

General Session I

Preparation and Marketing in Changing Times

Dr. Terry Church, *Presiding*

Personal Preparation for Change in Bovine Practice—The Bovine Practitioner in 2000

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Introduction

Thank you for the invitation and honor to present a paper on how the bovine practitioner should prepare to serve the cattle industry in the 21st century which is only 12 years away.

This is my home province. I was born in Edmonton and raised on a small farm only 180 miles from here.

In this presentation I will outline what I believe is necessary for the education and preparation of the bovine practitioner based on the accomplishments of bovine practice and the cattle industry in the last 25 years and the needs of the various segments of the cattle industry today and in the future.

My theme will be that we should become professional animal health and production specialists and not just disease specialists which we have been for the last 30 years.

Changes in the Cattle Industry and in Bovine Practice in Last 25 Years

Within the last 25 years, major changes have occurred in both the cattle industry and bovine practice as a result of the efforts of cattle producers, private bovine practitioners, regulatory veterinarians, bovine clinicians in veterinary colleges, epidemiologists, nutritionists, geneticists, physiologists, agricultural engineers, pathologists, microbiologists, animal scientists, agricultural extension professionals, computer scientists and many others.

In the cattle industry there has been continuous improvement in the efficiency of livestock production. Annual milk production per cow has increased by 40% from 1970 to 1987, the costs of milk production have decreased and the number of milk cows and dairy farms has decreased (15). Large-scale dairy farms milking up to 2000 cows have been established and are successful (16,17,18). Dairy farmers are aware of the importance of

good management which integrates feeding, housing, milking, disease control, improvements in forage quality, sire selection and new technology.

Many small beef cow-calf herds have disappeared and the number of well-managed economically viable herds has increased, weaning weights have increased and producers have become aware of the economic advantages of a well planned reproductive program characterized by a high pregnancy rate in a short breeding season. Management of the cow herd at calving time appears to have aided in the control of neonatal diarrhea (55). Cross-breeding is an established fact. Cow-calf producers have become aware of the marketing advantages of preconditioning their calves for sale.

In the beef feedlot industry, major progressive changes have occurred in the management of disease and in production. Feedlots can now prevent grain overload and bloat which were major causes of "sudden death." The causes of death are now better understood because of the diagnostic skills of veterinarians who have done necropsies, often under adverse conditions. Because of improved record-keeping systems and the necessity to know the costs of production, feedlots now have useful information on morbidity, mortality and the costs of disease as a component of the total costs of production. Feedlot operators are also very conscious of public health concerns about drug residues. The average carcass weight for mature cattle has increased sharply over the years. The average federally inspected cattle carcass weight for 1987 was 662 pounds per head, compared with 541 per head for 1950, over a 20 percent increase.

In bovine practice there have been significant improvements in the understanding of many important infectious disease complexes such as mastitis, bovine leukosis, undifferentiated diarrhea of newborn calves, acute undifferentiated respiratory disease and those caused by *Hemophilus somnus* infection in feedlot cattle. Several

diagnostic tests are now available to assist in the diagnosis of disease. Canada was declared brucellosis free in 1987 thanks to the efforts of a successful Federal-Provincial eradication program begun about 35 years ago in which practicing veterinarians played a major role. Much has been learned about the effects of housing and ventilation on bovine health and production (1). The development of ear tags containing insecticides has had a major impact on the control of certain insects, and the control of intestinal helminths has been aided by the development of effective anthelmintics and improved understanding of the epidemiology of parasite control. Real progress is being made in the control of mastitis and milk quality has improved remarkably. A vaccine for the control of pneumonic pasteurellosis in cattle was approved for sale in Canada in 1988 based on a long-term research program on the pathogenesis of the disease begun about 15 years ago at the Ontario Veterinary College and field trials done in a first-class commercial feedlot only 30 miles from Calgary (66). The technology of bovine embryo transfer began about 15 years and is now well established. Bovine herd health programs and the computerization of animal health and production data have become major activities in many bovine practices (2,3,4,5). There is good evidence that herd health programs are profitable to the cattle producer (5). Major strides have been made in new feeding systems, including computerized systems for dairy cows and much has been learned about the health and production factors which affect lactation curves in dairy cows. Improved understanding of the factors which influence reproductive performance in dairy and beef cattle has contributed to improvement of the efficiency of cattle production. Veterinary epidemiology is making us aware of the need for making quantitative measurements of disease and the identification of risk factors (6-12). Feedlot veterinary medicine is gradually becoming more scientific through improvements in the clinical and pathologic diagnosis of disease and the use of a computerized record system which provides the feedlot with useful information on the incidence, morbidity and mortality of diseases, and the evaluation of the drugs used for the treatment of disease. Great strides have been made in the diagnosis and surgical correction of diseases of the digestive tract such as displacement and torsion of the abomasum which occur in the high-producing dairy cow. Our improved understanding of the clinical and laboratory findings of many diseases of cattle has improved diagnosis, prognosis, treatment and control (13). Veterinary toxicology has improved our understanding of many toxicological problems in cattle. Veterinarians are better diagnosticians, more production-oriented and some first-class bovine veterinary service is being delivered to dairy herds, beef herds and beef feedlots. Approximately 62% of food animal veterinarians' revenue are attributed to professional services

and 38% to veterinary product sales (14).

A brief consideration of the historical aspects of rural large animal veterinary medicine may explain certain aspects of the state-of-the-art and science of bovine herd health (65).

