - Veterinarians are the major source of supply to pet owners for herbal supplements
 - Veterinarians are the major source of information about using herbal supplements to pet owners
 - The market share that herbal supplements have, in comparison to more commonly used products like food, bedding, tack, collars is relatively small (average 11% for dogs, cats and horses).

The data from the above white paper concludes that the market share for herbal remedies and other alternative therapies has been growing sufficiently over the years since 1990 that this survey has been conducted, such that the APPA has now created a specific category in this survey to measure the trends in this growing segment.

Since 1990 there has been a steady growth in consumer demand for dietary supplements that contain herbal ingredients. Most consumers consult with their veterinarian regarding supplements, and most consumers purchase their dietary supplements from their veterinarian.

Thus, veterinarians are in a unique position of providing evidence based information to their clients about products they believe, based on the best information available, will augment their existing clinical protocols.

It is known that herbs can interact adversely with pharmaceutical therapies, and that not all herbs are safe or effective. Currently we lack an adequate body of evidence-based information, or Board certified veterinarians, to guide the use of herbal therapies concurrent with conventional therapies. In some cases,

herbal therapies can serve as complete substitutes, where appropriate, for conventional therapies. Without these safeguards and without a College of Veterinary Botanical Medicine to accredit board-certified specialists in herbal therapies, the consumer is left without adequate protections that would provide safe and effective options for the use of the botanical therapies that they are requesting and are currently using anyway.

The consumer, the marketplace and the Veterinary profession are ready for the establishment of the ACVBM for all of the reasons stated above. A specialty board would gather the diverse sources of information into a cohesive package; establish post-graduate training, fellowship and research opportunities; and determine criteria for, and administration of the process for certification. The overall goal of the specialty is to encourage and facilitate advanced training of veterinarians in botanical medicine to support the veterinary profession, industry (including aquaculture, dairy, swine, poultry, companion animals, equine and other production species) consumers and industry bodies such as NASC.

2. Necessary number of potential diplomates

The uniqueness of this new specialty is that it is using treatments outside of the established pharmacological research model, yet still having a strong rational basis in pharmacology. The field is rapidly growing and interest among veterinarians and students is high. For example, current membership of the Veterinary Botanical Medicine Association has doubled in less than 5 years to 260 members. More than 3000 veterinarians are trained in Chinese or Western Botanical Medicine by IVAS, Chi or VBMA. The fact that the Delphi process identified 44 veterinarians who fulfilled the AVMA criteria for membership of the organizing committee is evidence that a pool of qualified potential diplomates already exists.

3. The specialty of veterinary botanical medicine and its base of scientific knowledge and practice

There is a very large base of scientific knowledge to support this specialty including proceedings of several RVSO meetings and symposiums, textbooks, journals and journal articles.

A further indication of the growth of the discipline has been the establishment of :

- Grants have supported research in botanical medicine (for example by <http://www.ahvmf.org> have supported Dr Ronald Koh BVM MS Certified Veterinary Chinese Herbalist and Assistant Professor, LSU School of Veterinary Science currently involved in a research project: The efficacy of acupuncture and Chinese herbal medicine on survival and quality of life in dogs with multicentric lymphoma receiving CHOP chemotherapy: a randomized controlled trial. - See more at: <http://www.lsu.edu/vetmed/vcs/people/faculty/faculty/koh.php#sthash.hnPgAPMT.dpuf>).
- Scholarships (such as through the University of Tennessee scholarship in Integrative Medicine underway 7/15/2014-12/14/16 which involves substantial herbal medicine training
- Academic positions that support botanical medicine services, research or teaching in several universities including:
- Dr Keum Hwa Choi DVM, MS, PhD, CVA, MSOMD, LAc, Diplomate NCCAOM Associate professor Department of Veterinary Clinical Studies University of Minnesota one of her current research areas is herbal medicine for managing cancer cases (<http://www.vetmed.umn.edu/bio/veterinary-clinical-sciences/keum%20hwa-choi>);
- Dr Mushtaq Memon BVSc, MSc, PhD Diplomate, American College of Theriogenologists Trained in Chinese Veterinary Herbal Medicine (<http://vcs.vetmed.wsu.edu/people/faculty/h-o/memon>).
- Dr Justin Shmalberg BA DVM Diplomate, American College of Veterinary Nutrition and American College of Veterinary Sports Medicine and Rehabilitation Clinical Associate Professor and Service Chief Integrative Medicine Department of Small Animal Clinical

Sciences College of Veterinary Medicine University of Florida

(<http://www.vetmed.ufl.edu/about-the-college/faculty-directory/justin-shmalberg/>)

- Dr Christine Egger DVM MVSc Diplomate of the American College of Veterinary Anesthesia Trained in Veterinary Herbal Medicine Professor College of Veterinary Medicine The University of Tennessee and coauthor of Pain Management in Veterinary Practice which has a section on herbal medicine (<http://www.vet.utk.edu/faculty/egger.php>).
- Dr Dwight Bowman Professor of Parasitology Cornell University College of Veterinary medicine, who published Kato S, Bowman DD, Brown DL. Efficacy of *Chenopodium ambrosioides* as an anthelmintic for treatment of gastrointestinal nematodes in lambs. J. Herbs, Spices, Med. Plants 7:11-25. 2000
- Dr Dorothy Brown American College of Veterinary Surgeons, Diplomate Professor of Surgery, Department of Clinical Studies University of Pennsylvania School of Veterinary Medicine who investigated *Coriolus versicolor* in dogs Brown Dorothy Cimino, Reetz Jennifer Single agent polysaccharopeptide delays metastases and improves survival in naturally occurring hemangiosarcoma. Evidence-based complementary and alternative medicine : eCAM 2012: 384301, 2012.
- Dr Reed Holyoak DVM, PhD, DACT Professor of Theriogenology, OK State Univ Department head. Incorporates herbal approaches in the treatment of reproductive issues in horses. Published on the use of Chinese herbs in paraparesis of dogs J Trad Comp med Dec 2015.
- Dr Manuel Roberto Cortinas Assistant Professor Practice University of Nebraska Lincoln School of Veterinary Medicine has a special interest in ethno veterinary and botanical methods of parasite control and organic livestock approaches as a tool to address anthelmintic and insecticide resistance.

Current Research

Among the colleges of veterinary medicine in the U.S., Canada and Mexico, there are 3 projects recruiting or recently completed:

University of Florida: Acupuncture and Herbal Medicine for treatment of side effects during CHOP therapy. <http://research.vetmed.ufl.edu/clinical-trials/small-animal/acupuncture-and-herbal-medicine-for-treatment-of-side-effects-during-chop-therapy/>

University of Pennsylvania: Novel Therapeutic for Dogs with Cataracts.

<http://www.vet.upenn.edu/research/clinical-trials/penn-vet-clinical-trials/clinical-trial/novel-therapeutic-for-dogs-with-cataracts>

Washington State University: Clinical Effectiveness of Phycox in Elbow Osteoarthritis in Dogs.

<http://vcs.vetmed.wsu.edu/research/clinical-studies/elbow-arthritis>

Presentations including herbal medicine and plant extracts at RVSOs and Symposiums 2013-2015

ACVIM

Effect of a Supplement (SmartGut® Ultra) on Gastric Ulcer Scores and Gastric Juice pH. F. Andrews; P. Lofton; G. Gammon; P. Camacho; J. Cartmill; F. Garza Jr; M. Keowen; M. Kearney Proceedings of the ACVIM Forum, 2013, Seattle WA.

