Alternative and Herbal Livestock Health Conference:

A Scientific Review of Current Knowledge

October 20-21, 2000

University of Connecticut
Bishop Center
Storrs, CT

University of Connecticut
Department of Plant Science

PROCEEDINGS

Alternative and Herbal Livestock Health Conference:
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Biochemistry of the Amazonian Medicinal Plant Cat's claw: A Natural Source of Antioxidants and Antiinflammatory Compounds

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Uncaria tomentosa is a vine commonly known as cat's claw or "uña de gato" (UdG) and is used in traditional Peruvian medicine for the treatment of a wide range of health problems, particularly gastrointestinal complaints and arthritis. The aim of this study was to determine the proposed anti-inflammatory properties of UdG. Specifically 1) does the bark extract of UdG protect against oxidant-induced stress in vitro 2) to determine if UdG modifies transcriptionally-regulated events, 3) to determine if UdG protects against oxidative injury beyond the concept of down regulating NF-?B activation, and 4) to determine the free radical scavenging activity of UdG in in vitro systems.

In the first set of experiments we addressed the first two specific aims. To achieve this purpose we used macrophages (RAW 264.7) and epithelial cells (HT29) and rats. Cell death was determined in two cell lines, RAW 264.7 and HT29 in response to peroxynitrite (PN, 300 μM). Gene expression of inducible nitric oxide synthase (iNOS) in HT29 cells, direct effects on nitric oxide and peroxynitrite levels, and activation of NF-*k*B in RAW 264.7 cells as influenced by UdG were assessed. Chronic intestinal inflammation was induced in rats with indomethacin (INDO, 7.5 mg/kg), with UdG administered orally in the drinking water (5 mg/ml). Administration of UdG (100 μg/ml) attenuated ($P < 0.05$) peroxynitrite-induced apoptosis in HT29 (epithelial) and RAW 264.7 cells (macrophage). Cat's claw inhibited lipopolysaccharide-induced iNOS gene expression, nitrite formation, cell death and inhibited the activation of NF-*k*B. Cat's claw markedly attenuated INDO-enteritis as evident by reduced myeloperoxidase activity, morphometric damage and liver metallothionein expression.

In the second set of experiments we addressed aims 3 and 4, respectively. For this purpose we introduced a modification in the cat's claw processing to reflect the action of the commercial forms currently available in the market. Cat's claw was prepared as a decoction (water extraction) of micropulverized bark with and without concentration by freeze-drying. RAW 264.7 cells were used in cytotoxicity assays (trypan blue) in response to the free radical 1,1-diphenyl-2-picrilhydrazyl (DPPH, 0.3 μM) and ultraviolet light (UV). TNFα production was induced by lipopolysaccharide (LPS 0.5 μg/ml). For the in vivo experiment, intestinal inflammation was induced in chickens with coccidia oocytes ($10x10^4$/ml), with UdG micropulverized given orally in the drinking water (10 mg/ml). Cat's claw was an effective scavenger of DPPH; the IC_{50} value for freeze-dried concentrates was significantly less than micropulverized (18 vs. 150 μg/ml, $P < 0.01$). Cat's claw (10 μg/ml freeze-dried) was fully protective against DPPH and UV irradiation induced

cytotoxicity. LPS increased TNFα media levels from 3 to 97 ng/ml. Cat's claw suppressed ($P < 0.01$) TNFα production by approximately 65-85% but at concentrations considerably lower than its antioxidant activity: freeze-dried $IC_{50} = 1.2$ ng/ml, micropulverized $IC_{50} = 28$ ng/ml. Cat's claw attenuated the coccidia-mucosal inflammation as evident by reduced morphometric damage of the intestinal mucosal. On the contrary, histological sections of the ileum of chickens infected with coccidiosis showed a pronounced disruption of the mucosal architecture, with loss of villi and a pronounced inflammatory cell infiltrate.

Our data collectively demonstrates that cat's claw protects cells against oxidative stress and negated the activation of NF-*k*B. These studies provide mechanistic evidence for the widely belief that cat's claw is an effective anti-inflammatory agent. Cat's claw is an effective antioxidant, but perhaps more importantly a remarkably potent inhibitor of TNFα production. The primary mechanism for cat's claw anti-inflammatory actions appears to be immunomodulation via suppression of TNFα synthesis. These findings demonstrate the feasibility to incorporate the use of herbal medicines, such as cat's claw, to promote the health of livestock animals considering the similarities with the stress factors observed in animal production. For developing countries, where the cost of conventional medications is expensive herbal medicines such as cat's claw deserve serious consideration.

Key Words: Cat's claw, *Uncaria tomentosa*, inflammation, TNFα, oxidants, free radicals, NF-*k*B, cytoprotection.

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Current Research on Medicinal Plants to Control Endo- and Ecto-parasite Infections in Livestock

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Disclaimer: Given that only preliminary results are presented in this paper, the authors do not endorse the use of any of the endo- or ecto-parasite treatments discussed.

Abstract.
There is considerable data on plants used in traditional veterinary and human medicine for endo- and ecto-parasite infections. In addition, zoopharmacognosy observations are providing information on potential endo- and ecto-parasite treatments. However, little efficacy and safety data are available for these treatments. The current status of and strategies for medicinal plant research for endo- and ecto-parasite infections are presented. Some of the plants currently under investigation include: *Cissus verticillata*, *Conocarpus erectus*, *Crescentia cujete*, *Jatropha gossypifolia*, *Laguncularia racemosa*, *Melinis minutiflora*, *Passiflora quadranqularis*, and *Senna alata* for endo-parasites and *Nerium oleander*, *Bixa orellana*, *Clusia rosea*, and *Petiveria alliacea* for ecto-parasites. These plants show activity in *in vitro* tests. *In vivo* and toxicity tests are planned for the future.

Introduction

The control of endo- and ecto-parasite infections is necessary for the maintenance of healthy, productive livestock. Endo-parasites (e.g., nematodes, cestodes) damage the gastro-intestinal (GI) tract, decrease feed intake, decrease nutrient absorption, alter feed utilization, and, in some cases, can lead to livestock death. Ecto-parasites (e.g., mites, lice, flies, and ticks) can distract livestock from grazing, damage hides, cause infections, and transmit diseases (Bowman, 1999; Parkins and Holmes, 1989).

Current endo- and ecto-parasite control methods rely on a combination of management methods and chemotherapeutics (anthelmintics, insecticides, and repellents). Alternatives to the commonly used chemotherapeutics are needed for several reasons. First, many of the available treatments for endo-parasites are becoming less effective. Endo-parasites are becoming resistant to almost every chemical class of available anthelmintics (Prichard, 1994). Second, there are environmental pollution and human health concerns with both types of treatments. For example, ivermectin, which is one of the most commonly used anthelmintics, can potentially kill beneficial soil microorganisms (Pfeiffer et al., 1998). Many of the ecto-parasite treatments are organophosphates, which are cholinesterase inhibitors. Third, there is a growing desire among the

general population for more "natural" and environmentally friendly treatments (e.g., the increase in the organic food market). Fourth, in many parts of world, synthetic endo- and ecto-parasite treatments are either unavailable or are not cost-effective (Hammond et al., 1997).

Plants with bioactive compounds are a potential alternative to the chemotherapeutics currently used to control endo- and ecto-parasite infections. Plant treatments for endo-parasites can be given as single oral doses, daily doses mixed with feeds, and planted in pastures. Ecto-parasite treatments can be sprayed on animals and mixed in bedding. Given the wide variety of applications and the need for new treatments, investigation on the use of medicinal plants in veterinary medicine is becoming a fast growing field of research.

There is extensive information available on the use of plants in traditional veterinary medicine (often referred to as ethnoveterinary medicine), and researchers such as Hammond, et al. (1997) have presented excellent reviews on the potential of using plant anthelmintics. Many recent conferences, publications, web sites, and list serves are increasing the dissemination of medicinal plant information.

There is much evidence that plant treatments can be effective. For example, from the 1920s to the 1940s, one of the most commonly used anthelmintics in humans, oil of chenopodium, was derived from the plant, *Chenopodium ambrosioides* (Ketzis, 1999). Also, many of the currently popular ecto-parasite treatments for small animals are synthetic pyrethroids, which are based on the pyrethrins found in *Chrysanthemum cinerariaefolium*. Another common ecto-parasite treatment is rotenone, derived from derris roots (*Derris elliptica*), which is used to treat mite infections in dogs.

While there is much information available on the historical and current use of plants in endo- and ecto-parasite treatments, there is little data on efficacy, appropriate doses, safety, and food residues. There is a need for systematic efficacy and toxicity testing (Mathias et al., 1996).

Research Methods in Plant Treatments

Our laboratory's approach to investigating medicinal plant treatments is based on six steps: 1) identification of potential plant treatments; 2) compound identification; 3) *in vitro* laboratory screening; 4) *in vitro* efficacy tests; 5) preliminary *in vivo* trials; and 6) *in viv*o toxicity and food residue trials. Most of our work focuses on tropical plant species and herbs. In the following sections, research methods used in our laboratory are discussed.