In Phase I which began in the early part of this century, national and state governments were involved in the eradication of the zoonoses such as brucellosis and tuberculosis. These programs were successful because the diagnostic tests were reliable, the testing was compulsory, and the financial resources were made available from the public treasury.

In Phase II, between 1945 and 1965, there was a large growth in rural large animal practices. This period coincided with a sharp increase in the standard of living in the developed countries which created an unprecedented demand for meat and milk. Farm animals became valuable and when they became ill, it was economical to call the veterinarian to treat them on an individual basis. During this period, modern clinical veterinary education was also born, and veterinary graduates possessed the knowledge and skills to treat a variety of animal diseases with remarkable success. Antimicrobial agents were also introduced during this period, and veterinarians could treat common infectious diseases such as pneumonia and enteritis with spectacular results. Veterinarians learned how to perform aseptic surgery, and the caesarean section in cattle, for example, became a common surgical procedure in veterinary practice. The ever increasing demand for meat and milk created a large demand for veterinarians and their services. Veterinarians spent most of their time treating individual sick animals and "fire-engine practice" was common. Because of a lack of time there was little effort made to control or prevent diseases on a herd basis. The emphasis was on the individual animal. Efforts to control or prevent disease consisted mainly of large-scale testing and vaccination programs for disease such as brucellosis.

In Phase III, beginning about 1965, veterinarians and farmers began to appreciate the value of taking positive action to maintain normal animal health and efficient production on herd basis. Farmers themselves gradually learned how to recognize and treat the common diseases. Veterinarians began to make recommendations for the control of specific diseases in the herd by vaccination, for example, or by changes in management. As veterinarians became more involved and more familiar with the herd and the farmer on a regular basis, the presence of subclinical disease and inadequacies in management which resulted in suboptimal animal performance were recognized. Subclinical disease in its broadest sense was soon recognized as a major cause of economic loss in food-producing animal herds. During this phase the use of the word *disease*, was expanded to include not only clinical and subclinical disease but also management inefficiency, all of which could result

in suboptimal performance.

The recognition that economic benefits could be derived by taking positive action against subclinical disease was then followed by the development of planned herd health programs. Veterinarians began to make regularly scheduled visits to farms to examine the animal health and production status of the herd and to make recommendations for improvement. During this phase, farmers and veterinarians recognized the value and necessity of keeping good records of animal health and production so that an objective analysis of health and production, including the costs of production, could be made.

Phase IV is taking place in the 1980's. In this phase practicing veterinarians make regularly scheduled visits to the herds, examine animals and records for evidence of subclinical disease, and collect and analyze data in some cases with the assistance of the computer. Both the farmer and veterinarian regularly analyze the animal health and production data, compare the actual performance with the targets of performance, and identify the reasons for failure to achieve the desired targets of performance. In collaboration with agricultural advisors the veterinarian makes recommendations for improvement in animal health and production using the whole farm approach.

It is now generally recognized that subclinical disease or production inefficiencies, many of which cause no recognizable clinical signs, are the most important contributors to reduced productivity. These production inefficiencies, which result from factors that impair animal health, can be minimized in the foreseeable future if present knowledge is applied, if animal health delivery systems are improved, and if new technology is developed through basic and applied research in areas where suitable measures are not presently available. The development of a totally integrated animal health and management system is the most important need. On a world-wide basis the pressure is on the cattle producer to become more and more efficient. This requires an animal health management and production system which provides **constant surveillance** of what is happening so that a diagnosis can be made and corrective action taken as soon as possible.

Bovine practitioners no longer depend for their income, as much as they once did, on calfhood vaccination for brucellosis, castration of calves, dehorning, dystocia, replacing vaginal and uterine prolapses, removing retained placentas, treatment of simple uncomplicated milk fevers and treatment of beef calves affected with shipping fever (65).

In Canada a wide variety of government support programs for large animal practice were instituted to encourage veterinarians to practice in remote rural areas. These were largely successful and many are being phased out. In Quebec, the Animal Health Improvement Program was established in 1971 to assist livestock services (60).

Initially, curative veterinary medicine was supported; in 1982 the program was expanded to include support for preventive veterinary medicine.

Challenges of Bovine Practice

In spite of our successes in bovine practice there are many challenges which are opportunities for progress. Not enough practitioners provide a broadly-based animal health and production management service to cattle producers who could profit by such a service. Our animal health care is fragmented. There are too many bovine practices with a small number of veterinarian rather than multiple person practices which would be more dynamic, effective and would benefit livestock producers and the profession (67). Because of the limitations of clinical and laboratory examinations in the field it is often perplexing to make a definitive etiological diagnosis when presented with a sick cow on the farm. It can be even more frustrating to make a diagnosis when many animals are affected with clinical disease in a herd or when there is simply impaired productivity such as a decrease in growth rate or milk production, without obvious evidence of clinical disease. Our expertise at the herd level is inadequate compared to the advanced techniques available for the diagnosis of disease in individual animals (9). In part this is due to the educational system at veterinary colleges which centers on the individual animal but veterinary educators are now attempting to teach herd health management. Because of economic constraints in the livestock industry and veterinary diagnostic laboratory services there is a lack of in-depth field investigations of many economically important diseases in herds. A wealth of useful information could be generated if such investigations were done when confronted with herd problems in which the diagnosis is not obvious. Even when the diagnosis is obvious there is usually insufficient study of the epidemiological factors which allowed the disease to occur and thus very little or nothing is learned for the future. As a consequence we still deal with too many anecdotes and opinions on the etiology, diagnosis, and treatment and control of many diseases of cattle. Witness the wide range of recommendations which are made for the vaccination of cattle for the control of respiratory diseases in weaned beef calves and in feedlot cattle. Is it any wonder that cattle producers wonder about the validity of our knowledge and the basis for our recommendations? We may have depended too much on the sale of antibiotics, vaccines and pharmaceuticals as a source of practice income rather than place more emphasis on remuneration for professional services (20). The extra-label use of drugs creates potential problems of drug residues which could result in the banning of the use of certain drugs altogether (21,22). Our failure to practice critical appraisal of the clinical findings,

diagnosis, treatment and control procedures which we recommend affects our credibility as professional veterinarians (23).