In Vitro Effects of Yunnan Baiyao (Yb) on Coagulation. K. Loyd; L.A. Cohn; S.A. Smith. Proceedings of the 2014 ACVIM Forum, Nashville TN.

ACVO

Kim SH, Lee ER, Park SW, Park S, Noh H, Seo K. Effect of Cepae extract on corneal haze after applying the modified big bubble technique in dogs. Proceedings of the ACVO, 2014, Fort Worth, TX.

Chen Y, Lin CT. The retinal protective and antioxidative effects by nutritional antioxidant supplements in high intraocular pressure induced retinal ischemia in rats. Proceedings of the ACVO, 2013, Puerto Rico.

Kado F, Guou C, Kawada H, Blessinnig K. Nutraceutical Optixcare EH ameliorates oxidative stress in rats. Proceedings of the ACVO, 2013, Puerto Rico

Miller EJ, Gemensky-Metzler AJ, Wilkie DA, Colitz CMH. Effects of grape seed extract, lutein, and omega-3 fatty acids on lens epithelial cell behavior in vitro and ex vivo. Proceedings of the ACVO, 2013, Puerto Rico

VCS

Pondugula S, Ferniany G, Ashraf F, Abott K, Flannery P, Smith B, Mansour M, Colemana E, Bird R, Smith Annette. A plant-based dietary fatty acid inhibits the growth of canine and human B-cell lymphoma cells by downregulating the activity of multidrug transporters. Proceedings of the Veterinary Cancer Society, Oct 17-19, 2013, Minneapolis, MN.

Levine C. Effects and synergy of feed ingredients on canine neoplastic cell growth. Proceedings of the Veterinary Cancer Society, 2015, Tysons VA.

ACVB

Pike AL, Horwitz DF. An open label prospective study of the use of L-theanine (anxitane) in storm sensitive client owned dogs. Proceedings of the Veterinary Behavior Symposium, July 25, 2014, Denver, CO.

WINSS

Combalin E, Sanchez C, Lambert C, Serister S, Henrotin YE. Synergistic beneficial effects of curcuma extract, green tea extract and hydrolysed collagen in bovine chondrocytes in monolayer culture. The Waltham International Nutritional Sciences Symposium, October 1-4, 2013, Portland OR.

Clero D, Feugier A, Grandjean D. Interest of a pre-exercise nutritional supplementation on working dogs serum inflammation and oxidative stress markers evolution during a standardized mid-intensity exercise. The Waltham International Nutritional Sciences Symposium, October 1-4, 2013, Portland OR.

Martineau AS, Leray V, Talbot C, Breniaux M, Ouguerramm K, Nguyen P. Effect of simultaneous omega 3 PUFA and curcumin supplementation on insulin sensitivity and plasma lipids in obese dogs. The Waltham International Nutritional Sciences Symposium, October 1-4, 2013, Portland OR.

Veterinary Text Book Titles from the last 10 years in Veterinary Herbal Medicine include:

- 2016 Practical Guide to Traditional Veterinary Chinese Medicine Equine Practice Xie H Chi Institute of Chinese Medicine
- 2014 Practical Guide to Traditional Chinese Veterinary Medicine Dr H Xie Redwing Books
- 2014 Essential Guide to Chinese Herbal Formulas Dr Steve Marsden CIVT
- 2012 Chinese Herbal Formulas for Veterinarians Drs Beebe & Salewski, Chen & Chen Redwing Books
- 2012 Chinese Veterinary Herbal Handbook Xie H, Frank L, Preast V Chi Institute of Chinese Medicine
- 2010 Xie's Chinese Veterinary Herbology Wiley-Blackwell
- 2010 Ethnoveterinary Botanical Medicine: Herbal medicines for Animal Health CRC Press
- 2007 Integrating Complementary Medicine into Veterinary practice Goldstein R Ed
- 2007 Veterinary Herbal Medicine Dr Susan Wynn, Dr B Fougere Elsevier
- 2006 Clinical Handbook of Chinese Veterinary Herbal Medicine Beebe, S., Salewski, M Herbal Medicine Press, 2006
- 2005 Psychoactive Herbs in Veterinary Behaviour Medicine Schwartz S Wiley

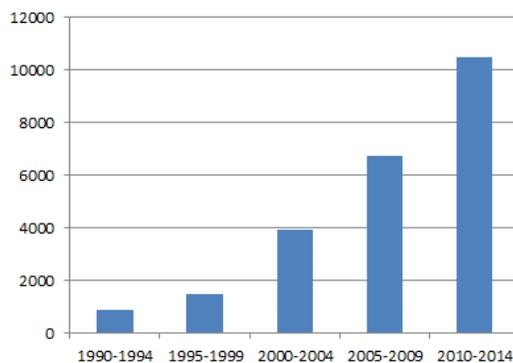
Samples of Text Book Chapter Titles from the last 5 years in Veterinary Herbal Medicine include:

- 2016 Chapter in Principles and Practices of Veterinary Technology Sirois M Chapter 19 pp 494:507
- 2014 Chapter in Veterinary Clinics of North America: Small Animal Practice Holistic Pediatric Veterinary Medicine Pages 355-366
- 2014 Chapter in Veterinary Clinics of North America: Small Animal Practice Advances in Veterinary Oncology Evidence Based Integrative Medicine in Clinical Veterinary Oncology pp831-855
- 2014 Chapter in BSAVA manual of canine and feline neurology Treatment of neurological disorders with traditional Chinese veterinary medicine. Chrisman, C. L. Pages: 496-507
- 2014 Chapter in Pain management in veterinary practice. Egger, C. M. ; Love, L. ; Doherty, T. Chapter 15 Traditional Chinese Herbal Medicine and Homeopathy in Pain Management practice Pages: xiii + 447 pp. Wiley Blackwell
- 2014 Chapter in Anthelmintics: Clinical Pharmacology, Uses in Veterinary Medicine and Efficacy Quick W. pp,89-108 ,pp,155-176
- 2013 Chapter in Veterinary Clinics of North America: Small Animal Practice Jeanne B. Budgin, Molly J. Flaherty Alternative Therapies in Veterinary Dermatology Pages 189-204
- 2013 Chapter in Behaviour Problems of the Dog Landsberg G, Hunthausen W, Ackerman L Chapter 9 Complementary and Alternative Therapies for behaviour problems. Saunders Elsevier
- 2011 Chapter in Complementary Medicine for Veterinary Technicians and Nurses Scanlan N Chapter 10 Wiley Blackwell

Journal Publications.

Further, over the last 15 years there has been an increasing publication of research on plant extracts in animals, with more than 10000 studies published from 2010 to 2014 alone.

Table 1. Publications in pub med, plant extracts and animals for each 5 year period since 1990.