Identification of plants

Two main sources of information on potential plant treatments have been used to date in our research: interviews with people knowledgeable about and who currently use ethnomedicine and ethnoveterinary medicine treatments in the Dominican Republic and Honduras and observations of wild animals. Interviews are used to collect information on plant treatments for all types of livestock and human ailments (e.g., parasites, stomach pain, diarrhea, skin infections, mastitis, etc.), preparation methods, and doses. Animals are observed to determine if they are eating and/or

rubbing themselves with plants known to contain bioactive compounds or if they are eating and/or rubbing themselves with plants not normally a part of the diet when the animal is known to have an endo- or ecto-parasite infection. In addition, animals and birds are observed to determine if they are using unusual plants as bedding or nesting materials. This study of self-treatment, referred to as zoopharmacognosy, has focused on gorillas and chimpanzees in Africa and birds in the Dominican Republic (Rodriguez and Wrangham, 1993). However, observations of other animals are underway.

Voucher specimens of plants used by animals or informed about through interviews are collected and sent to the Jardin Botanico Nacional, Santo Domingo, Dominican Republic or the Bailey Horatorium, Cornell University for identification. Bulk collections of the plants are dried and the compounds are extracted with 95% ethanol, a 50:50 mixture of methanol and chloroform, or hot water.

Compound identification

Compound identification is an on-going process. If little information on the plant is available in the literature, then Thin Layer Chromatography techniques are used to obtain a general idea of the types of compounds in the plants. However, since most of the preliminary tests are done with crude plant extracts, full elucidation of the active compounds is not completed until after it is known that the extract is bioactive. Data in the literature on the types of compounds in the plant, plant family, or plant genus often are used to decide the most appropriate method for identifying the active compound in the plant. Some methods used for compound identification include: GCMS, H-NMR, and HPLC.

***In vitro* and *In vivo* tests**

Initial *in vitro* tests use crude plant extracts or purchased plant oils. Initial tests include mortality and repellency tests with the Lesser Mealworm (*Alphitobus diaperinus*; a common insect in chicken houses), larvae motility tests and egg-hatch tests with *Haemonchus contortus* (a significant parasite of goats and sheep), and nematode mortality tests with free-living stages of nematodes. In addition, all extracts are screened to determine antibacterial and antifungal properties. Bacteria and fungi used in these tests include: *Escherichia coli*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Bacillus cereus*, and *Candida albicans*. All tests follow general published guidelines (Coles et al., 1992; Hamburger and Hostettmann, 1991; Janssen et al., 1987; Laudani and Swank, 1954; Lorimer et al., 1996).

In the initial tests, relatively high concentrations of the crude extracts are used. Extracts that show some activity are retested at different concentration levels, until the lowest effective concentration level is found. Plants that had activity in the initial tests might also be tested again using more sophisticated repellency tests and larvae development and motility tests.

Plants that show high efficacy in the *in vitro* tests will be tested *in vivo* with mice or small ruminants. Currently, only one endo-parasite treatment (*Chenopodium abrosioides*) has reached this stage of testing in our laboratory. Protocols for the *in vivo* tests were based on those

recommended by the World Association for the Advancement of Veterinary Parasitology (Wood et al., 1995), and included a preliminary efficacy trial, a milk and tissue residue trial, and an efficacy dose-titration trial. Fresh plant material and chenopodium oil were given to kids with *H. contortus* infections, and the number of parasite eggs in the feces and adult parasites in the abomasum were counted and compared to those of untreated kids. No ecto-parasite *in vivo* studies have been conducted in our laboratory. Planned efficacy trials will be based on protocols outlined by Uribe et al. (1989).

Status of Research

Plants identified to date

A review of the literature indicates that plants from almost every family are currently used or have been used in endo- and ecto-parasite treatments in livestock or humans. In our laboratory, information on over 40 plants has been collected via interviews in the Dominican Republic and Honduras. These plants are listed in Table I along with plants cited in the literature as used in ethnoveterinary treatments. Some plants identified in zoopharmacognosy applications include: the fruit of *Aframamum* spp., *Panicum maximum*, *Aspilia mossambicensis*, and *Veronia amygdalina* (Rodriguez and Wrangham, 1993; Robles et al., 1995)

Compounds

All compound identification in our laboratory is in the preliminary stages and, with only a few exceptions, only the general class of compounds has been identified. Many of the plants collected contain flavonoids, monoterpenes, phenols, and tannins. Some secondary plant compounds of especial interest and that are known or believed to decrease parasite infections are: ascaridole, eugenol, genistein, methylchavicol, satonin, superoxides, terpineol, and thymol.

***In vitro* and *In vivo* tests**

Results from preliminary *in vitro* tests are presented in Table III. In the *in vivo* tests, *C. ambrosioides* was found not to be a viable anthelmintic treatment. It did not significantly decrease endo-parasite infection levels. In addition, two of the four kids given the higher doses (0.4 ml oil/kg body weight) died. Kid goats given the lower doses were depressed and rumen activity was decreased for several hours after treatment. In addition, when the oil was given to lactating does, the active compound (ascaridole) and some of its metabolites could be found in the milk 3-6 hours post-treatment.

Discussion

Using zoopharmacognosy and interviews with people currently using ethnoveterinary and ethnomedicine based treatments has been an effective means of identifying plants for laboratory treatments. All of the plants tested have had activity against either endo- or ecto-parasites *in vitro*. However, as shown with *C. ambrosioides*, *in vitro* efficacy does not guarantee *in vivo* efficacy. In addition, the tests with *C. ambrosioides* showed that natural treatments can be harmful and leave residues in foods (milk, meat). The results of the *C. ambrosioides* tests clearly demonstrate the need for systematic efficacy and safety testing of plant treatments.

C. ambrosioides is not the only plant treatment that has been ineffective and raised safety concerns with "natural" treatments. The traditionally used powdered fruit of *Mallotus philippinensis* and *Artemisia cina* were ineffective in *in vivo* tests (Cabaret, 1996; Jost et al., 1996). Stem bark of *Zanthoxylum liebmannianum* was effective *in vivo*, but the active compound (alpha-sanshool) caused seizures in mice (Navarrete and Hong, 1996).

Other *in vivo* tests with plants have shown more promise. Leaves of *Eucalyptus grandis* fed to goats for 7 days, significantly lowered *H. contortus* infection levels compared to non-treated goats and did not cause adverse reactions (Bennet-Jenkins and Bryant 1996). Tests with papaya latex, have shown that doses of 4 and 8 g/kg body weight decrease *Ascaris suum* infections in pigs. However, the higher dose did cause transient diarrhea (Satrija et al., 1994). Of the plant-based ecto-parasite treatments, one that shows good potential is *Gliricidia sepium*. When applied to cattle, it repelled ticks (*Boophilus microplus*) and warble flies (*Dermatobia hominis*) (Miranda et al., 1999).

Conclusions and Recommendations

Livestock owners who use plant treatments to control endo- and ecto-parasite infections need to be aware of the risks related to these treatments. Uncontrolled parasite infections (due to inefficacious treatments) can lead to decreased livestock productivity and sometimes death. Also, plant treatments can cause some of the same problems as currently used treatments – toxic reactions and food residues. Given the growing interest in these alternative treatments, research into efficacy and safety is essential. Negative and positive results of livestock owner experimentation and laboratory *in vivo* studies need to be made readily accessible to the general public and forums for sharing information need to be developed.

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Table I. Plants Used to Treat Endo- and Ecto-parasite Infections in Livestock

Plants Used in the Dominican Republic for Endo-parasites (most are being tested)[a]

Apocynaceae
Nerium oleander
Arecaceae
Mikania spp.
Ateraceae
Ambrosia artemisaefolia
Bignoniaceae
Catalpa longissima
Crescentia cujete Cactaceae
Opuntia ficus indica
Caesalpiniaceae
Cassia grandis
Senna alata
Senna alexandria
Caricaceae
Carica papaya
Chenopodiaceae
Chenopodium ambrosioides
Combretaceae
Laguncularia racemosa
Conocarpus erectus
Cucurbitaceae
Momordica charantia
Euphorbiaceae
Jatropha gossypifolia
Fabaceae
Cajanus cajan
Centrosema spp.
Lamiaceae
Plectranthus ambionicus
Malphighiaceae
Bunchosia glandulosa
Malvaceae
Gossypium barbadensis
Mimosaceae
Prosopis juliflora
Moraceae
Cecropia schreberiana
Passifloraceae
Passiflora quadranqularis
Phytolaccaceae
Petiveria alliacea
Poaceae
Melinis minutiflora
Portulacaceae
Portulaca oleraceae
Rhamnaceae
Gouania spp.
Rubiaceae
Coffee arabica
Spermacoce assurgen
Rutaceae
Citrus aurantifolia
Citrus aurantium
Citrus limeta
Scrophulariaceae
Capraria biflora
Smilacaceae
Smilax aff. rotundifolia
Sterculiaceae
Guazuma tomentosa
Vitaceae
Cissus verticillata

Plants Used Elsewhere for Endo-parasites (not being tested at Cornell University)

Arecaceae
Areca catechu
Asteraceae
Senecio lyratipartitus
Burseraceae
Boswellia dalzelii
Euphorbiaceae
Croton macrostachys
Erythrina senegalensis
Leguminoseae
Leucaena glauca
Menispermaceae
Cissampelos mucromata
Palmaceae
Cocos nucifera