There are some intraprofessional differences between large and small animal practice which may explain why bovine practice appears to be less attractive to veterinarians in the last 10 years (24,25,26). In small animal practice, because of the emotional attachment between the animal and the client, there is an element of cruciality in the minds of the client. The large animal practitioner provides a delivery service on the farm, may appear in dirty coveralls and often works in an uncomfortable environment. Farmers may not be supportive because they themselves have considerable experience with animals and their common diseases and are often critical of what the veterinarian is doing or recommending. Large animal practice is also physically dangerous. There are no central emergency large animal clinics to do the night work and thus large animal practitioners may have to work long hours especially during the busy season which becomes stressful. In large animal practice, there is no cruciality because the animals are primarily of economic value and there is limited if any emotional attachment between the owner and the animals. There is no mystique and no power of intimidation in large animals as in small animals. In small animal practice the clinic is the center of practice, which is more efficient, more professional, more impressive to the clientele, more routine, the working conditions and environment are much more pleasant and the equipment is usually readily available. Veterinary technicians are now commonly available to assist in the provision of intensive care and more sophisticated laboratory testing is done because it is readily accessible and the clients are more willing to pay for the laboratory work-up. Many more animals can be examined and cared for in a day, emergency clinics are available and fewer small animal practitioners appear to become disillusioned by their work. In small animal practice, the clinic with all of its equipment and facilities including computers is impressive, appears mystical, and leaves the impression of intimidation which helps the professional to function effectively. Small animal practice is dramaturgical; the equipment, the records, the surgery room and the radiographs all provide the stage for the veterinarian to act and do wonders in the "back-room" out of sight of the owner. In large animals, the owner is right there watching you most of the time and assessing what you are doing and comparing your procedures with the veterinarians who worked there before or with the owners' own diagnosis. In small animals, the veterinarian is in total command and it is easier to exude the image of a professional person than it is in large animal practice. What is the status of the professional image of bovine practitioners?

From an information point of view we have insufficient

information about the factors which limit production in cattle herds. If we could identify more of the factors which limit current levels of production we could make more reliable and effective recommendations with confidence. What are the major causes of economic loss in dairy herds, cow-calf herds and beef feedlots? The epidemiological techniques are now available to identify and quantify these factors which will help to make progress in management of animal health and production (6,7,11). Research into the relationship between bovine health and production has not kept pace with the rapid growth in livestock production systems which the cattle industry has developed in the last 10-15 years.

We still lack the information, technology and knowledge necessary for the diagnosis, treatment and control of several diseases or problems which are associated with the loss of production. Some examples follow. The prevalence of Johne's disease is increasing and the diagnosis and control are major problems. The definitive etiological diagnosis of abortion is still a perplexing and frustrating problem. The prevalence of salmonellosis in cattle appears to be increasing, and public health scientists are claiming that the use of antibiotics in feedlot cattle and dairy herds is linked to the emergence of antibiotic-resistant salmonellae which are causing disease in man (62,63). The current methods for the treatment and control of salmonellosis in cattle herds are unreliable and frustrating for the bovine practitioner. Does the presence of the bovine viral diarrhea virus in the intestinal tissues of diarrhetic calves aged 3 to 6 weeks mean that the virus is the cause of the disease? What if the cows were vaccinated annually for the last 2 years with a vaccine containing the bovine viral diarrheal virus. Even more difficult, what do I recommend to the producer who is my client and who followed my advice to vaccinate the breeding females before breeding, a recommendation which was based on limited data because the vaccine company did not make available any useful efficacy data.

Some bovine practitioners are not as concerned as they should be about public health concerns of drug residues in meat and milk (21). We have also not shown due regard for the concerns of the animal welfare movement which is well-financed and effective.

As with other veterinarians, bovine practitioners have not developed the skills and discipline of keeping up-to-date with the current literature in bovine health and production which is complex. It is a challenge for the veterinarian to find the "pearls of knowledge" which are buried in the large number of publications worldwide.

The communication and marketing skills of bovine practitioners have not kept pace with the rest of the agribusiness world which stresses effective oral and written communication skills and uses modern marketing skills to provide service to clients (27,28). The quality of letters and

reports which are sent to producers and to prospective employees (new graduates) has a major influence on how you are perceived as a professional. Word processors provide part of the solution but practitioners must create the document.

The Cattle Industry in 2000

The sciences and activities which have accounted for improvements in bovine health and production in the last 25 years are related to advances in ruminant nutrition and feeding systems, genetics and the selection of breeding stock for growth or milk production, agricultural engineering and improved housing, advanced milking machine technology, improved management procedures in beef feedlots, an awareness of the economic and managerial value of regular herd health programs, improved education of cattle owners and managers and animal attendants, improved understanding of the diseases and economical analysis of the costs of production of milk and meat.