Publications since 1990 include over 2000 systematic reviews and meta-analyses using animal models. Recent examples in 2016 include the use animal models and herbal and plant products in:

- Inflammatory bowel disease⁴³
- Asthmatic inflammation⁴⁴
- Ischemic stroke⁴⁵
- Neurodegenerative diseases⁴⁶

The scientific evidence and publications regarding veterinary herbal medicine is growing. The scientific basis of *in vivo* studies that elucidate mechanisms of action of botanical medicines and their constituents coupled with *in vitro* studies provides a solid scientific basis and supports the claim that this speciality is distinct and identifiable. Included in this petition is a list of 12 selected whole papers (Appendix VIII) demonstrating a broad range of research in the use of botanical plants and extracts in veterinary medicine and published abstracts from USA, European and Australian journals from the last ten years (Appendix IX). These pertain directly to *in vivo* studies and a few selected *in vitro* studies in veterinary medicine (such as a recent one on yunnan baiyao in canine hemangiosarcoma cells⁴⁷) and we have excluded the many thousands of laboratory animal studies forming a strong scientific case for pocket pets. This sample of published materials demonstrates the broad extent and application of science related to veterinary herbal medicine. Journals publishing articles are outlined for each veterinary medicine area following:

Veterinary botanical medicine and Aquaculture

Journals publishing peer reviewed studies on plant medicine for fish disease and health

- Aquaculture
- J Applied Ichthyology
- Veterinary Parasitology

⁴³ Triantafyllidis JK, Triantafyllidi A, Vagianos C, Papalois A. Favorable results from the use of herbal and plant products in inflammatory bowel disease: evidence from experimental animal studies. *Ann Gastroenterol*. 2016 Jul-Sep;29(3):268-81.

⁴⁴ Liu F¹, Xuan NX¹, Ying SM¹, Li W¹, Chen ZH¹, Shen HH². Herbal Medicines for Asthmatic Inflammation: From Basic Researches to Clinical Applications. *Mediators Inflamm*. 2016;2016:6943135.

⁴⁵ Seto SW, Chang D, Jenkins A, Bensoussan A, Kiat H. Angiogenesis in Ischemic Stroke and Angiogenic Effects of Chinese Herbal Medicine. *J Clin Med*. 2016 Jun 6;5(6)

⁴⁶ Solanki I, Parihar P, Parihar MS. Neurodegenerative diseases: From available treatments to prospective herbal therapy. *Neurochem Int*. 2016 May;95:100-8.

⁴⁷ Wirth KA, Kow K, Salute ME, Bacon NJ, Milner RJ. In vitro effects of Yunnan Baiyao on canine hemangiosarcoma cell lines. *Vet Comp Oncol*. 2014 Jun 29.

- Fish and Shellfish Immunology
- Fish Physiology and Biochemistry
- Journal of Fish Diseases
- Veterinary Pharmacology and Therapeutics
- North American Journal of Aquaculture

A recent (2015) review in Veterinary Pharmacology and Therapeutics reports promising effects of many herbal medicines for treating parasitic diseases caused by protozoa and metazoan, and broad activity against bacteria and fungi. The review lists the main findings and methodologies of the latest research on herbal medicines to stimulate and accelerate research recognizing the current issues regarding indiscriminate use of chemicals and antibiotics in aquaculture⁴⁸. For example Valladao et al. (2015) were successful in treating severe cases of ichthyophthiriasis in *Piaractus mesopotamicus* fish using two-hour daily baths of the essential oil of *M. alternifolia* for five days, which shows that this has great potential for use in aquaculture⁴⁹. Likewise a review of the use of immunostimulant herbs in aquaculture as an alternative to drugs, chemicals, growth promoters and antibiotics concludes they can be used as alternatives to these agents primarily because they are easily obtained, inexpensive, act against a broad range of pathogens and are biodegradable⁵⁰.

Appendix IX-A outlines the abstracts of 14 recent journal articles demonstrating the importance of botanical medicines in aquaculture and supported by a further 35 journal titles published since 2010 from a possible 350 articles published in the last 5 years on plant extracts and fish.

Veterinary botanical medicine and Small Animals

Journals publishing peer reviewed studies on plant medicine for canine and feline medicine

- American Journal Veterinary Research
- Veterinary Dermatology
- The Veterinary Journal
- Journal of Feline Medicine and Surgery
- Applied Animal Behavior Science
- Journal of Veterinary internal Medicine
- Journal Applied Animal Research
- Veterinary Comparative Oncology
- Journal Veterinary Pharmacology and Therapeutics
- Veterinary Clinics of North America Small Animal

Human use of botanical medicines often informs research for veterinary use. Chou et al (2016) reported on the efficacy of cranberry extract for urinary tract conditions in dogs. An *in vivo* and *in vitro* component of the study on 12 dogs with a history of recurrent UTI demonstrated that oral administration of cranberry extract in 6 dogs prevented development of UTI in patients and adherence of E Coli to kidney cells and

⁴⁸Valladao G, Gallani S, Pilarski F Phytotherapy as an alternative for treating fish disease J Vet Pharmacol Therap 38 417-428 2015.

⁴⁹ Valladão GM, Gallani SU, Ikefuti CV, da Cruz C, Levy-Pereira N, Rodrigues MV, Pilarski F. Essential oils to control ichthyophthiriasis in pacu, *Piaractus mesopotamicus* (Holmberg): special emphasis on treatment with *Melaleuca alternifolia*. J Fish Dis. 2016 Jan 18.

⁵⁰ Galina J, Yin G, Ardo L, Jeney Z The use of immunostimulating herbs in fish. An overview of research Fish Physiol Biochem 2009 35:669-676

compared equally to antibiotics over 6 months⁵¹. The potential for cranberry in the management of recurrent UTIs is promising in the era of antibiotic resistance.

Some of the challenging clinical cases such as atopic skin disease may benefit from traditional botanical medicine. Marsella et al (2010) reported in *Veterinary Dermatology* on a multicentre trial undertaken with the University of Florida, the Animal Dermatology Clinic (San Diego, CA), Colorado State University and the Veterinary Referral Center of Colorado. It involved the use of a powdered formulation of the fruit *Actinidia arguta* (hardy kiwi). This fruit has been traditionally used for health in traditional Asian medicine. In this randomized, placebo controlled trial involving 76 dogs, the preparation was found to be a promising treatment for mild to moderate canine atopic dermatitis when used for 8 weeks. While the molecular mechanism underlying the therapeutic effects remains to be elucidated it was well tolerated and no clinical adverse effects were reported⁵².

Similarly another proprietary formula consisting of three herbs used in both Chinese and Western botanical medicine, *Rehmannia glutinosa*, *Paeonia lactiflora* and *Glycyrrhiza uralensis* was investigated by Ferguson et al (2006) and reported in *Veterinary Dermatology* for treatment of atopic dermatitis in 120 dogs in a randomized, double-blind, placebo controlled, parallel group design, large-scale study. The efficacy of the combined formula was demonstrated to be at least as good as, and in many cases superior to, that reported for other systemic steroid-sparing agents that are administered to dogs with AD, such as antihistamines, pentoxifylline, aroxylline, leukotriene inhibitors and misoprostol. This study was a follow up to a previous study on the same combination that demonstrated reduced erythema and pruritus in canine AD with mild diarrhoea and flatulence observed in a small minority of dogs supporting the safety of the formula⁵³.

Further in 2010, Schmidt et al reported in *Veterinary Dermatology* a double-blind randomized placebo-controlled trial including 22 dogs that demonstrated that the same formula containing *Rehmannia glutinosa*, *Paeonia lactiflora* and *Glycyrrhiza uralensis* was can be an effective glucocorticoid sparing agent in canine atopic dermatitis⁵⁴.

More recently in *The Veterinary Journal* Blaskovic et al (2014) reported on 48 dogs diagnosed with atopic dermatitis that were included in a randomized, double-blinded, placebo-controlled, multicentre clinical trial. Dogs were treated with a topical formulation containing PUFAs and essential oils including neem oil, rosemary extract, lavender oil, clove oil, tea tree oil, oregano extract, peppermint extract and cedar bark extract or placebo once weekly for 8 weeks. There was significantly more improvement in pruritus scores in the treatment group than in the placebo. No adverse reactions were observed. The study concluded it was safe and beneficial in ameliorating the clinical signs of atopic dermatitis⁵⁵.