Plants Used in the Dominican Republic for Ecto-parasites (most are being tested)[a]

Apocynaceae
Nerium oleander
Bixaceae
Bixa orellana
Fabaceae
Gliricidia sepium
Malvaceae
Pavonia fruticosa
Melastomataceae
Miconia laevigata
Meliaceae
Azadirachata indica
Papaveraceae
Argemone mexicana
Phytolaccaceae
Petiveria alliacea
Piperaceae
Piper aduncum Rubinaceae
Morinda royoc

Plants Used Elsewhere (not being tested at Cornell University)

Annonaceae
Annona squamosa
Araceae
Acorus calamus
Ascelpiadaceae
Sarcostemma viminale
Bombacaceae
Adansonia digitata
Caesalpiniaceae
Cassia alata
Caprifoliaceae
Sambucus canadensis
Euphorbiaceae
Euphorbia bicolor
Euphorbia marginata
Ricinus communis
Leguminosae
Amorpha fruticosa
Baptisia tinctoria
Liliaceae
Aloe ferox
Veratrum album
Meliaceae
Azadirachta indica
Piperaceae
Piper auritum
Polygonaceae
Polygonum hydropiper
Solanaceae
Nicotiana tabacum
Verbenaceae
Tectona grandis

Sources for plants not used in the Dominican Republic: Hammond et al., 1997, Mateo, 1992, Matzigkeit, 1990, Palacpac-Alo, 1990.

[a] Some of the plants listed are used in human medicine and not for animals. Also, some of the endo-parasite plants are used to treat stomach pain and are only used in parasite treatment mixtures.

Table II. *In vitro* Bioactivity of Plants Used in Endo- and Ecto-parasite Treatments

Plant	Ovicidal	Larvicidal	Repellent	Antibacterial
Bixa orellana (seeds)[a]	X	--	X	--
Catalpa longissima[a]	X	X	--	X
Chenopodium ambrosioides[b]	X	X	NT	NT
Cissus verticillata (vinestock)[d]	X	NT	--[c]	--
Clusia rosea (seeds)[a]	NT	NT	X	X
Conocarpus erectus[a]	--	X	NT	X
Crescentia cujete[a]	NT	NT	X	X
Jatropha gossypifolia[a]	X (leaves) -- (roots)	X (leaves) -- (roots)	X (root)[c]	--
Laguncularia racemosa[a]	--	X	NT	--
Melinis minutiflora (roots)[a]	NT	NT	X	--
Nerium oleander[c]	NT	NT	X	--
Passiflora quadranqularis[a]	X	NT	X	--
Petiveria alliacea (roots)[c]	NT	NT	X	--
Senna alata[a]	X	NT	--[c]	--
Senna alexandria[a,d]	X	--	NT	NT

X = exhibited activity -- = did not exhibit activity NT = not tested

Notes: Leaves were used for all extracts, unless otherwise indicated.
Ovicidal and larvicidal tests used *H. contortus*.
Repellency tests used *Alphitobus diaperinus*.
Antibacterial tests were conducted with *B. cereus* and *P. aeruginosa*.

a Ethanol extract
b Plant oil
c Methanol/chloroform extract
d Water extract

Herbs and Alternatives in Equine Practice

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Abstract

Complementary and alternative veterinary medicine (CAVM) in equine practice is a broad subject. Understanding the concept of health and disease is central to deciding whether to treat an individual animal. Many common, low-grade signs of ill health are considered normal by most veterinarians. The normal balance of beneficial bacteria in the intestinal tract is critical to the health of the whole animal since the bacteria do most of the work making minerals available to the horse's body, as well as manufacturing vitamins. Horses have the natural ability to select the minerals they need if they are offered the minerals in a palatable form without sweeteners to disguise the taste. Plant and soil health, as well as soil mineral content and availability is achieved through a healthy soil bacterial population which converts minerals into a form the plants can use. Feed processing can be a detriment to the nutritional status of feed and consequently the animal. Homeopathy and herbal medicine are generally used to treat specific diseases, while nutrition is often used to support the healing process. A short introduction to methods of treatment used in equine practice concludes this paper.

Key words: equine, soil, minerals, intestinal flora, alternative medicine

Introduction

Complementary and alternative veterinary medicine (CAVM) in equine practice is a broad subject encompassing acupuncture, chiropractic, homeopathy, herbal medicine and nutrition. This paper will discuss alternative medicine in equine practice and its relationship to soil health. Intestinal health is directly related to soil health in that both function optimally when the beneficial bacteria are in balance. As feed becomes more processed, less nutrition is available for the horse. A brief introduction to the treatment of disease in equine practice covers homeopathy, herbs and nutrition related to the intestinal tract.

What is health?

When looking at medicine holistically, the first question to ask is what is health? Health is defined as freedom from disease. In conventional medicine "normal", chronic conditions are accepted as healthy, as long as the animal is considered free from devastating illness. In other words, many signs of chronic disease, when not life threatening, are accepted as normal health. According to this definition many domesticated horses are not truly healthy. Many horses have low-grade problems that few people regard as signs of ill-health; the practitioner simply treats

each symptom as it appears.

True health in holistic terms is freedom from any signs of disease. It includes the ability to acquire common, self-limiting diseases, such as the flu, and have adequate immunity such that the illness is short-lived and requires little medication to recover. A healthy individual should mount a strong reaction to an infectious disease, often running a high fever (up to 105°F or more) for a short period of time, followed by a quick recovery.

A horse, by nature, is a prey animal. It lives in areas with scrub-type vegetation, and moves twenty hours a day eating, with about four hours spent resting and sleeping. Humans expect horses to adapt to our ways of living, eating and exercise, and, for the most part, horses do this very well. However the levels of stress brought on by the unnatural living conditions create chronic disease and weakened immune systems.

Signs of chronic disease

Signs of disease manifest as mental or physical symptoms that range from mild to severe. Any deviation from health can be considered a sign of disease, but may only indicate an imbalance in feed. It is important for humans as guardians of animals to become more observant of the following signs of disease.

Mental signs that chronic disease may be present include excessive fears, nervousness and inability to adapt to change. Horses with repetitive behaviors such as weaving, stall-walking, self-mutilation or cribbing appear addicted to these behaviors and are probably not dealing with the stresses of confinement very well. If a horse is having a hard time adapting to the stress of confinement, the immune system is probably being compromised and the horse's health may deteriorate.

Typically horses that are either consistently underweight or overweight have a problem with chronic disease. Underweight horses may have trouble digesting or utilizing food, or they may have low-grade liver disease or cancer. Horses chronically overweight, especially those with fat deposits and "cresty" necks, may have metabolic problems but may simply be overfed and underexercised .

The respiratory system is commonly affected in the chronically ill horse. Allergies usually manifest as heaves and allergic coughs (although allergies with itchy skin are commonly seen in the warm climates). Allergies are a sign of immune system imbalance and overreactivitly. Many high-speed horses (racing, eventing, steeplechasing) bleed from the lungs, showing signs of weakness in the respiratory tract. Foals with upper respiratory "snots" of several months duration may be considered normal by conventionally trained individuals. However, from a holistic perspective, protracted infections are an indicator of disease.

Skin is the largest organ in the body, and internal health and nutritional state are reflected in the skin and hooves. The dry, dull, bleached coats on which people spend fortunes, can be best treated from the inside using a complete holistic approach. One of the primary signs of a healthy horse is a deep rich color to the hair. Truly healthy horses have a glow to their coat and they do not bleach out in the sun.

Allergies, especially itching eruptions, are signs of chronic immune system problems (Dodds, 1993), and though skin allergies are difficult to cure with any form of medicine, the holistic approach is often successful. Often, seemingly simple conditions like dermatophilis ("rain rot", etc.) are signs of subtle disease. All horses on a given property may be exposed to a causative agent, yet only a subset of the horses succumb to the infection. As horses are cured from chronic

disease, skin conditions including warts, sarcoids, oily or sticky sweat, discharges from the sheath, poor wound healing and excessive scar tissue production tend to resolve.

Feet are an adaptation of the skin structures, and the old adage, "no foot, no horse", is as true today as when it originated. Poor nutrition, chronic disease and weather conditions play important roles in the health of the foot, as does the quality of the farrier work. Cracked, brittle or dry feet as well as soft or crumbly feet can be signs of chronic disease. Thrush, white line disease, abscesses and seedy toe need to addressed from a holistic standpoint and be considered as subtle signs of disease.

Gastro-intestinal disorders are an important disease entity, as colic is the number one killer of horses. However, most facilities where colic is common have identifiable management problems, especially when taking into account horses' natural grazing and exercising habits. Lack of correct roughage is one of the primary causes of colic, since the equine gut is designed for long stem roughage and not concentrates. The stress of confinement contributes to colic, as does the overuse of antibiotics and dewormers. Horses with chronic digestive tract problems including dry feces, soft feces, ulcers, sensitivity to change in diet or weather, odiferous stools, failure to digest completely, cravings for dirt, salt or wood, fussy eaters and various mouth problems probably suffer from chronic disease.