Some assumptions and predictions can be made about the characteristics of the cattle industry in the 21st century. The pressure to improve the efficiency of production and lower the costs of production will continue indefinitely (15,29). Cattle producers will be much more knowledgeable about animal health and production and will possess the knowledge and skills necessary to make a diagnosis and carry out treatment of many commonly occurring diseases. The management of livestock will be well advanced and automated as much as possible. Electronic identification of livestock will be common (53). Genetic investigations have indicated that cows bred for high production require more health care and that the increased health costs are only a small fraction of the greater returns from cows that are genetically superior for yield traits (75). Producers will better understand what the veterinarian is doing and will expect a cost-benefit analysis of recommendations for treatment and control of diseases or of changes in production procedures. As in the present era, changes will occur much more rapidly than ever before. The pressures for efficiency of production will continue and common infectious diseases of the alimentary and respiratory tracts will become more common and difficult to control. Nutritional and metabolic diseases may become more common because of the push for higher and higher milk production per cow at a lower cost. The stocking rates of cattle in barns, yards, fields and feedlots will continue to increase which will exacerbate the problems associated with animal welfare. Feeding systems, particularly in dairy herds will continue to improve, assisted by computer technology and will probably be an expensive capital investment. Milk production will continue to increase; the use of bovine somatotropin will increase milk production in well-managed herds by about 20% and its use may be

commonplace in dairy herds unless long-term field trials reveal undesirable side effects (30,31,32). The production of milk greatly in excess of demand will lower the price sharply which will result in a decrease in the number of dairy farms and even more pressure on the farmer to improve the efficiency of production and lower the costs of production. The number of dairy and beef herds will continue to decrease. The size of dairy and beef herds will continue to increase but the percentage of very large herds will still be small and be located in certain geographical areas in which they are found now (15,29). Government support subsidies for the meat and milk may be gone by 2000. The majority of cattle farms will still be owned and operated as family farms. The use of computers and computerized data bases will be a way of life and decisions will be based on information generated on the farm in combination with other data bases (33). Capital investment per unit of animal will be high which will continue to apply pressure on the producer to be as efficient as possible and to slowly increase in size so as to obtain the benefits of economy of scale. There will be less consumption of red meat and milk by society which wants to eat more vegetables and poultry meat (34). Cattle producers will be very conscious of the need to use drugs judiciously to avoid residues in meat and milk and the progressive producers will be sensitive to the need to produce good quality meat and milk (35).

Bovine Practice in the 21st Century

The successful bovine practice of the future will be a service-oriented multiple-person practice which provides a broad range of animal health and production services to a variety of different cattle producers and which can adapt to rapid changes in livestock management and production technology (37,57,58,59). Bovine practitioners must state clearly that they are in the business of providing a broadly-based animal health and production management service (14). The veterinary needs of cattle industry include:

Accurate, economical and rapid diagnosis and treatment of disease in individual animals;

accurate, economical and rapid diagnosis and treatment and control of disease which occurs in groups of animals (herd medicine);

a broad-spectrum animal health and production management service which aims for optimum production of wholesome meat and milk free of chemicals and antimicrobials on a humane basis with due concern for animal welfare, the prevention of the zoonoses, and maximum profit for the producer.

The modern dairy cattle producer, cow-calf producer or feedlot operator whose objective it is to optimize production and maximize profit wants assistance with the integration of animal health and production (16). "The recent increased

interest in application of economic analysis in veterinary medicine is an important step in the direction of assisting producers to enhance their profitability. Much of the profession's future role may be determined by the degree of success achieved in blending economics and animal health management (71)."

An example of a broadly-based animal health and production service which can be provided by bovine practitioners is given by the complete cow-calf herd health service program outlined by Ribble (36) and set out in Table (1).

A broadly-based dairy herd health and production management service and a modern feedlot health and production management service can be modelled according to the outline below and the needs of the particular producer.

Table 1. The Complete Cow-calf Herd Health Service Program. (Ribble, 1987)

1. Technical Services

- a. *General*: clinical and routine necropsy examinations of all animals: reproductive examination of cows and bulls.
- b. *Health Accounting Services*: routine nutritional monitoring: routine production performance monitoring including comparison with targets of performance: quarterly health management reports.
- c. *Routine Electives*: deworming, dehorning, castration, foot-trimming, and vaccination.
- d. *Emergency Service*: individual animal emergencies.

2. Pharmacy

Drugs are supplied wholesale with a 5% handling fee: this eliminates veterinary "conflict-of-interest" concerning drugs. Drugs are delivered to the farm when possible. The veterinarian is to have complete control over which drugs are used on the farm.

3. Consulting Services

- a. *Information*: regular telephone and in-person information exchange: regular transfer between farms of information and expertise gained by the veterinarian from individual farms (maintaining complete confidentiality): a program continuing education of farm staff.
- b. *Preventive Medicine Procedures*: regular analysis of validity and specific applicability of preventive medicine techniques.
- c. *Science/research Services*: investigation of disease outbreaks. REGULAR performance of on-farm field trials to assess different management techniques and new pharmaceuticals.