⁵¹ Chou HI, Chen KS, Wang HC, Lee WM. Effects of cranberry extract on prevention of urinary tract infection in dogs and on adhesion of *Escherichia coli* to Madin-Darby canine kidney cells. *Am J Vet Res.* 2016 Apr;77(4):421-7.

⁵² Marsella R, Messinger L, Zabel S, Rosychuck R, Griffin C, Cronin PO, Belofsky G, Lindemann J, Stull D. A randomized, double-blind, placebo-controlled study to evaluate the effect of EFF1001, an *Actinidia arguta* (hardy kiwi) preparation, on CADESI score and pruritus in dogs with mild to moderate atopic dermatitis. *Vet Dermatol.* 2010 Feb;21(1):50-7.

⁵³ Nagle TM, Torres SM, Horne KL et al. A randomized, double-blind, placebo-controlled trial to investigate the efficacy and safety of a Chinese herbal product (P07P) for the treatment of canine atopic dermatitis. *Veterinary Dermatology* 2001; 12: 265–74

⁵⁴ Schmidt V¹, McEwan N, Volk A, Helps J, Morrell K, Nuttall T. The glucocorticoid sparing efficacy of Phytopica in the management of canine atopic dermatitis. *Vet Dermatol.* 2010 Feb;21(1):96-105.

⁵⁵ M. Blaskovic , W. Rosenkrantz , A. Neuber , C. Sauter-Louis , R.S. Mueller , The effect of a spot-on formulation containing polyunsaturated fatty acids and essential oils on dogs with atopic dermatitis *The Veterinary Journal* 199 (2014) 39–43

In recognition of some of the limitations of antibiotics and antifungals in small animal conditions, essential oils from plants have also been investigated for their potential use in veterinary medicine, including a randomised controlled trial (Kim et al 2009) in 11 dogs with otitis externa, where essential oils were compared favourably to antibiotics⁵⁶; Nardoni et al (2016) reported in the Journal of Feline Medicine and Surgery a comparative open field study involving 14 cats with *Microsporum canis*. The study compared an essential oil based shampoo containing *Thymus serpyllum* (2%), *Origanum vulgare* and *Rosmarinus officinalis* (5% each) and oral itraconazole was as effective as a conventional treatment (oral itraconazole + 2% miconazole/2% chlorhexidine shampoo) concluding that the natural treatment would seem an interesting, natural alternative to conventional topical treatment⁵⁷.

Likewise essential oils of Citrus aurantium 1%, Lavandula officinalis 1%, Origanum vulgare 0.5%, Origanum majorana 0.5%, Mentha piperita 0.5% and Helichrysum italicum var. italicum 0.5%, in sweet almond oil and coconut oil in a commercial product Malacalm was investigated by Nardoni et al (2014) for the treatment of *Malassezia pachydermatis*. The treatment was compared to placebo and to conventional therapy (based on ketoconazole 10 mg/kg/day and chlorhexidine 2% twice a week for 3 weeks) in a randomised controlled trial. At the end of the treatment trial, both treatment groups improved significantly without adverse events. In follow-up on day 180, recurrence of clinical signs was observed in all the subjects treated conventionally, but none of those dogs treated with the essential oil formula had recurrence. The study concluded that the formula appeared to be a safe tool for limiting recurrences of this condition⁵⁸.

Essential oils have also been investigated for their effects on small animal behaviour. In the Journal of the American Veterinary Medical Association, Wells (2006) reported on the use of lavender essential oil to reduce travel-induced excitement in dogs associated with travel. 32 dogs were exposed to car travel without lavender oil and compared to travel with lavender oil and their behaviour quantified. Dogs spent significantly more time resting and sitting and less time moving and vocalizing during the experimental condition⁵⁹. Graham et al (2005) reported in Applied Animal Behaviour Science⁶⁰ on the influence of essential oil olfactory stimulation (control, lavender, chamomile, rosemary and peppermint) on the behaviour of 55 dogs housed in a rescue shelter. It is suggested that the welfare of sheltered dogs may be enhanced through exposure to appropriate forms of olfactory stimulation. Lavender and chamomile were particularly beneficial, resulting in activities suggestive of relaxation and behaviours that are considered desirable by potential adopters. More recently Ellis and Wells (2010) identified catnip rather than lavender as being a herb that may hold potential as environmental enrichment for captive domestic cats⁶¹.

Finding alternatives to chemical parasiticides has led to the development of a number of commercial products using botanicals. A study reported in Parasitology Research 2008 (Abdel-Ghaffar et al)

⁵⁶ Sang-Hun Kim¹, Suk Kim², Hyung-Kyou Jun¹, Duck-Hwan Kim¹,* Efficacy of aromatherapy for the treatment of otitis externa in dogs Korean J Vet Res(2009) 49(1) : 85~89

⁵⁷ Nardoni S, Costanzo AG, Mugnaini L, Pisseri F, Rocchigiani G, Papini R, Mancianti F. An open-field study comparing an essential oil-based shampoo with miconazole/chlorhexidine for hair coat disinfection in cats with spontaneous microsporiasis. J Feline Med Surg. 2016 Jan 18.

⁵⁸ S. Nardoni , L. Mugnaini , L. Pistelli , M. Leonardi , V. Sanna , S. Perruccia , F. Pisseri , F. Mancianti Clinical and mycological evaluation of an herbal antifungal formulation in canine Malassezia dermatitis Journal de Mycologie Médicale (2014) 24, 234–240

⁵⁹ Wells DL. Aromatherapy for travel-induced excitement in dogs. J Am Vet Med Assoc. 2006 Sep 15;229(6):964-7.

⁶⁰ Graham L, Wells D, Hepper P The influence of olfactory stimulation on the behaviour of dogs housed in a rescue shelter Applied Animal Behaviour Science 91 (2005) 143–153

⁶¹ Ellis S, Wells D The influence of olfactory stimulation on the behaviour of cats housed in a rescue shelter Applied Animal Behaviour Science 123 (2010) 56–62

discussed the concerns about indiscriminate use of parasiticides that may pollute the environment, but also adversely affects the animal and human health. In this uncontrolled study 10 dogs infested with *S. scabiei* mites were treated with a neem seed shampoo derived from the neem tree (*Azadirachta indica*) that was shown to be effective against sarcoptic mange in dogs. 80% of dogs had hair regrowth and no clinical signs at 2 weeks. The remaining 20% showed only moderate mite counts and improved clinical signs. Furthermore, the topical treatment with neem seed extract shampoo was well tolerated and safe⁶².

More recently an interest in herbal medicines for integrative cancer care has led to studies including Yunnan Bai Yao (Chinese medicine) as a potential adjunctive therapy for canine hemangiosarcoma through the University of Florida Veterinary School⁶³ published in *Veterinary Comparative Oncology* and in 2011 at the University of Pennsylvania Veterinary School with coriolus (a fungal botanical medicine) shown to improve quality of life and outcomes in dogs with hemangiosarcoma⁶⁴.

The growing publication of studies in veterinary and allied journals attests to the recognition that botanical medicines offer the potential to improve treatment of many common conditions that affect cats and dogs. There are over 400 journal articles published on plant extracts and canine and feline research. Studies in animals have led to improvements in the treatment of human diseases as well. It should also be acknowledged that dogs are often used as models for studying the effects of botanical medicines of humans. For example *H. hirsute* has been demonstrated to have cholesterol lowering effects in dogs (van Dooren et al 2015)⁶⁵. *Calendula officinalis* has been used to treat acetic acid induced ulcerative colitis in German Shepherds as a model for the human disease. 10 dogs were randomly allocated to receive a placebo of saline or calendula via enema, and calendula was effective in resolving the ulceration⁶⁶.