The reproductive system is affected by nutrition, management, heredity and chronic disease. Horses are selected for desirable performance and are not selected for reproductive health as they are in the wild. Mares have many problems, both physical and behavioral, associated with their heat cycles. Infertility of the male and female, including lack of libido, sterility, ovulation problems and chronic uterine infections of all types, can often be corrected holistically.

Equine musculoskeletal problems, which usually manifest as lameness, are a common reason for horse owners to seek veterinary services. Lameness is yet another sigh that can be an indication of disease in the horse. Muscle stiffness and tying up, as well as weak tendons and ligaments, may have a nutritional or chronic disease origin. Arthritic changes in the joints, including navicular syndrome, can result from an ill-fitting saddle, shoeing, nutrition or chronic disease. From a Chinese perspective, constant swelling or stocking up of the legs indicates poor digestion (Xie, 1994).

The signs discussed above are merely an introduction to the signs of chronic disease and are presented to stimulate thought about the current state of health in our horses. Typically disease symptoms are resolved best by treating the chronic disease with the appropriate therapy (homeopathy, acupuncture, chiropractic, herbal medicine and others), nutrition and management changes.

Intestinal health as the foundation of all healing

Horses are designed by nature as foraging animals; they were made to graze on whatever scrub, grass and weeds were available for the greater part of each day. During this time they move continually, except for relatively short periods spent sleeping. If they become ill, a wide selection of herbs (weeds) are available, in many pastures, to help remedy their health problems. Today, commercialization of nutrition into bags of feed and supplements along with rich cultivated pastures have changed equine nutrition habits from rough forage to processed feeds and rich grass. The lack of biodiversity in the pastures plus the modern feeding practices contribute to poor intestinal health.

Physiology of equine digestion

The equine digestive tract is a unique system that allows the animal to obtain nutrients and energy form a variety of feedstuffs. Horses use acid digestion in the stomach and fermentation in the cecum in the digestive process. The stomach absorbs water and begins protein digestion primarily through the action of pepsin. The stomach's acidic environment allows for ionization and subsequent absorption of some minerals such as calcium, magnesium, manganese and iron (Kimbrough, 1995). The small intestine then hydrolyses the protein, fat and carbohydrates into the final form for absorption. The fermentation vat, the cecum, is perhaps the most important part of the equine digestive tract since it is here that the fiber portion of the diet is digested. The cecum is designed to break down and ferment long stem fiber and through bacterial metabolism produce vitamins and fatty acids. Horses evolved to graze continually in the wild to keep the digestive tract full and moving. The common practice of feeding twice a day does not keep the food moving through continually and can lead to poor digestion or colic (Clarke, 1990, White, 1993).

The intestinal environment is a miniature eco-system where each player has a place and a job, just as a symphony, and if any piece is out of place, the whole is affected. The intestinal tract contains bacteria and protozoa designed to digest food, manufacture vitamins and fatty acids and make minerals available. Bacteria inhabiting the intestinal tract are pH specific in their requirements for growth, so they are found where the correct pH is for each bacterial species. The bacteria use dietary fiber in the digestive tract as an energy source. They live on the fiber not in the intestinal wall. Consequently when fiber is deficient, the bacterial population is not healthy (Folino, 1995). When the horse is fed mostly concentrates in the form of grain and very little long stem fiber such as hay, the incidence of colic is higher.

Bacterial and the pH of the digestive tract are intimately related. The normal pH of the intestinal tract changes from acidic in the stomach and upper small intestine, moves towards neutral in the lower small intestine and becomes close to neutral in the large intestine (Swenson, 1977). With incomplete digestion and poor quality feeds, the pH and motility can become altered, allowing pathogenic bacteria move up from the alkaline large intestine, into the acidic small intestine potentially causing diarrhea to occur. Alternatively, if the pH of the large intestine becomes more acidic, and the acidophilic bacteria move down, the large intestine can become irritated.

Natural, raw food has all the bacteria and enzymes needed to aid digestion, however, processing often destroys them. The healthy digestive tract, can still digest good quality cooked or processed food since the healthy bacteria and the enzymes already present in the digestive tract will continue to function even though new bacteria are not introduced in processed food. The unhealthy digestive tract has difficulty functioning with poorer quality feed. Live foods also appear to have a "life force" that cannot be put into a package or processed into a ration.

Anything that occurs in the animal's life to upset the natural balance of the intestinal tract flora will affect digestion and direct utilization of the food. A course of oral antibiotics upsets the digestive flora balance and should only be used in specific appropriate situations (Schmidt, 1993). Overuse of antibiotics and non-steroidal anti-inflammatory drugs have been shown to increase intestinal permeability, allowing improperly digested or foreign material to enter the bloodstream. One of the side effects of antibiotics is suppression of the immune system.

Other factors that appear to disturb the normal digestive flora are frequent use of dewormers, illness, confinement, the stress of being worked while in pain (a common happening

in today's horse world), and changes of diet. The latter are very common since most feed manufacturers use least-cost programs to formulate feed. The more horses are confined, stressed and managed by humans, the more nutritional deficiencies and imbalances the veterinarian will find.

Minerals

Mineral availability and balance is probably the most important aspect of nutrition and healing in equine practice. Most modern farms consist of chemically fertilized soils planted repeatedly with the same crops. This leads to depletion of trace soil minerals and subsequent mineral depletion of harvested grains used as feed. There is a complex interaction between many minerals; even a slight excess of one mineral in a diet can mean another mineral may not be properly processed. In nature each "weed" has a trace mineral associated with it, so if a particular mineral is needed the horse will eat the weed. Also, if the soil needs a particular mineral a certain weed will grow there to provide that mineral (McCaman, 1994).

A new branch of science called zoopharmocognosy involves the study of animals and their natural ability to select plants and herbs according to their needs and particular illnesses (Lipske, 1993, DeMaar, 1993). Horses will naturally select from free-choice minerals as long as they are not too sick to sense their needs through instinct and odor recognition. Conventional nutrition research reports that no species can accurately select free-choice minerals. However, upon observation it becomes apparent that the seasonal variations in mineral and vitamin consumption are significant.

Free-choice minerals need to be fed with salt provided separately. If both are fed together with salt in a mineralized salt block, the salt will limit the mineral intake due to the high salt content (about 95%). When horses are given plain free-choice minerals the quantity they eat is often astounding. Most horses will eat two to three times the normal intake for a few months or until they have balanced out their minerals, then will taper off to a maintenance level. Artificial flavorings, salt and molasses should not be used in combination with free-choice minerals as they may affect the natural selection of the nutrient.

In the author's opinion, the best way to approach mineral nutrition is through a free-choice system, with the salt and mineral separated. Very few companies provide a plain mineral supplement; usually salt will be in the top half of the ingredient list. Avoid unbalanced single minerals or combinations of just a few minerals unless they are given free-choice (and are palatable for that purpose). Many products are formulated based on human requirements, which may not be appropriate for the nutritional needs of the horse. Racehorses are constantly given iron tonics to "build their blood", but most horses this author has tested have had normal levels of iron.

Soil and plant health

Horses are often not considered as having a role in sustainable agriculture. However, the ownership of horses is vitally important to maintaining open land in rapidly developing areas. In fact, horses are a primary source of agribusiness in many states.

Since feedstuffs are grown in soil it is important to understand soil health as much as it is to understand animal nutrition. Knowledge of soil health is almost nonexistent in the equine world, as horse owners and veterinarians do not consider themselves farmers or caretakers of the land. Very little organic grain is used in the equine world, even by people who are heavily into

natural healing. This is due in part due to the lack of availability.

Achieving soil health parallels achieving intestinal health in many ways. Soil minerals become available to the plants through bacterial action. Organic matter provides the substrate for healthy bacterial growth just as soluble fiber does in the intestinal tract (Ridzon 1994). A lack of a healthy bacterial balance in the soil leads to poor mineral absorption, soil compaction and poor plant health (Walters, 1996). Poor plant mineral content leads to poor animal nutrition, even though the grain or hay produced may look big, green and healthy after adding nitrogen.

The soil in which most of our grains are grown is heavily fertilized with conventional fertilizers, replacing only three of the nutrients needed to make the plants look healthy. Many horse owners religiously fertilize their soils leading to grass that is too rich for the digestive system of the horse. Some use herbicides to improve the aesthetic appearance of the pasture, which they equate with their lawn. Many do not realize that the weeds (herbs) have a place in the eco-system of the pasture, nor do they understand the toxic load placed on their horses liver and kidneys.

Most herbicides contain estrogenic compounds. The estrogenic nature of these chemicals is altering the balance of hormones in the body (Krimsky 2000). In the world, mares are supposed to go into a winter anestrus (no heat cycles), however in recent years most of the mares in this author's practice cycle through the winter routinely. This indicates an imbalance in the hormonal system.

Genetically modified grains are used in increasing amounts. Most bags containing corn have at least some genetically modified grain present. The implications of genetic alterations of food are unknown at this time, however research from other countries does not support this practice in humans.