Some bovine practitioners will still be necessary to provide traditional emergency veterinary service to owners of small herds of dairy or beef cattle. Cattle producers who receive their primary income from the production of beef or milk will expect their veterinarian to be competent problem solvers who can analyze a problem, access the relevant knowledge from the most up-to-date information

data bases and apply that knowledge to the solution of the problem. Accuracy in diagnosis and effective treatment and control will be expected which in turn requires that the information used for decision-making be as current and reliable as possible. In an era in which there is a propensity for civil litigation, bovine practitioners will have to provide reliable advice (38). Regardless of the segment of the cattle industry served, the modern bovine practice will be involved in making accurate diagnoses, problem-solving at the herd level particularly when production is suboptimal, the use of computers and data bases, the submission of regular reports on the status of animal health and production in the herd including the provision of written advice based on the analysis and interpretation of animal health and production data obtained from visits to the herd. The evaluation of drugs and vaccines directly on the farm, especially in feedlots, and the monitoring of the use of drugs which can become residues in meat and milk will become a responsibility of the veterinarian. As the intensification of livestock production continues to increase, veterinarians may be inclined to recommend the use of more drugs, chemicals and antimicrobials for the control of infectious diseases while at the same time must be concerned about drug residues in meat and milk and the development of drug-resistant bacteria from animals which have been treated with or fed antibiotics (62,63). It will be a challenge for the bovine practitioner to critically appraise this literature which may not be valid and unfairly misleading.

The bovine practice of the future will have a computerized information center (56) which will include the records of all calls made to the farm whether to individual animals or regular herd health visits, necropsy reports, abattoir information including carcass grades obtained, causes of condemnation and drug residues, copies of disease prevention, recommendations made, annual reports to the clients, the costs of veterinary services including drugs and vaccines used on the farm, the costs of production of meat and milk on each farm, the results of feed analysis, as description of the farms and its facilities, culling information, DHIA and somatic cell count reports, preconditioning recommendations, weaning weights and calving performance in beef herds and so on. The development of such information centers is perhaps only a vision today but I believe it will evolve with time and will be an important source of information for decision-making. Decisions will be based on reliable information rather than on memory and opinions. The use of the techniques of applied epidemiology will allow correlation between calf health and subsequent performance in the heifer replacements or the adult cow (68,69). It has been shown that pneumonia in dairy calves can adversely affect the age at first calving of the heifer and the subsequent performance of that animal in the herd. The storage of

animal health data from all of the herds would allow analysis of the epidemiology of the diseases. In other words, the veterinary practice will be the repository of the relevant information needed for the veterinarian to make intelligent decisions. In the near future it will be possible for the veterinarian to access the animal production data from the DHIA records. Computers will also be used for on-line searches of large bibliographic data bases in animal health and production which will provide instant access to the latest published information on a subject (39). Decision analysis techniques will be used to assist in making decisions about the use of a certain vaccination or treatment programs when confronted with outbreaks of disease (40). Mobile telephone and computers operated from a motor vehicle are now available which could allow the practitioner to access data bases directly from the farm. It is easy to imagine the practitioner who is uncertain about a diagnosis, accessing a computer-assisted diagnosis data base directly from his practice vehicle which is parked next to the dairy barn or the feedlot pen. In this information age and using the sciences of prediction, veterinarians will have to be prepared to assist producers who ask "What if we do this or that?" "What will happen and what will be the economic consequences?"

Veterinary techniques will be commonplace in practice to assist in the collection of laboratory samples and animal health and production data directly from the farm and to process the information in a computer and in the preparation of reports. Technicians will actually do much more of the routine elective procedure such as dehorning, castration, vaccination and the detection and treatment of sick animals than they do now. Veterinary technicians will be employed by veterinarians who in turn will contract with a feedlot to provide all of the animal health services which includes the identification and treatment of sick animals. Technicians can be invaluable to bovine practices which provide a complete animal health management service.

Regular meetings of producers to present new information and technology will be held to assist in their progressive education. We have a responsibility to keep our producers informed about new developments. Regular animal health newsletters are very effective for this purpose. The computer can also be used to access information for producers.

All of these activities will require a restructuring of bovine practice. In addition to the clinical work done on the farm, veterinarians will be engaged in the analysis and interpretation of animal health and production data, comparing targets of performance (2) with actual performance and determining the reasons for the shortfalls, making decisions, generating advisory reports and getting paid for doing the same (41). Bovine practitioners must get paid for their advisory services and deskwork and they

will if the advice is sound and profit-oriented. They should not have to donate their time during the evening and weekends to formulate dairy rations and prepare herd health reports. Because of the importance of life style, the new generation of veterinarians will be reluctant to work 60-80 hours per week in a bovine practice and will become disenchanted and seek new career opportunities. Established bovine practitioners must provide the environment and work conditions which will make the practice attractive and stimulating to work in. It is expected that the number of veterinarians in food animal practice will increase 73% from 7,000 in 1980 to about 12,000 in 2000 (50). There will be more multiple-person practices consisting of a broad-range of expertise including strengths in medicine, surgery, nutrition, reproduction, mastitis control, and dairy production as examples, in a dairy cattle practice.

Education of the Bovine Practitioner for the 21st Century—Challenges and Opportunities

Expertise of Bovine Practitioners.

The experienced bovine practitioner of today is competent in the diagnosis and treatment of the individual animal affected with a variety of the common medical and surgical diseases (63,73). In addition, in the last 10 years, bovine practitioners began to provide a wide range of herd health services to dairy herds, beef herds and beef feedlots. A considerable amount of free advisory service, usually associated with the sales of animal health products, has also accounted for a significant part of practice activity.