Appendix IX-B outlines the abstracts of 25 recent journal articles demonstrating the broad range of studies of botanical medicines in canine and feline medicine and supported by a further 30 journal titles published in the last 10 years on plant extracts and canine or feline.

Veterinary Botanical Medicine and Cattle including Dairy

Journals publishing peer-reviewed studies on plant medicine for cattle medicine

- BMS Veterinary Research
- Research in Veterinary Science
- Journal Dairy Science
- American Journal of Animal and Veterinary Science
- Canadian Veterinary Journal
- Veterinary immunology and Immunopathology
- Animal Feed Science and Technology
- Animal Reproduction Science

⁶² Abdel-Ghaffar F, Al-Quraishy S, Sobhy H, Semmler M. Neem seed extract shampoo, Wash Away Louse, an effective plant agent against *Sarcoptes scabiei* mites infesting dogs in Egypt. *Parasitol Res.* 2008 Dec;104(1):145-8

⁶³ Wirth KA, Kow K, Salute ME, Bacon NJ, Milner RJ. In vitro effects of Yunnan Baiyao on canine hemangiosarcoma cell lines. *Vet Comp Oncol.* 2014 Jun 29.

⁶⁴ Brown DC, Reetz J. Single agent polysaccharopeptide delays metastases and improves survival in naturally occurring hemangiosarcoma. *Evid Based Complement Alternat Med.* Volume 2012, Article ID 384301, 8 pages

⁶⁵ van Dooren I, Faouzi Mel A, Foubert K, Theunis M, Pieters L, Cherrah Y, Apers S. Cholesterol lowering effect in the gall bladder of dogs by a standardized infusion of *Herniaria hirsuta* L. *J Ethnopharmacol.* 2015 Jul 1;169:69-75.

⁶⁶ Mehrabani D, Ziaei M, Hosseini SV, Ghahramani L, Bananzadeh AM, Ashraf MJ, Amini A, Amini M, Tanideh N The effect of *calendula officinalis* in therapy of acetic Acid induced ulcerative colitis in dog as an animal model. *Iran Red Crescent Med J.* 2011 Dec;13(12):884-90.

- Veterinary Parasitology
- Journal Veterinary Internal Medicine
- Theriogenology
- Livestock Science
- Journal of Parasitic Diseases
- International Journal of Environmental Research and Public Health

Non-antibiotic treatments are needed in organic dairy herds⁶⁷ that has prompted a plethora of studies on botanical medicines and plant compounds such as essential oils⁶⁸ and proprietary botanical formulas⁶⁹ for the treatment of mastitis. More broadly though, the use of antibiotics is being increasingly discouraged in the dairy industry because their presence in dairy milk may have potential downstream effects on population health and the agri-food chain⁷⁰.

Analysis of the published literature including the Journal of Dairy Science and a review in Natural Products Communication Journal (Mullen et al 2014; Taga et al 2012) shows that many botanical medicines including essential oils have significant antibacterial, antifungal and anti-inflammatory effects. A recent study through the Texan A & M & Florida Schools of Veterinary medicine and published in the Canadian Veterinary Journal evaluated a combination botanical product containing Western herbs for intramammary treatment of mastitis and demonstrated a faster recovery for the treatment group compared to the control group with median intervals from end of treatment to recovery of 4.6 d and 6.5 d, respectively⁷¹. A similar study showed a benefit with the Chinese herb *Panax ginseng* via intra mammary administration. Results indicated an immunomodulatory effect and the study concluded the beneficial effect of the extract could be used as alternative therapy in the control of mastitis at drying off, either alone or in conjunction with dry cow antibiotic therapy published in Veterinary immunology and Immunopathology⁷².

Another area of investigation is the use of botanical medicines as alternatives to anthelmintics. A recent study published in the Journal of Parasitic Diseases demonstrated that the anthelmintic efficacy of crude neem (*Azadirachta indica*) leaf powder against strongyle infections in cattle was equivalent to fendendazole when compared to infected untreated controls. It was concluded that crude neem leaf powder has anthelmintic property and it can further be studied to isolate the active component to produce herbal anthelmintics⁷³. In the International Journal of Environmental Research and Public Health study on the potential of botanical medicines to protect human health investigated the influence of neem

⁶⁷ Mullen KA, Lee AR, Lyman RL, Mason SE, Washburn SP, Anderson KL. Short communication: an in vitro assessment of the antibacterial activity of plant-derived oils. J Dairy Sci. 2014 Sep;97(9):5587-91

⁶⁸ Taga I, Lan CQ, Altosaar I. Plant essential oils and mastitis disease: their potential inhibitory effects on pro-inflammatory cytokine production in response to bacteria related inflammation. Nat Prod Commun. 2012 May;7(5):675-82. Review.

⁶⁹ Pinedo P, Karreman H, Bothe H, Velez J, Risco C Efficacy of a botanical preparation for the intramammary treatment of clinical mastitis on an organic dairy farm. Can Vet J. 2013 May;54(5):479-84.

⁷⁰ Taga I, Lan CQ, Altosaar I Plant essential oils and mastitis disease: their potential inhibitory effects on pro-inflammatory cytokine production in response to bacteria related inflammation. Nat Prod Commun. 2012 May;7(5):675-82. Review.

⁷¹ Pinedo P, Karreman H, Bothe H, Velez J, Risco C Efficacy of a botanical preparation for the intramammary treatment of clinical mastitis on an organic dairy farm. Can Vet J. 2013 May;54(5):479-84.

⁷² Baravalle C¹, Dallard BE, Cadoche MC, Pereyra EA, Neder VE, Ortega HH, Calvinho LF. Proinflammatory cytokines and CD14 expression in mammary tissue of cows following intramammary inoculation of *Panax ginseng* at drying off. Vet Immunol Immunopathol. 2011 Nov 15;144(1-2):52-60.

⁷³ Jamra N, Das G, Singh P, Haque M. Anthelmintic efficacy of crude neem (*Azadirachta indica*) leaf powder against bovine strongylosis. J Parasit Dis. 2015 Dec;39(4):786-8.

(*Azadirachta indica*) materials (leaf, bark, and oil) on the survival of a strain of *E Coli* (Ec0157) in dairy manure : the neem leaf and bark supplements eliminated the pathogen in less than 10 days with a D-value (days for 90% elimination) of 1.3 d. In contrast, nearly 4 log CFU EcO157/g remained after 10 d in neem-free manure control. Control of this pathogen at the source (manure) are critical as produce crops are often grown in proximity to animal raising operations. The study concluded application of inexpensive neem supplements to control pathogens in manure and possibly in produce fields may be an option for controlling the transfer of foodborne pathogens from farm to fork⁷⁴.

Appendix IX-C outlines the abstracts of 25 recent journal articles demonstrating the amount of literature on botanical medicines for mastitis in dairy cattle medicine as well as a few studies on metritis and retained placenta. We have included a sample of recent literature, mainly *in vivo* and a few interesting *in vitro* studies from over 400 possible articles published in the last 10 years on plant extracts and cattle.