Once the feed is harvested, it is heavily processed in most cases. Horse feed is more frequently being ground up, cooked at high temperatures and extruded or pelleted in a process similar to dog food manufacturing. It is impossible to determine the exact quality of ingredients going into the processed feed. Preservatives are being used increasingly, adding to the liver's toxic load. The ideal way to provide better nutrition is to select pre-cleaned (dust free) plain whole grains as a base, then add specific ingredients for the individual horses or herds as needed.

Treatment of disease

Once the basic nutrition has been corrected, the alternative practitioner can then use herbs and homeopathy to treat specific diseases, as well as targeted nutrition to correct or support the tissue involved. Herbal medicine refers to the use of raw or processed herbs in their whole form. Homeopathy refers to the science of using very dilute substances to treat diseases that are similar to those that can be created in a healthy individual if that individual takes the substance in a concentrated form.

A detailed history and thorough physical exam are the most important parts of the diagnostic decision-making in a holistic practice. All of the traditional veterinary diagnostics, such as blood tests and radiographs, are utilized but are often given a lower priority. Alternative medicine requires more detailed information than conventional medicine in order to tailor the treatment to the individual rather than the disease.

Homeopathy

Homeopathy is one of the most versatile modalities used in natural healing. The remedies are made according to international standards and their manufacture is regulated by the FDA. Education of the practitioner is vitally important to the success of the prescription.

The remedies can be used to treat many different conditions. Infections are readily treated with skillful use of the remedies. These can range from a simple cut or cold to a sinus infection or osteomyelitis (bone infection), depending on the experience of the practitioner. Many eye problems such as corneal ulcers and "moon blindness" and internal imbalances such as liver, kidney and reproductive diseases respond well to homeopathic remedies. Colic and stomach ulcers can also be treated, though it must be remembered that a complete diagnosis is required to be sure there are no life threatening problems being overlooked. Respiratory disease including allergic conditions can be treated. Musculoskeletal conditions such as laminitis, tendonitis, navicular and bone spavin are frequently alleviated homeopathically.

Basic first-aid homeopathy is fairly straight forward. Required information includes appearance, amount of pain, colors of discharges, odors, and modalities (what conditions influence animal or affected body part for better or worse - cold, hot, pressure, touch, motion, weather)(Day, 1984). A quick response to treatment can be expected. Common traumatic injuries such as open wounds and bruises respond very well.

Treating chronic disease with homeopathy, often called constitutional treatment, requires a complete history. With a complex case this may take up to an hour, though often a limited history is all that is available. All body systems must be covered completely. The condition present needs to be described in as much detail as possible, especially how the condition responds to hot, cold, touch, motion and weather. The response to the remedy will be much slower than when treating an acute condition. Results may not be seen for up to two weeks, so the horse owner must be patient.

Herbal medicine

Herbs have been used by all cultures for centuries; each area of the world uses herbs local to that area. Western herbs tend to work slowly to restore health and balance to the body, while Chinese herbology contains some fast acting herbs (antibacterials and antivirals). Chinese formulas can be much deeper acting and can cure problems faster, however, in general the practitioner needs a knowledge of Chinese medicine in order to prescribe accurately. Chinese herbology has been used with animals for centuries. There are many animal studies published on Chinese herbs, however, the translations are not complete at this time. Clinical experience with Chinese herbal formulas used in the United States is growing.

Herbs are generally used together in a formula, so the quality of a formula depends on the skill of the person putting it together. The efficacy and potency of a formula is affected by the quality of the raw ingredients. The best manufacturers test each batch for purity and strength but many companies cut corners by using inferior quality raw materials.

Herbal medicine can be used to treat arthritic conditions, immune system problems, diarrhea, colic and other digestive upsets. Internal medical problems including liver, heart, stomach, lung and kidney imbalances can be helped with many herbal formulas. Behavior can be altered with herbs by relaxing the muscles or toning down the nerves. Premade formulas for animals (Western and Chinese) are becoming more commonly available and are an excellent way to use herbs in practice.

Nutrition for the intestine

Since the intestinal tract is so frequently bombarded with antibiotics and non-steroidal anti-inflammatories, many horses will need therapy directed at repairing the intestine. High quality probiotics should be used to help replace the intestinal flora. Lactobacillus sporogenes is one probiotic (healthy bacteria) that does not need refrigeration so is well adapted to use in the barn. Fermented probiotics with enzymes can help the repair the gut wall, while the amino acid l-glutamine provides energy for the cells lining the intestinal tract. Certain herbs such as Slippery Elm can sooth the digestive tract and promote healing. The acidity of the stomach needs to be maintained for protein and mineral digestion so the use of alkalinizing agents such as bicarbonates and antacid drugs should be discouraged. Homeopathic remedies can also be used to help heal the intestine provides they are carefully selected to fit the profile of the patient.

Conclusion

The role of the horse in agriculture is important. Equine health from a holistic perspective relates closely to soil and plant health. When treating horses using alternative medicine it in important to consider all aspects of health form identifying subtle signs of ill health to treating the soil where the food is grown.

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Toxic Plants and Livestock Health

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"In order for a plant to be functionally poisonous, it must not only contain a toxic secondary compound, but also possess effective means of presenting that compound to an animal in sufficient concentration, and the compound must be capable of overcoming whatever physiological or biochemical defense the animal may possess against it. Thus the presence of a known poisonous principle, even in toxicologically significant amounts, in a plant does not automatically mean that either man or a given species of animal will ever be effectively poisoned by the plant." (Kingsbury JM. 1979)

With the increase in the use of herbal remedies for treating both human and animal diseases, it is important to recognize that many plants contain toxic components that may have therapeutic as well as poisonous outcomes depending upon the dose of the toxin consumed. A classical example of this is the glycoside digitalis from foxglove that has proven therapeutic benefits, but if overdosed can induce fatal cardiac conduction disturbances. The quantity of toxin present in a plant can be quite variable depending upon the stage of growth, soil composition, moisture content, and whether or not it is growing in shade or full sun. Animal species response differences to toxins vary widely. Ruminants for example are far more likely to develop nitrate and cyanide poisoning from plant sources than are horses. Sheep can eat larkspur (*Delphinium* spp.) without problem, while cattle are very susceptible to fatal poisoning from these plants.

Cattle and sheep can adapt to eating some toxic plants if they are allowed to gradually increase the amounts of the plant eaten over 1-2 weeks. This allows time for the rumen microflora to adapt to a new substrate that they can metabolize into a nontoxic substance. An example of such adaptation is the ability of sheep to consume large quantities of Halogeton (*Halogeton glomeratus*) that contains high levels (30% dry matter) of soluble oxalates if they are gradually introduced to the plants over 1-2 weeks. Animals on a balanced and adequate plain of nutrition are also better able to tolerate greater levels of toxin as can be seen in cattle that can tolerate higher nitrate consumption if they are fed a ration containing grain as opposed to a low energy roughage diet.

In addition to the plant toxins themselves, livestock health is often compromised by the presence of fungal toxins that may contaminate livestock food sources. Some fungi can infect plants as they are growing, while others grow in plants after they have been harvested and stored inappropriately. Fescue poisoning resulting from the presence of an endophytic fungus (*Neotyphodium coenophialum*) growing in tall fescue grass (*Festuca arundinaceae)* is a well recognized problem in cattle and horses especially in the south eastern States. A similar mycotoxin-induced disease is paspalum (Dallas) grass staggers resulting from the ergot-producing fungus *Claviceps paspali.*

Red and white clovers are subject to infection with a fungus (*Rhizoctonia leguminicola)*, which produces the mycotoxin slaframine. When consumed by horses and cattle it induces excessive salivation or slobbering. Aflatoxins produced primarily by *Aspergillus* flavus are a common source of poisoning in all animals that consume grains that are moldy. There are also many other mycotoxins such as tricothecenes, ochratoxins and fumonisins that are a significant problem to livestock health. A severe neurological disease of horses, leucoencephalomalacia, results from horses eating moldy grain containing fumonisins produced by the fungus *Fusarium moniliforme.*

When investigating plant poisoning it is important to take into consideration the intrinsic toxins present in plants, the potential for contaminating mycotoxins, species susceptibility and the cumulative effects and potential interactions of chemicals in plants or plant products fed to animals. For example, a horse treated with Russian comfrey containing pyrrolizidine alkaloids, that is also exposed to moldy feeds with aflatoxins, and/or is fed hay with hounds tongue (*Cynoglossum officinal*) in it, would have an increased potential for developing severe live disease as a result of the cumulative effects of these liver toxins. In many instances little is known about the effects of the interaction of plant toxins with other drugs administered concurrently to an animal!