The need for Vital Information and Clinical Research.

There are many situations in which we lack sufficient knowledge or understanding of certain diseases which severely limits our ability to serve the cattle producer more effectively and economically. Some examples include the difficulties with the control of diarrhea in newborn calves, the interpretation of the presence of the bovine virus diarrhea virus (BVDV) in the intestinal tissues of 6-week old calves which have died from diarrhea, the interpretation of the presence of the BVDV in the lungs of cattle which have died from pneumonic pasteurellosis, the treatment and control of outbreaks of acute undifferentiated respiratory disease in feedlot cattle, the significance of the bovine respiratory syncytial virus as a pathogen in outbreaks of respiratory disease in cattle, the efficacy of almost all of the vaccines currently available for the control of respiratory disease in cattle or the vaccines for the control of rotavirus and coronavirus diarrheas of newborn calves or for *Hemophilus somnus* infection. Bovine practitioners must demand to have vaccine efficacy data based on clinical trials done under field conditions. If the information cannot be obtained from the manufacturer, it is questionable whether the vaccines should be recommended or used.

Other examples of our lack of understanding include outbreaks of abortion which are undiagnosed, the cause of retained placentas, the downer cow syndrome, the factors which precipitate outbreaks of peracute coliform mastitis in dairy cows, the diagnosis of copper deficiency and why in some herds with hypocuprosis, supplementation with copper does not result in an improvement in body weight gains while in others it does, the prevention of navel-ill in calves, and the failure of a significant population of calves to achieve adequate levels of colostral immunoglobulins which may result in increased calf mortality.

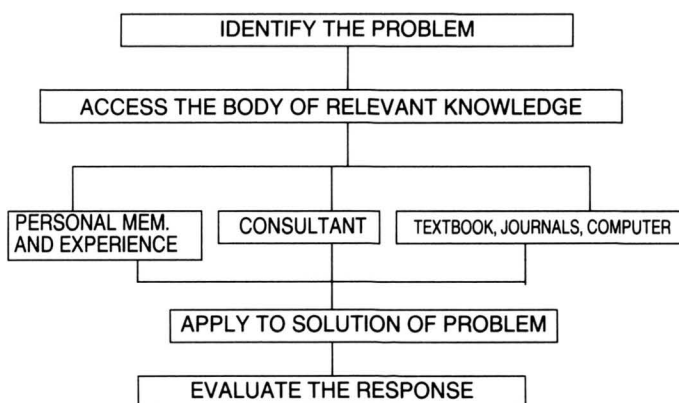
Most of these problems have been studied by researchers under ideal conditions but the extrapolation of the research results to the field situation is a major problem. This predicament provides an opportunity for the bovine practitioner to do some clinical research and field trials by collaborating with colleagues at veterinary colleges, diagnostic laboratories and research laboratories. Progress will be slow if practitioners wait for veterinary colleges to do the research in their own teaching practices. As production intensifies additional on-farm research will be needed to determine methods of handling new problems (71). I would suggest the American Association of Bovine Practitioners should have a research priorities planning committee which would identify animal health and production problems which should be researched. The information which is available about disease and production medicine can be obtained from one's personal library, a veterinary library or an on-line computer search of large bibliographic data bases which store the titles and abstracts from thousands of agricultural and veterinary journals.

Making a Diagnosis and Problem-Solving. In my experience, a major challenge in bovine practice is the ability to make an accurate diagnosis, economically and rapidly, in the individual animal or in a group of animals which are affected with clinical disease or impaired productivity and being able to recommend and institute effective and economical treatment and control measures. Furthermore, it must be done on the farm using wisely selected economical laboratory aids when necessary. Making an accurate diagnosis requires a good understanding of the etiology, epidemiology, and clinical and laboratory findings of the clinical and subclinical diseases of cattle. There is considerable interest in computer-assisted diagnosis which has the potential to improve the speed and accuracy of making a diagnosis. The Cornell Consultant computer-assisted diagnosis program is now available by long distance telephone (42). The entry of key clinical signs will yield an exhaustive list of differential diagnoses which are not ranked according to probability but the list does remind the clinician of possibilities which can be considered. As new information

on the epidemiological, clinical and laboratory findings of diseases becomes available, it will be possible to write computer-assisted diagnosis programs which will provide a weighting of each differential diagnosis. **The success of computer-assisted diagnosis will, however, depend on the ability of the clinician to conduct an accurate clinical examination and to identify the important clinical findings which represent the disease in question.** In certain surveys in human medicine the computer was more accurate in making a diagnosis than the attending clinician. The development of computer-assisted diagnostic programs would be a worthy area of clinical research in bovine practice.

Problem-solving is related to making a diagnosis. Bovine practitioners must research a clinical problem thoroughly, assume responsibility and attempt to solve the problem. The components of problem-solving skills can be summarized as follows:

FIG (1). The Components of Problem-Solving



We can improve our problem-solving skills by collaborating with consultants. We will improve our credibility and image in the minds of the producer by being able to solve problems. Too often, disease outbreaks and herd production problems resolve spontaneously, the economic losses are incurred, a diagnosis is not made, and the producer concludes that the veterinarian couldn't solve the problem anyway. If production problems go unsolved is it any wonder that producers do not recognize our expertise in such matters? The use of consultants would also improve the knowledge base and skills of the bovine practitioner who would become more capable much more quickly and provide some upward professional mobility which is lacking in veterinary medicine. The development and accreditation of consultants by examination must be encouraged.