Veterinary Botanical Medicine and Equids

Journals publishing peer reviewed studies on plant medicine for equine medicine

- Equine Veterinary Journal
- Veterinary Parasitology
- American Journal of Veterinary Research
- Canadian Veterinary Journal
- Compendium Continuing Education
- Veterinary Journal
- Parasitology Research

Despite the 500% growth in herbal administrations to horses over the past 16 years⁷⁵ published research on equids and botanical medicine is still relatively limited. A review by Williams et al 2008 in Veterinary Journal pertinent to herbal supplementation in horses discussed several equine studies including one where *Panax ginseng* has been found to exert an inhibitory effect on pro-inflammatory cytokines and cyclooxygenase-2 expression; that equine studies have tested the anti-inflammatory effects of a single dose of ginger, post-exercise; echinacea was reported to have anti-inflammatory and antioxidant properties; yucca contains steroid-like saponins, which produce anti-inflammatory, antioxidant and anti-spasmodic effects and horses fed garlic at >0.2g/kg per day developed Heinz body anaemia⁷⁶. Another study suggested that Sea Buckthorn berry may be efficacious in the prevention of worsening of non-glandular gastric ulcers in horses during times of stress⁷⁷. These point to potential benefits in equine health.

The recognition of the potential of botanical medicine to improve equine health care and expand treatment options is further exemplified by investigations into multiple plant agents for challenging conditions such as *Prunella vulgaris* for equine infectious anemia virus (EIAV)⁷⁸, and a review by

⁷⁴ Ravva SV, Korn A. Effect of Neem (*Azadirachta indica*) on the Survival of Escherichia coli O157:H7 in Dairy Manure. Int J Environ Res Public Health. 2015 Jul 10;12(7):7794-803.

⁷⁵ Silver R, Bookout B, Karreman H Documentation of Trends in the Public Acceptance of Botanical Therapies: Consumer Buying Patterns, patterns of Use and Industry Correlates Jan 2016

⁷⁶Williams CA, Lamprecht ED. Some commonly fed herbs and other functional foods in equine nutrition: a review. Vet J. 2008 Oct;178(1):21-31.

⁷⁷ Reese RE, Andrews FM, Elliott SB, et al. The effect of seabuckthorn berry extract (Seabuck Complete) on prevention and treatment of gastric ulcers in horses. Presented at the Proceedings of the 9th International Equine Colic Research Symposium, Liverpool. June 8–11, 2008.

⁷⁸ Brindley MA, Widrlechner MP, McCoy JA, Murphy P, Hauck C, Rizshsky L, Nikolau B, Maury W Inhibition of lentivirus replication by aqueous extracts of *Prunella vulgaris*. Virol J. 2009 Jan 20;6:8

Tinworth et al 2010 in Veterinary Record on the potential for botanical medicines to manage insulin resistance and hyperinsulinaemia in non-obese horses based on human and laboratory animal data⁷⁹.

More recent studies have explored the use of plant medicines for the management of ecto and endo parasites, including the use of essential oils for donkey lice published in the Equine Veterinary Journal in 2016⁸⁰ and plants showing significant anthelmintic activity against strongyle nematodes published in Veterinary Parasitology 2015⁸¹.

Chinese Herbal Medicine for equine reproductive management and respiratory disease has been discussed in the Compendium for Continuing Education (2011)⁸².

Appendix IX-D outlines the abstracts of 22 recent journal articles demonstrating selected publications on botanical medicine research on equids.

Veterinary Botanical Medicine for Goats and Sheep

Journals publishing peer-reviewed studies on plant medicine for caprine and ovine medicine

- Veterinary Parasitology
- Research Veterinary Science
- Parasitology Research
- Tropical Animal Health Production
- Journal Dairy Science
- Animal Science Journal

Terrill et al 2012 highlight the research trends in ovine medicine by stating that anthelmintic resistance is reaching epidemic proportions in small ruminants in the U.S. and that non-chemical control alternatives are critically needed. They describe the generally warm, moist environmental conditions in the southern United States (U.S.) as ideal for survival and growth of the egg and larval stages of *Haemonchus contortus* and other gastrointestinal nematodes (GIN) of sheep and goats. Critically, infection with GIN is the greatest threat to economic small ruminant production in this region. They also highlight the emerging markets for grass-fed and organic livestock⁸³.

A global focus on botanical medicine- plant extracts for the management of gastrointestinal parasites is exemplified by a 2014 review by Mbaya et al, show that extracts of various species of medicinal plants have shown significant *in-vivo* and *in-vitro* pharmacological activities against ecto, endo and haemoparasites. They point out that the scientific evaluations of the use of the plants as antiparasitic agents were based on the claims of ethnoveterinary medicine. The pharmacological activities of these plants were associated with the presence of various bioactive compounds such as alkaloids, flavonoids, saponins, glycosides, allicinine, harmala, harmaline, harman, tetrahydroharman, ursolic acid, terpenes,

⁷⁹ Tinworth KD¹, Harris PA, Silence MN, Noble GK. Potential treatments for insulin resistance in the horse: a comparative multi-species review. *Vet J.* 2010 Dec;186(3):282-91.

⁸⁰ Ellse L, Sands B, Burden FA, Wall R. Essential oils in the management of the donkey louse, *Bovicola ocellatus*. *Equine Vet J.* 2016 May;48(3):285-9.

⁸¹ Peachey LE, Pinchbeck GL, Matthews JB, Burden FA, Mulugeta G, Scantlebury CE, Hodgkinson JE. An evidence-based approach to the evaluation of ethnoveterinary medicines against strongyle nematodes of equids. *Vet Parasitol.* 2015 May 30;210(1-2):40-52.

⁸² Shmalberg J, Xie H. Acupuncture and Chinese herbal medicine for treating orses. *Compend Contin Educ Vet.* 2011 May;33(5):E1-11.

⁸³ Terrill TH, Miller JE, Burke JM, Mosjidis JA, Kaplan RM. Experiences with integrated concepts for the control of *Haemonchus contortus* in sheep and goats in the United States. *Vet Parasitol.* 2012 May 4;186(1-2):28-37.

tannins, phenolic compounds, embelin and brucine. In the *in-vivo* studies, plant extracts were tested using animal models such as mice, sheep, goats, cattle and dogs⁸⁴.

Botanical medicines are also finding potential in reducing lamb mortality and improving ewe performance (Smeti et al 2015)⁸⁵; improving ewe milk production (Giannenas et al 2011)⁸⁶ possibly through activity on the rumen microbiota in work conducted with the Department of Animal Sciences, The Ohio State University (Cobellis et al 2016)⁸⁷; providing alternatives to blow fly control (Callander et al 2012)⁸⁸ and lice treatment (James et al 2012)⁸⁹ and ovine dermatophytosis (Mugnaini et al 2013)⁹⁰.

Appendix IX-E outlines a sample of 8 abstracts and 34 references of 446 journal articles published on the anthelmintic activity of plant extracts in sheep and goats

Veterinary Botanical Medicine for Poultry

Journals publishing peer-reviewed studies on plant medicine for poultry.

- Poultry Science
- British Journal Poultry Science
- Research in Veterinary Science
- Parasitology Research
- Parasitology
- Avian Disease
- Canadian Journal of Veterinary Research
- Journal Applied Toxicology
- Journal of the Science of Food and Agriculture
- Animal Science Journal
- Virology Journal
- Annals of Agriculture and Environmental Medicine
- Biological and Pharmaceutical Bulletin
- Pharmaceutical Biology
- Biological Research

⁸⁴ Mbaya AW, Ogwiji M. In-vivo and In-vitro activities of medicinal plants on ecto, endo and haemoparasitic infections: a review. *Curr Clin Pharmacol.* 2014;9(3):271-82. Review.