Major Categories of Poisonous Plants

Plants Associated with Sudden Death in Animals
Cyanogenic glycosides

Acacia spp.	Cat claw, acacia
Amelanchier alnifolia	Service, Saskatoon berry
Bahia oppositifolia	Bahia
Mannihot esculentum	Cassava, manihot, tapioca
Cercocarpus montanum	Mountain mahogony
Chaenomales spp.	Flowering quince
Cynodon spp.	Star grass
Eucalyptus spp.	Eucalyptus, gum tree
Glyceria spp.	Tall manna grass
Hydrangea spp.	Hydrangea
Linum spp.	Flax
Lotus spp.	Birds foot trefoil
Malus spp.	Crab apple
Nandina domestica	Heavenly or sacred bamboo
Phaseolus lunatus	Lima bean
Photinia spp.	Christmas berry
Prunus spp.	Chokecherry, pin cherry
Pteridium aquilinum	Bracken fern
Sambuccus spp.	Elderberry
Sorghum spp.	Johnson, Sudan grass
Sorghastrum spp.	Indian grass
Stillingia texana	Texas queen's delight

Plants used for Homeopathic Purposes *Prunus spp.*
Chokecherry, pin cherry

Suckleya suckleyana	Poison suckleya
Trifolium repens	White clover
Triglochin maritima	Arrow grass
Vicia sativa	Common vetch
Zea mays	Corn, maize

Nitrate Accumulating Plants

Ambrosia spp.	Ragweeds
Amaranthus spp.	Pigweed
Avena fatua	Wild oat grass
Chenopodium spp.	Lamb's quarter
Cirsium arvense	Canada thistle
Convolvulus arvense	Field bindweed
Datura stramonium	Jimsonweed
Echinochloa spp.	Barnyard grass
Helianthus annuus	Sunflower
Kochia scoparia	Kochia weed
Malva spp.	Cheese weed
Melilotus spp.	Sweet clover
Polygonum spp.	Smart weed
Rumex spp.	Curly leafed dock
Salsola kali	Russian thistle
Solanum spp.	Nightshades
Solidago spp.	Goldenrods
Sorghum halapense	Johnson grass

Crop Plants – Nitrate Accumulators

Avena sativa	Oats
Beta vulgaris	Sugar beets
Brassica napus	Rape
Glycine max	Soybean
Linum spp	Flax
Medicago sativa	Alfalfa
Pennisetum glauca	Pearl millet
Secale cereale	Rye
Sorghum vulgare	Sudan grass
Triticum aestivum	Wheat
Zea mays	Corn

Alkaloids

Delphinium species	Larkspur
Aconitum spp.	Monkshood
Conium maculatum	Spotted hemlock

Unsaturated alcohols

Cicuta species	Water hemlock

Plants used for Homeopathic Purposes

Plants Causing Heart Disease

Cardiac Glycosides

Digitalis purpurea	Foxglove
Nerium oleander	Oleander
Convallaria majalis	Lily of the valley
Apocynum spp.	Dogbane

Plants used for Homeopathic Purposes
Foxglove
Dogbane
Lily of the valley

Cardio-toxic alkaloids

Astragalus and Oxytropis Spp.	Locoweeds

Cardio-toxic diterpenoids

Rhododendron spp.	Rhododendrons & azaleas
Kalmia spp.	Laurel
Pieris japonicus	Japanese pieris

Plants Associated with Photosensitization

Primary Photosensitizing Plants

Ammi majus	Bishop's weed, greater ammi
Cooperia pedunculata	Rain lily
Cymopterus watsonii	Spring parsley
Fagopyrum esculentum	Buckwheat
Hypericum perforatum	St. John's wort,
Thamnosma texana	Dutchman's britches

Plants used for Homeopathic Purposes
St Johns wort

Secondary or Hepatogenous Photosensitization

Agave lecheguilla	Agave
Bassia hysopifolia	Basssia
Cenchrus spp.	Sandbur
Cynodon dactylon	Bermuda grass
Descurainia pinnata	Tansy mustard
Kalstroemia	Caltrops
Kochia scoparia	Kochia, Mexican fire weed
Lantana camara	Lantana
Lolium perenne	Perennial rye grass
Medicago sativa	Alfalfa
Microcystis spp.	Blue-green algae, water bloom
Nolina texana	Sacahuiste
Panicum coloratum	Klein grass
Panicum spp.	Panic grasses
Polygonum spp	Knottweed
Tetradymia spp.	Horsebrush
Thamnosma texana	Dutchman's breeches
Tribulus terrestris	Puncture vine, caltrop
Trifolium spp.	Clovers
Vicia spp.	Hairy vetch

Plants Affecting the Liver

Senecio spp.	Groundsels
Cynoglossum officinale	Hounds tongue
Crotolaria spp.	Rattlebox
Amsinckia intermedia	Fiddleneck
Echium spp.	Blueweed
Symphyticum officinale	Comfrey
Xanthium spp.	Cocklebur

Plants used for Homeopathic Purposes
Comfrey*Symphyticum officinale*

Plants Affecting the Nervous System

Aesculus spp.	Horse chestnut

Artemisia spp.	Sages
Astragalus spp.	Locoweed
Centaurea solstitialis	Yellow star thistle
Acroptilon repens	Russian knapweed
Corydalis spp.	Fitweed
Equisetum arvense	Horsetail
Eupatorium rugosum	Snakeroot
Haplopappus heterophyllus	Rayless goldenrod
Karwinskia humboldtiana	Coyotillo
Kochia scoparia	Kochia weed
Oxytropis spp.	Locoweed
Pteridium aquilinum	Bracken fern
Sophora secundiflora	Mescal bean

Plants used for Homeopathic Purposes

Sage	*Artemisia* spp.
Horse tail	*Equisetum* spp.

Plant Teratogens and Abortifacients

Plants Associated with Livestock Abortion

Agave lechequilla	Lechuguilla
Astragalus spp	Milk vetch
Brassica spp	Rape
Conium spp	Poison/spotted hemlock
Cupressus spp	Cyprus
Festuca spp	Fescue
Gutierrezia sarothrae	Broomweed, snakeweed
Halogeton spp	Halogeton
Indigofera spp	Creeping indigo
Juniperus spp	Juniper
Medicago sativa	Alfalfa
Phytolacca americana	Poke weed
Pinus ponderosa	Ponderosa pine
Solidago spp	Goldenrods
Tanacetum spp	Tansy
Trifolium spp	Clovers
Veratrum spp	False hellebore

Plants used for Homeopathic Purposes

False hellebore	*Veratrum* spp.

Teratogenic Plants

Astragalus spp	Milk vetch, locoweed
Conium maculatum	European or spotted hemlock
Lupinus spp	Lupine
Nicotiana glauca	Wild tree tobacco
Nicotiana tabacum	Tobacco
Veratrum spp.	False hellebore
Blighia sapida	Akee
Colchicum autumnale	Autumn Crocus
Cycadaceae spp	Cyads
Datura stramonium	Jimson weed

Plants used for Homeopathic Purposes

False hellebore	*Veratrum* spp.

Teratogenic Plants (continued)

Indigofera spicata	Creeping indigo

Lathyrus spp	Wild pea
Leucaena leucocephala	Mimosa
Oxytropis spp	Locoweed
Papaveraceae	Poppies
Senecio spp	Groundsel
Vinca rosea	Periwinkle

Plant Affecting the Mammary Gland

Snakeweed	*Eupatorium rugosum*	Acetylbenzofurans (tremetol)
Rayless golden rod	*Haplopappus heterophylus*	"
Groundsels, senecio	*Senecio* spp.	Pyrrolizidine alkaloids
Rattle pod	*Crotolaria* spp.	" "
Hound's tongue	*Cynoglossum* spp.	" "
Fiddle neck	*Amsinckia intermedia*	" "
Comfrey	*Symphytum* spp.	" "
Heliotrope	*Heliotropium* spp.	" "
Viper's bugloss	*Echium* spp.	" "
Mustards, Crucifers	*Brassica* spp.	Glucosinolates ***
Poison hemlock	*Conium maculatum*	Piperidine alkaloids (coniine)
Tobacco	*Nicotiana* spp.	" "
Locoweeds	*Astragalus, Oxytropis* spp.	Indolizidine alkaloids (swainsonine)
Lupine	*Lupinus* spp.	Quinolizidine alkaloids (anagyrine)
Bitterweeds	*Helenium, Hymenoxys* spp.	Sesquiterpene lactones ***
Bracken fern	*Pteridium aquilinum*	Ptaquiloside
Buttercups	*Ranunculus* spp.	Protoanemonins ***
Onions, garlic	*Allium* spp.	N-propyl disulphide ***
Autumn crocus	*Colchicum* spp.	alkaloids (colchicine)
Avocado	*Persea* americana	Unknown toxin
Sage	*Artemesia* spp.	Monoterpenes, diterpenes ***

*** Plants that impart and abnormal flavor to milk.

Plants used for Homeopathic Purposes in Cattle and Horses

Aconitum	Monkshood
Apocynum	Dogbane
Phoradendron leucarpum	Mistletoe
Phytolacca	Pokeweed
Atropa belladonna	Belladonna
Bryonia	Wild hops
Buxus sempervirens	Box
Convallaria majalis	Lily of the valley
Cytisus scoparia	Scotch broom
Digitalis spp.	Foxglove
Melia azedarach	Chinaberry
Gelsemium sempervirens	Carolina jessamine
Symphyticum officinale	Comfrey
Hypericum perforatum	St Johns wort
Pulsatilla	Windflower, pasque flower
Rhus toxicodendron	Poison ivy
Thuja spp.	White cedar