Provision of Broadly-based Animal Health and Production Service.

The greatest challenge at the present time is the implementation of a broadly-based animal health and production management service which the producer needs

and for which the veterinarian gets paid for professional skills and advice (54). It will require regular monitoring and analysis of records so that the results speak for themselves. Preventive medicine programs become more cost effective as herds become larger and should be used by a larger percentage of dairy producers (75). An important key to health and production management is the comparison of targets of performance with actual levels of performance of the herd (2). The **trump card** of the veterinarian is the ability to determine the causes of the shortfalls in performance and how it can be improved economically. This will also include doing field trials and clinical research on the farm because every farm is different, the cattle are different, the environment is different, the management is different, and the problems are different each year. The best and most innovative producers should be selected initially. The success of a herd health program depends on the willingness of the producer and the clinical performance of the veterinarian (2).

Veterinarians frequently say that they cannot provide a complete animal health and production service because they do not possess the knowledge and skills to do the job. However, with the use of computers and the development of data and information bases it will be possible for the veterinarian to access an unlimited amount of useful information for application to a problem or for improvement of the efficiency of livestock production. Imagine what could be done by accessing the raw unpublished information which is stored in computers by a wide variety of agencies which appear in the list below. It is theoretically possible to link data bases to artificial intelligence systems and make more reliable decisions based on more reliable data rather than memory based data which is notoriously unreliable. All of these data bases could be accessed by the veterinarian in his clinic or even on the farm. What an exciting prospect!

| | |
|--|---|
| Veterinary Diagnostic Laboratories | Dairy Herd Improvement Associations |
| Artificial Insemination Centers | Daily Livestock Marketing News |
| Drug and Vaccine Companies | Food-Animal Residue-Avoidance Data Bank |
| Veterinary Teaching Hospitals | Private Veterinary Clinics |
| Veterinary and Agricultural Bibliographic Data | Abattoirs |
| National Animal Disease Reporting System | Milk Marketing Services |
| Government Regulatory Agencies | Public Health Departments |
| Environmental Pollution Agencies | Breed Agencies |
| Wildlife Agencies | Computer-Assisted Diagnostic Programs (Consult) |

Communication Skills. Bovine practitioners need to improve oral and written communication skills. A written report should follow every herd health visit and recommendations for changes in animal health and production management should be written out, sent to the client and recorded in the veterinary clinic. Practitioners must take the time to educate producers to maximize the use of existing technology. Take the time to analyze and interpret

the regular DHIA report and show the producers how progress is being made or how deterioration is occurring. The preparation of regular newsletters at strategic times of the year is an excellent method of informing livestock clients about the importance of a variety of routine and annual animal health and production activities such as vaccination recommendations, preconditioning programs and evaluation of reproductive performance in beef herds, as examples. In addition, each year there are differences in livestock markets, growth of crops, body condition of the animals, the effects of drought or excessive rainfall, the introduction of unexpected diseases into the practice area, all of which can be highlighted in newsletters to clients who welcome such information and invariably ask further questions which commonly lead to increased utilization of the veterinarian.

Bovine practitioners must also become involved with the public media in the controversies of animal rights and animal welfare. We must be able to articulate our views about the nutritional value of meat and milk and that the cattle industry is concerned about the humane care of their animals. **We must not run away from these issues or the media!**

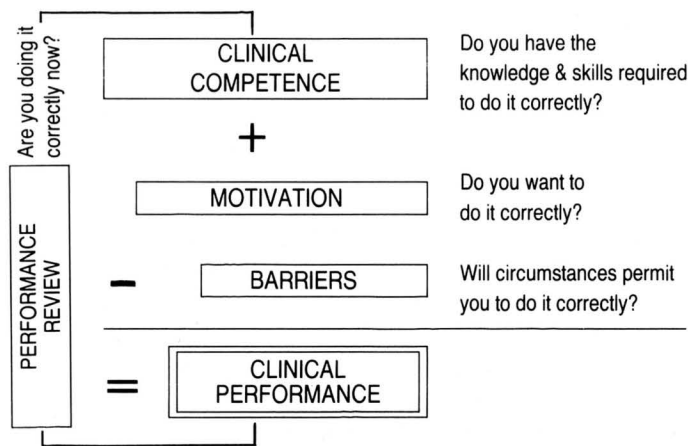
Education and Preparation of the Bovine Practitioner for the Future: Methods and Procedures

Personal Learned Experience. There are several components to the education and preparation of the bovine practitioner for the future. The most important element is being realistic about one's level of competence and knowledge, and recognizing when one is getting beyond one's depth. You must know your skills well enough to recognize your limitations, and get expert advice when you want to exceed them. Our effectiveness as clinicians begins to decline after we graduate from veterinary college. Over the years in practice we become good diagnosticians but our knowledge base deteriorates because we forget and fail to learn new facts as they emerge and to disregard obsolete information. Keeping up to date is difficult because of the way journals and continuing veterinary education programs are operated. Keeping up to date with important useful new advances in the knowledge of bovine animal health and production is a challenge because of the complex interface between veterinary medicine and the agricultural sciences. The key to continued effectiveness as a clinician is learning how to decide when your current diagnostic and management maneuvers are no longer good enough and need to be changed.

Your clinical effectiveness tomorrow will be determined by your skills in self-assessment and in tracking down and assessing veterinary medical and bovine production-oriented knowledge most of which resides in journals today. Clinical performance has four determinants (Fig. 2) (23).