⁸⁵ Smeti S, Joy M, Hajji H, Alabart JL, Muñoz F, Mahouachi M, Atti N. Effects of *Rosmarinus officinalis* L. essential oils supplementation on colostrum production of dairy ewes and lamb mortality and growth. *Anim Sci J.* 2015 Jul;86(7):679-88.

⁸⁶ Giannenas I, Skoufos J, Giannakopoulos C, Wiemann M, Gortzi O, Lalas S, Kyriazakis I. Effects of essential oils on milk production, milk composition, and rumen microbiota in Chios dairy ewes. *J Dairy Sci.* 2011 Nov;94(11):5569-77.

⁸⁷ Cobellis G, Yu Z, Forte C, Acuti G, Trabalza-Marinucci M Dietary supplementation of *Rosmarinus officinalis* L. leaves in sheep affects the abundance of rumen methanogens and other microbial populations. *J Anim Sci Biotechnol.* 2016 Apr 27;7:27.

⁸⁸ Callander JT, James PJ. Insecticidal and repellent effects of tea tree (*Melaleuca alternifolia*) oil against *Lucilia cuprina*. *Vet Parasitol.* 2012 Mar 23;184(2-4):271-8

⁸⁹ James PJ, Callander JT. Dipping and jetting with tea tree (*Melaleuca alternifolia*) oil formulations control lice (*Bovicola ovis*) on sheep. *Vet Parasitol.* 2012 Oct 26;189(2-4):338-43.

⁹⁰ Mugnaini L, Nardoni S, Pistelli L, Leonardi M, Giuliotti L, Benvenuti MN, Pisseri F, Mancianti F. A herbal antifungal formulation of *Thymus serpyllum*, *Origanum vulgare* and *Rosmarinus officinalis* for treating ovine dermatophytosis due to *Trichophyton mentagrophytes*. *Mycoses.* 2013 May;56(3):333-7.

A recent review on botanical alternatives to antibiotics for use in organic poultry production highlights the issues of antibiotic resistance (from sub therapeutic use of antibiotics in poultry feed) and consumer concerns of residue contamination and antibiotic resistant bacterial pathogens in the USA (Diaz-Sanchez et al 2015)⁹¹. Similar concerns have led to a ban on antibiotic use in Europe since 2006 (Varmuzova et al 2015)⁹².

In a 2010 review on dietary plant bioactives in poultry health and productivity the authors state there is increasing evidence indicating that plant medicines can be efficient in controlling poultry diseases and may also influence production parameters such as feed efficiency and product quality and replicate some of the effects of antibiotic growth promoters (Wallace et al 2010)⁹³. Chinese herbal medicines have been investigated for their effects on common diseases in poultry for example common formulas are known to be immunomodulating (Li et al 2013)⁹⁴ and herbs are a rich source of lead compounds for antiviral treatments including Marek's (Sun et al 2014)⁹⁵. Ginseng has been shown to have activity against Infectious Bursal Disease (IBD), caused by infectious bursal disease virus (IBDV) which is of global economic importance in poultry. Oral administration of a ginseng extract enhances both humoral and gut mucosal immune responses to IBD vaccination and offers a better protection against virulent IBDV challenge and therefore might be a promising oral adjuvant for vaccination against infectious diseases in poultry (Zhai et al 2014)⁹⁶. Hypericum perforatum was shown to have a protective effect against unvaccinated chickens infected with IBDV with significant therapeutic efficacy (Shang et al 2012)⁹⁷.

Bozkurt et al 2013 review the use of botanical extracts in the control of coccidial infection in poultry with some plants and their respective volatile oils and extracts having the potential to alleviate coccidiosis and reduce its severity⁹⁸. The use of plant extracts to control poultry helminths is also increasing and herbs like ginger and curcumin have been shown (*in vivo*) to have potential anthelmintic effects against *Ascaridia galli* (Bazh et al 2013)⁹⁹. There is also a growing interest in the use of essential oils to control ectoparasites. In particular the economic impact of the poultry red mite, *Dermanyssus gallinae* as well as the lack of new acaricides and the occurrence of resistance and tighter legislation have driven research in this area (Nechita et al 2015)¹⁰⁰. Aflatoxins are also a concern in poultry production and plants such as

⁹¹ Diaz-Sanchez S, D'Souza D, Biswas D, Hanning I. Botanical alternatives to antibiotics for use in organic poultry production. *Poult Sci.* 2015 Jun;94(6):1419-30.

⁹² Varmuzova K, Matulova ME, Gerzova L, Cejkova D, Gardan-Salmon D, Panhéleux M, Robert F, Sisak F, Havlickova H, Rychlik I. Curcuma and Scutellaria plant extracts protect chickens against inflammation and Salmonella Enteritidis infection. *Poult Sci.* 2015 Sep;94(9):2049-58.

⁹³ Wallace RJ¹, Oleszek W, Franz C, Hahn I, Baser KH, Mathe A, Teichmann K. Dietary plant bioactives for poultry health and productivity. *Br Poult Sci.* 2010 Aug;51(4):461-87

⁹⁴ Li XT, Wang B, Li JL, Yang R, Li SC, Zhang M, Huang W, Cao L. Effects of Dangguibuxue Tang, a Chinese herbal medicine, on growth performance and immune responses in broiler chicks. *Biol Res.* 2013;46(2):183-8.

⁹⁵ Sun Y, Niu L, Song M, Zhao X, Sun N, He J, Wu C, Jiang J, Bai Y, Guo J, Li H. Screening compounds of Chinese medicinal herbs anti-Marek's disease virus. *Pharm Biol.* 2014 Jul;52(7):841-7.

⁹⁶ Zhai L, Wang Y, Yu J, Hu S. Enhanced immune responses of chickens to oral vaccination against infectious bursal disease by ginseng stem-leaf saponins. *Poult Sci.* 2014 Oct;93(10):2473-81.

⁹⁷ Can J Vet Res. 2012 Jul;76(3):180-5. Hypericum perforatum extract therapy for chickens experimentally infected with infectious bursal disease virus and its influence on immunity. Shang R, He C, Chen J, Pu X, Liu Y, Hua L, Wang L, Liang J.

⁹⁸ Bozkurt M¹, Giannenas I, Küçükyılmaz K, Christaki E, Florou-Paneri P. An update on approaches to controlling coccidia in poultry using botanical extracts. *Br Poult Sci.* 2013;54(6):713-27.

⁹⁹ Bazh EK, El-Bahy NM. In vitro and in vivo screening of anthelmintic activity of ginger and curcumin on *Ascaridia galli*. *Parasitol Res.* 2013 Nov;112(11):3679-86.

¹⁰⁰ Nechita IS¹, Poirel MT², Cozma V³, Zenner L². The repellent and persistent toxic effects of essential oils against the poultry red mite, *Dermanyssus gallinae*. *Vet Parasitol.* 2015 Oct 24. S0304-4017(15)30052-2.

turmeric and Sea Buckthorn have been shown to have a protective effect against toxicity (Gholami-Ahangaran et al 2016, Solcan et al 2013)^{101, 102}.

Appendix IX-F outlines a sample of 40 abstracts of 846 journal articles demonstrating selected publications on botanical medicine research in poultry.

Veterinary Botanical Medicine for Swine

Journals publishing peer reviewed studies on plant medicine for swine.