Resources on Plant Toxicology

Books

1. Botanical Safety Handbook. McGuffin M, Hobbs C, Upton R, Goldberg A (Eds). CRC Press, New York 1997.
2. A Dictionary of Natural Products. Hocking GM (Ed). Plexus Publishing Inc. Medford, New Jersey 1997.
3. A Dictionary of Plant Toxins. Harborne JB, Baxter H, Moss GP (Eds). John Wiley & Sons, New York, 1996.
4. Complementary and Alternative Veterinary Medicine. Schoen AM, Wynn SG (Eds). Mosby Inc. 1998.
5. Herbal drugs and phytopharmaceuticals: a handbook for practice on a scientific basis. Bissett N. (Ed) CRC Press, Boca Raton, Florida. 1994.
6. Herbal Medicine. Weiss R. Beaconsfield Publishers, Beaconsfield, England 1994.
7. Field Guide to Plants Poisonous to Livestock -Western U.S. Weathers SA (Ed). Rosebud Press 1998.
8. Handbook of Medicinal Herbs. Duke JA (Ed). CRC Press Boca Raton, Florida. 1985.
9. Toxicology. Osweiler GD. (Ed) Williams & Wilkins, Philadelphia 1996.
10. Poisonous Plants. Proceedings Third International Symposium. James LF, Keeler RF, Bailey EM, Cheeke PR, Hegarty MP. (Eds) Iowa State University Press 1992.
11. Plant-Associated Toxins. Colegate SM, Dorling PR. (Eds). CAB International 1994.
12. Toxic Plants and other Natural Toxicants.Garland T, Barr AC (Eds) CAB International New York 1998.
13. Plant and Fungal Toxins. Vol 1. Keeler RF, Tu AT. (Eds) Marcel Dekker Inc. New York,

1983.
14. Natural Toxicants in Feeds, Forages, and Poisonous Plants. Cheeke PR. (Ed) Interstate Publishers inc. 1998.
15. Common Poisonous Plants and Mushrooms of North America. Turner NJ, Szczawinski AF. (Eds) Timber Press, Portland, Oregon. 1991.
16. Poisonous Plants of the United States and Canada. Kingsbury JM. Prentice-Hall Inc. Englewood Cliffs, New Jersey 1964.
17. Poisonous Plants of the Central United States. Stephens HA. Regents Press of Kansas, Lawrence. 1980
18. Poisonous Plants of the Midwest. Evers RA, Link RP. University of Illinois, Urbana-Champaign 1972.

Web Resources

1. vth.colostate.edu/poisonous_plants
2. http://cal.vet.upenn.edu/poison/ppstslmonks.htm
3. http://www.wam.umd.edu/~mct/Plants/poisonous.html (Medicinal and Poisonous Plant Databases)
4. http://www.library.uiuc.edu/vex/vetdocs/toxic.htm
5. http://res.agr.ca/brd/poisonpl/ (Canadian Poisonous Plants)
6. http://vm.cfsan.fda.gov/~djw/readme.html (Poisonous Plant Database USDA)
7. http://vet.purdue.edu/depts/addl/toxic/cover1.htm Indiana Toxic Plants
8. http://toxnet.nlm.nih.gov/ (Toxicology database)
9. http://www.ces.ncsu.edu/depts/hort/consumer/poison/poison.htm (Poisonous Plants of North Carolina).
10. http://www.extension.umn.edu/distribution/livestocksystems/DI5655.html (Minnesota Poisonous plants).
11. http://www.Botanical.com/botanical/mgmh/h/helbla14.html (Modern Herbal Index).
12. http://www.agric.gov.ab.ca/agdex/100/3066601.html (Poisonous Plants on Range and Pasture).
13. http://www.fau.edu/divdept/science/envsci/poison-pl.html (Poisonous Plants of Southern Florida).
14. http://www.caf.wvu.edu/~forage/library/poisonous/page19.htm (Poisonous Plants of the Southern States).
15. http://www.inform.umd.edu/EdRes/Topic/AgrEnv/ndd/goat/POISONOUS_PLANTS.html.

National Animal Poison Control Center
http://www.napcc.aspca.org/

Homeopathy - Health from the Ground Up

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The workable and successful concepts of organic agricultural practices, grass based nutritional systems and holistic livestock healthcare have enabled farm families to survive and thrive into the 21st Century.

At the core of any sustainable holistic healthcare system is Homeopathy. It is very important for those entering organic agriculture to ponder the future and plan for any contingencies . Most of today's farmers are not old enough to remember farming without antibiotics. Because we have been accustomed to using conventional drugs, we can now substitute natural homeopathic medicines where drugs had formerly been employed.

Farmers who seek homeopathic consultation probably fall into three categories:

1. Those who are committed to holistic agriculture and will not turn back to harsh drugs
2. Those who have tried other forms of therapy and found them wanting
3. Those who are desperate as a result of sudden flare-ups of mastitis, high somatic cell counts, infertiliy or other diseases.

Homeopathy has many advantages when used in a knowledgeable manner. Farmers prefer it over harsh approaches because of its safety for the animals, farm family, and the environment, ease of oral dosing, and economic advantage. At times it may be cost effective and preferable to view a herd of any species (especially a dairy herd) as one patient. In those cases the simillimum can be determined and the entire herd receive the homeopathic medicine.

After graduation from University of Pennsylvania School of Veterinary Medicine in 1970, I practiced conventional medicine in southeastern Pennsylvania for five years. A restlessness developed as I did not see the successes and cures from the antibiotics, steroids, and conventional drugs that I was using. My search continued until 1981, when I was directed to Millersville University for the National Center for Homeopathy Summer School. There I heard such wonderful teachers as Henry Williams, M.D., Julian Winston, George MacLeod, MRCVS and David Wember, M.D. That was the springboard that started me, and the use of homeopathic and holistic therapies increased from that date.

By 1990 Bonnie and I were able to break from the conventional practice. In March 1990, the Clark Veterinary Clinic birthing process was completed with the support of both large and small animal clients. Initially a group of Lancaster county farmers asked if we would make farm visits and teach homeopathic medicines while performing herd health exams. That was like a second springboard that began our association with organic farmers.

John Muir said,"Everything is connected to everything else". Arthur Young, DVM repeated that thought when he said, " A small pebble makes a large ripple in a pond". As a homeopathic veterinarian, you have a tremendous potential to have a ripple effect on the lives of both your patients and clients and on the agricultural community around you.

Some very wise homeopaths in the past saw this ripple concept and spoke about it at other American Institute of Homeopathy meetings. Dr. Marion Bell Rood, a practitioner in MI saw the deterioration of soil fertility and the wide spread use of antibiotics eventually causing a deterioration of human health as early as the 1940s. In 1948 Dr. H.W. Eilkenberry, Pres. AIH echoed the theme. "It is evident that a high percentage of our topsoil has been lost -yes, wasted- because of careless and negligent methods of farming and lumbering. Inasmuch as the topsoil is the rich and fertile part of the ground from which wholesome nourishing foods are produced, the loss of that rich and fertile topsoil has deprived us of much of the nourishment to which we are justly entitled," warned Dr. Eilkenberry.

The present situation in conventional and commercial agriculture emphasizes the application of N-P-K (Nitrogen, Phosphorus and Potassium) fertilizer rather than the increasing the organic matter of the soil. "That is all the plant needs", they say. However, the truth is that the more N-P-K fertilizer is applied to the plant and the soil the more the plant and soil becomes deficient. It is estimated that one pound of chemical Nitrogen destroys 100 pounds of soil Carbon. Levels of trace minerals such a Copper, Boron., Selenium, Zinc, Cobalt and Manganese continue to decline under these chemical applications. As deficiencies worsen, the rate of fertilizer application often increases until the only nutrients supporting the plant comes from fertilizer. Since the American people have been consuming these deficient foods from conventional farms (such as vegetables, meat, milk, eggs, yogurt, butter, cheese and soybeans), those deficiencies have been transferred to the public. And at the dawn of the 21st century 25% of American couples are infertile. And severe, chronic diseases are affecting the young at a much higher rate.

With organic agricultural practices, the emphasis is upon increasing the organic matter in the soil to a optimum level of 4% to 7%. With the application of manures and compost derived from organic farms the soil increases in vitality and fertility. When there is optimum organic matter, the soil acts like a sponge soaking up the rain and preventing erosion. The much desired minerals are retained in high Carbon soil, combined in organic compounds.

With organic, grass based agriculture the nutrients remain in the soil ready for plant use and in turn ready for consumption by the animals that are grazing on the nutrient rich plant. Growth (and production) of quality vegetables and fruits is dependent on the organic matter derived from the manure and compost from organic livestock. Numerous vegetable/fruit producers testify to the need for such organic material. The decomposition of fruit and vegetables waste does not replace the nutrients that are used as those foods are grown. Animals are essential for sustainable agriculture.

Two organic farms in Pennsylvania have unique and different histories. Farmer A bought his farm in 1992 while a member of the state government. At that time he and his family made a commitment not to use any chemical fertilizers with the thought that when his time is government

service ended the farm could be developed into an organic dairy. In 1995, Farmer A began his grass-based dairy operation. An emergency situation of bloat occurred. A third of the herd had symptoms of bloat. The local veterinarian though apologetic offered no non-conventional solutions. The farmer quickly sought homeopathic consultation. With frequent dosing of Carbo veg all the cows responded and not one was lost. That tense time was the springboard that confirmed his need for homeopathic medicine for his 34-cow herd.