- Veterinary Parasitology
- Journal Swine Health Production
- Research in Veterinary Science
- Animal Science Journal
- Virology Journal
- Journal of Animal Physiology and Animal Nutrition (Berlin)
- Asian Australis Journal of Animal Science
- Journal of Animal Science Technology
- Archives of Animal Nutrition
- Theriogenology
- Journal of Animal Science
- Animal Science Journal
- Journal Ethnopharmacology
- Reproduction in Domestic Animals
- Animal Reproduction Science
- Immunopharmacology and Immunotoxicology
- Amino Acids
- Clinical and Vaccine Immunology
- Environmental Toxicology and Pharmacology
- Meat Science
- The British Journal of Nutrition

In the past two decades, an intensive amount of research has been focused on the development of alternatives to antibiotics to maintain swine health and performance however there is limited research validating herbs in general for their potential benefits for pigs and the perfect alternative does not exist (Thacker 2013)¹⁰³. None the less plant derived products called botanicals, phytochemicals, and also phytochemicals are used extensively in feed to improve pig performance¹⁰⁴. Aside from having antimicrobial activity, these products potentially provide antioxidative effects, enhance palatability, improve gut

¹⁰¹ Gholami-Ahangaran M, Rangsz N, Azizi S. Evaluation of turmeric (*Curcuma longa*) effect on biochemical and pathological parameters of liver and kidney in chicken aflatoxicosis. *Pharm Biol.* 2016 May;54(5):780-7.

¹⁰² Solcan C, Gogu M, Floristean V, Oprisan B, Solcan G. The hepatoprotective effect of sea buckthorn (*Hippophae rhamnoides*) berries on induced aflatoxin B1 poisoning in chickens 1. *Poult Sci.* 2013 Apr;92(4):966-74.

¹⁰³ Thacker PA¹ Alternatives to antibiotics as growth promoters for use in swine production: a review. *J Anim Sci Biotechnol.* 2013 Sep 14;4(1):35.

¹⁰⁴ Windisch W, Schedle K, Plitzner C, Kroismayr A. Use of phytochemical products as feed additives for swine and poultry. *J Anim Sci.* 2008;86(suppl 14):E140-E148.

function, or promote growth¹⁰⁵ Two of the most common phytogetic substances evaluated in swine include the spices oregano and thyme¹⁰⁶.

Three plant extracts from capsicum, turmeric and garlic have improved immune responses of pigs and feed efficiency of pigs challenged with porcine reproductive and respiratory syndrome virus (Liu et al 2013)¹⁰⁷ and reduced diarrhea and inflammation caused by *Escherichia coli* infection, which may be beneficial to pig health (Liu et al 2013)¹⁰⁸. *Centella asiatica* increases serum haematocrit and white blood cells and mycoplasma immunity to *Mycoplasma hyopneumoniae* in swine (Maneewan et al 2014)¹⁰⁹. Chinese herbs have been investigated in treating swine disease. In China Chinese patent medicines play an important role in veterinary clinical use. Treatment of swine with Wu Huang Hu can significantly inhibit pneumonia in infectious pleuropneumonia (Wang et al 2015)¹¹⁰. *Sophora flavescens* and stevioside combined have a beneficial effect on rotaviral diarrhea in pigs (Alfajaro et al 2014)¹¹¹, *Glycyrrhiza uralensis* extract cures rotaviral enteritis with both antiviral and anti-inflammatory effects in piglets (Alfajaro et al 2012)¹¹². *Taraxacum mongolicum*, *Viola yedoensis* Makino, *Rhizoma coptidis*, and *Radix isatidis* were evaluated in combination on newborn piglets challenged with virulent porcine epidemic diarrhea virus and the herbs ameliorated the impaired growth performance and lesions compared to controls. The study suggested the mixture could be used as a prophylactic or therapeutic agent (Kim et al 2015)¹¹³.

In swine reproduction, numerous herbs have been studied for their effects on preserving boar spermatozoa, examples include *Salvia miltiorrhiza* and *Rosmarinus officinalis* which can both protect against peroxidative damage and increase sperm motility and litter size during the process of freezing-

¹⁰⁵ Jacela JY, DeRouchey JM, Tokach MD, et al. Feed additives for swine: Fact sheets – prebiotics and probiotics, and phytogetics. J Swine Health Prod. 2010;18(3):132–136.

¹⁰⁶ Neill CR, Nelssen JL, Tokach MD, Goodband RD, DeRouchey JM, Dritz SS, Groesbeck CN, Brown KR. Effects of oregano oil on growth performance of nursery pigs. J Swine Health Prod. 2006;14:312–316

¹⁰⁷ Liu Y¹, Che TM, Song M, Lee JJ, Almeida JA, Bravo D, Van Alstine WG, Pettigrew JE Dietary plant extracts improve immune responses and growth efficiency of pigs experimentally infected with porcine reproductive and respiratory syndrome virus. J Anim Sci. 2013 Dec;91(12):5668-79

¹⁰⁸ Liu Y¹, Song M, Che TM, Almeida JA, Lee JJ, Bravo D, Maddox CW, Pettigrew JE. Dietary plant extracts alleviate diarrhea and alter immune responses of weaned pigs experimentally infected with a pathogenic *Escherichia coli*. J Anim Sci. 2013 Nov;91(11):5294-306

¹⁰⁹ Maneewan C¹, Mekbungwan A, Charerntantanakul W, Yamauchi K, Yamauchi K Effects of dietary *Centella asiatica* (L.) Urban on growth performance, nutrient digestibility, blood composition in piglets vaccinated with *Mycoplasma hyopneumoniae*. Anim Sci J. 2014 May;85(5):569-74

¹¹⁰ Wang G¹, Kang S¹, Yin Z², et al Therapeutic effect of Chinese patent medicine "Wuhuanghu" on porcine infectious pleuropneumonia and its acute and subchronic toxicity as well as evaluation of safety pharmacology. Environ Toxicol Pharmacol. 2015 Sep;40(2):388-96.

¹¹¹ Alfajaro MM, Rho MC, Kim HJ et al Anti-rotavirus effects by combination therapy of stevioside and *Sophora flavescens* extract. Res Vet Sci. 2014 Jun;96(3):567-75.

¹¹² Alfajaro MM, Kim HJ, Park JG et al Anti-rotaviral effects of *Glycyrrhiza uralensis* extract in piglets with rotavirus diarrhea. Virol J. 2012 Dec 18;9:310.

¹¹³ Kim HB, Lee CY, Kim SJ, Han JH, Choi KH. Medicinal herb extracts ameliorate impaired growth performance and intestinal lesion of newborn piglets challenged with the virulent porcine epidemic diarrhea virus. J Anim Sci Technol. 2015 Oct 8;57:33

thawing (Shen et al 2015)¹¹⁴, ¹¹⁵. Silymarin has been shown to increase prolactin concentrations and protect against oxidative stress in gilts (Farmer et al 2014)¹¹⁶.

Appendix IX-G outlines a sample of 20 abstracts of 599 journal articles demonstrating selected publications on botanical medicine research in swine.

¹¹⁴ Shen T, Jiang ZL, Liu H, Li QW. Effect of *Salvia miltiorrhiza* polysaccharides on boar spermatozoa during freezing-thawing. *Anim Reprod Sci.* 2015 Aug;159:25-30.

¹¹⁵ Malo C, Gil L, Cano R, Martínez F, Galé I. Antioxidant effect of rosemary (*Rosmarinus officinalis*) on boar epididymal spermatozoa during cryopreservation. *Theriogenology.* 2011 Jun;75(9):1735-41.

¹¹⁶ Farmer C, Lapointe J, Palin MF. Effects of the plant extract silymarin on prolactin concentrations, mammary gland development, and oxidative stress in gestating gilts. *J Anim Sci.* 2014 Jul;92(7):2922-30.