Farmer S began conventional farming in 1986 but after three years his hard work matched his frustration. Initially very skeptical, Farmer S would sit back in the corner during my homeopathic lectures and asked questions that put me on the spot. He just wasn't convinced of the ability of homeopathic medicine to address the many health problems in his livestock, but he was an honest seeker after truth. Then a family pet goat became paralyzed. With no conventional drug options and pressure from his children, he relented and called for homeopathic consultation. Cicuta virosa was the remedy chosen with positive results. As the goat improved the medicine disappeared only to be found in the hands of their two-year old, the bottle empty. With assurances from their homeopathic medical physician than no harm had occurred, they pondered the fact that, "What other medicine could bring a paralyzed goat to its feet but not harm a two-year old child? Only a homeopathic medicine". That incident was the springboard that began their homeopathic adventure for their 100+ dairy herd, and other species of livestock on the farm.

Farmer A's farm although mildly neglected had not been abused by chemicals before he purchased it. It is often easier to take a neglected farm and return it to top condition than to take a chemically abused farm and try the same thing. Because an organic farm needs a 25 feet buffer zone surrounding it, a wise and courageous farmer will seek the support of his surrounding neighbors. This he did. All 12 neighbors agreed not to apply any forbidden fertilizers or chemicals on their 25 feet of property that joins Farmer A's land. That in itself was quite an achievement. It then was relatively easy to have every square inch of his land certified followed by the dairy cattle. Farmer A's farm would be best be described as a semi-seasonal, grass-based organic dairy. The missing link to his operation was of course Homeopathy.

Farmer S is surrounded by five other farmers, all skeptics. Even though they thought and communicated to him that he was "cracked", he continued to change methods toward sustainability. The 25-foot buffer zone is maintained by Farmer S on his land. At present, he and his wife and nine children operate a 280-acre grass-based semi-seasonal organic dairy.

Many of the universities find it difficult to accept the fact that an organic dairy operation can be profitable without having the farm family rely on "off the farm income". All the income of Farmer S is derived from the land, the crops, and the livestock.

A grass-based dairy operation means:

1. All of the farm produces grass or legumes for the purpose of grazing or hay making.
2. Only small amounts of grain are fed to the animals, or none at all.
3. The farm has only a few acres of non-grazing cropland compared to the large percentage of the land that can be grazed. "If you can't graze it you don't raise it."

A semi-seasonal dairy operation means:
1. The MAJORITY but not ALL of the livestock have their calves the same time each year and therefore are dry or non-lactating at the same time as well.
2. In Pennsylvania, births occur in March and April and the cattle are dry or non-lactating in December, January and February.

A seasonal dairy operation means:
1. ALL the cows would be giving birth within a 4-6 week window of time and be dry or non-lactating nine months later hen they and hopefully the farmer and his family go on vacation (or attend a homeopathic meeting).

A conventional year- around dairy would have constant calving at all times of the year leaving little room for time off for the farmer and his family.

God did not intend cows to eat grain. Cows do not need to eat soybeans. The cow was not created to eat the things man eats. He created ruminants to convert forage into milk, and meat and hide and things for us to use. A conventional farm is feeding grain to these cows by the shovelfuls and then they have to give drugs in large quantities to combat the acidosis produced by the high levels of grain and the stress of confinement and crowding.

Chemical fertilizers began to be promoted after World War I. for economic reasons, Germany did not want to close the munitions plants that produced the explosives. Instead they took the same raw materials and began to manufacture fertilizer. What happen in Oklahoma City? What blew up that federal building? A truckload of fertilizer.

By 1950, many of the world's farmers had become convinced that all you need to grow bigger crops was to put a little ammunition - N-P-K fertilizer on the plants. The Nitrogen, Phosphorus, and Potash compounds on the plants would produce higher yields. Now the farmers of the year 2000 are paying for the sins of the farmers of the 1940's and 1950's. Fortunately Farmer A and Farmer S are not going that route. As Farmer S would say," I'm religiously opposed to chemical fertilizers".

In 1990, our practice serviced one organic dairy in Vermont. Opportunities developed to allow my wife and I to lecture and instruct farmers and veterinarians in the principles of homeopathy for the health needs of their organic farms.. At present there is an dramatic increase in the number of organic dairies. In the first 9 months of 2000, about 1300 dairy farms were certified in the US. It is growing at about the same rate as homeopathy - 25% to 35 % growth per year. Now the consumer need not be limited to a quality organic restaurant like NORA in Washington, DC but can travel to an organic farm and purchase their organic vegetables, chicken, turkey, yogurt, cheese, milk, eggs and meats directly from the farmer.

What homeopathic medicines did Farmer A use his first year? For the bloating symptoms, Carbo veg was dosed frequently. Later when a new pasture was opened, the drinking water was medicated with Carbo veg and cows were encouraged to eat a little dry hay and take a drink before grazing. A few stubborn cases of bloat were dosed with Nux vomica in alteration with Carbo veg.

The first year of farming Sepia was prescribed for each missed estrus. A dairyman knows that the cow was hiding her estrus(receptivity) yesterday when he observes blood tinged mucous on her tail today. It is too late to breed her today since ovulation is passed. After Sepia, she will again be receptive in 19 or 20 days. Cows in proestrus were given Ovarian before each breeding. This homeopathic nosode prepared from the fluid of a healthy ovary helps to regulate ovulation.

Today, Farmer A employs Arnica in cases of trauma, Phytolacca in painful mastitis, and Aconite for acute fevers. The next most frequently used medication is Lycopodium which is effective in the prevention and treatment for the metabolic condition known as ketosis.

Farmer S in his first homeopathic year found that Calcarea Carb and Calcarea Phos were strongly therapeutic in maintaining milk production and fertility in the herd. Calcium was likely deficient over the entire farm in those early years. Conventional farming practices and N-P-K fertilizer often produce deficiencies of Calcium, Carbon, and trace minerals. Applying manure and compost year after year will replenish these soil nutrients.

In addition to Sepia in postestrus, dosing with Pulsatilla in proestrus and Ovarian in estrus was helpful for the herd during the 1991 breeding season. Regular herd health exams continued for two years with no major episodes. In 1993, Farmer S experienced a rash of illness in livestock. The cause was found to be mold in the corn silage. Afterward, the family began diligently seeking a feeding program that did not rely on corn silage.

Both family farms have enjoyed some measure of economic freedom since converting to grass-based organic dairying. Farmer S in 1998 recorded an income of $764.00 per cow per year. His cull rate was 18%. The national conventional average is 40% to 50%, and the organic cull rate average is 30% to 33%.

These two farm families are examples of success in organic dairying. Using homeopathic medicines (and principles) lead to both success and sustainability. If questioned, I am sure that each family member would be enthused about the progress of the past and plans for more sustainability in the future.

International Trade, Beef Production, and Food Safety: Lessons from the 20th Century

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Beef production, distribution and consumption at the beginning of the 21st century raises many ecological, human health and international trade concerns. Beef is among the most highly consumed foods in the US, both by adults and children. Children face special risks from residues and contaminants in foods. Rapid rates of growth and development of children's organ systems and functions may make children more susceptible to adverse health outcomes from exposure to biological and chemical hazards. Potential chemical hazards include veterinary drug residues especially hormones and antibiotics, and pesticides. Risks associated with these residues are vigorously contested among food safety experts, and reflect differences among national regulatory systems, risk assessment methods, and approaches to risk management.

Considerable uncertainty surrounds understanding the distribution of these residues in the US food supply, resulting from sampling and analytical detection methods. Some residue data are classified as confidential business information by federal agencies, inhibiting the public's ability to review and participate in government risk assessment and management efforts. The US legal system evolved during the 20th century permitting government to regulate chemicals individually rather than as mixtures. US law also has allowed USDA and EPA to balance health risks against economic benefits when setting allowable pesticide residue limits in foods. This decision standard was altered by the 1996 Food Quality Protection Act, that now demands residue limits be set to ensure "a reasonable certainty of no harm". Transforming the US pesticide regulatory system from one governed by a risk-benefit balancing standard to one that ensures a "reasonable certainty of no harm" has proven to be an extraordinary challenge.

The European Union has adopted the "precautionary principle" when establishing acceptable levels of risk for some products. In practice this may result in the choice of additional safety factors lowering or prohibiting certain pesticide and drug residue levels and these may result in trade barriers against imports that do not comply with the more cautious standards. The European Union ban on US beef treated with bovine growth hormone provides an example. Distinguishing between trade protectionism and legitimate national concerns over environmental health risks is becoming increasingly difficult, and often demands interpretation of complex and uncertain scientific information on risk. A contrasting approach is demonstrated by the Cartagena Protocol on Biosafety concluded in January 2000. This international agreement requires "informed consent" of a nation prior to the release of a genetically modified organism into its environment.

The paper concludes with a recommendation that knowledge of environmental health threats including chemical residue and toxicity data be freely accessible to the world community as international common property. Further, deliberations to set acceptable levels of risk from products traded internationally—by WTO, CODEX, and others—should be conducted in a transparent manner.