The first is *Clinical Competence* which is a measure of the knowledge and skills which are required to do the work correctly. The second is *Motivation* which measures the inclination to put competence into practice. The third is *Barriers* or will the circumstances allow you to do it correctly. The barriers in bovine practice are many, different on each farm and include economics, lack of compliance, poor livestock management, unwillingness of the farmer to change, inadequate records, goals and values of farmer which are not production or profit oriented, disrespect for the knowledge and skills of the veterinarian and reluctance to pay for advice. The fourth determinant is *Performance review* which is feedback on what you are doing and how well you are doing it (23). The development of effective practice habits may be more important than the acquisition of new knowledge. There is a difference between many years of learned experience and many years of repeated experiences with little or no learning.

FIG. 2. The Determinants of Clinical Performance (23).



The performance review can concentrate on clinical skills such as accuracy and precision of history taking, clinical examination, and making a diagnosis and prognosis as is done in human medicine. In bovine practice a performance review could include regular critical assessment of diagnosis, therapy, control of disease and the recommendations we make for improvement in animal production and management.

Species Specialization. I contend that the bovine practitioner of the future must move in the direction of becoming a species-industry specialist who possesses the knowledge of animal health and production in dairy cattle, beef cattle or in beef feedlot cattle (44). The practicing veterinary profession and veterinary faculties have assumed that such specialization will occur in private practice. However, progress is slow; very few veterinarians are emerging as self-trained specialist bovine practitioners.

There are very few formal postgraduate species specialization programs available for a new graduate who wishes to pursue such a practice career (74). A veterinarian can become a species specialist by self-education and personal experience, selected postgraduate courses, diploma courses (45) which are 3-6 weeks in length or selected conferences and special seminars such as are offered at the Annual Meeting of the American Association of Bovine Practitioners. The bovine specialist will possess the knowledge and skills necessary to make a diagnosis and provide recommendations for treatment and control of diseases in cattle. The bovine production aspects will require knowledge and skills associated with nutritional consultation (64), reproduction, housing and ventilation, calf health, the rearing of heifer replacements, breeding and genetics, the costs of meat or milk production as all of these are applied to either the dairy herd, the beef cow-calf herd or the beef feedlot. Species-industry specialists will have specialist understanding of production systems and the skills to insert animal health management techniques into such systems. Species specialist who are production oriented will use a herd health approach to the delivery of veterinary service. The specialist will have to be able to answer complex management and economic questions about disease and its economic consequences. For example, a large-scale dairy operator may ask the veterinarian not only to identify the methods of controlling neonatal diarrhea of calves but also to evaluate the methods in terms of their net favorable effect on the economic health of the dairy herd (16). To answer such a question, the veterinarian would need to be aware of the latest literature on the control of disease, an understanding of management and economics, and a working knowledge of applied epidemiology and biostatistics. Thus in order to deliver a dairy herd health management service to large-scale dairy herds, veterinarians will need post-graduate level education and experience in many fields including bovine medicine, reproduction, epidemiology, nutrition, biostatistics, decision analysis, clinical research techniques, computer literacy, environmental control, production economics, personnel management and financial analysis (16).

Bovine practitioners can now be certified by examination by the American Board of Veterinary Practitioners. Such certification would have positive benefits for the veterinary profession and livestock producer. Specialization encourages excellence which is what the livestock industry expects from us. We must show leadership and encourage specialization and certification by examination.

Bovine practitioners will also require a knowledge of the public health hazards associated with the use of drugs in milk and meat producing animals. Some concern will also have to be shown to the animal welfare aspects of intensive rearing of cattle (52).

In summary, there is a need for the development of formal

post-graduate programs which can accelerate the education of bovine practitioners.

Veterinary Epidemiology. The science of veterinary epidemiology as applied to farm livestock has just begun to take its rightful place in veterinary education (6,7,11). Bovine practitioners deal with populations of animals and as such are concerned with the behaviour of disease in populations and the identification of epidemiological determinants or risk factors which are a powerful tool for the control of disease (51). A recent publication of the Veterinary Clinics of North America (46) dealt with "Investigation of disease outbreaks and impaired productivity" and two textbooks in veterinary epidemiology, published recently, are now available (6,11). Animal health economics will interact with epidemiology for purposes of responsible economic evaluation of animal health management at the farm level (71). The bovine practitioner of the future will also be involved in the evaluation of vaccines and drugs and a knowledge of clinical research techniques will be a valuable asset.

Computer Literacy. The bovine practitioner must become computer literate. The computer is now being used in veterinary practices for accounting, drug inventory, work-processing, writing of newsletters, the analysis of animal health and production data, decision analysis, computer-assisted diagnoses, on-line computer searches of the literature and accessing other data bases.

Veterinary Information Management. Keeping up to date with the veterinary and agricultural literature related to a species or class of livestock is a challenge. Veterinarians generally are not well informed about new useful information in the published literature because clinical practice takes priority over reading journals and filing articles for future reference (72). Information about bovine diseases and production is now published in more than 50 journals. Most bovine practitioners subscribe to only a few veterinary association journals. How then can the bovine practitioner remain informed about new developments and how can he find the information necessary to solve a problem? The animals and problems we deal with and our own performance review will pinpoint gaps in our knowledge which should prompt us to consult a library or a consultant. The library may be our own personal filing system (47) containing journal articles textbooks and other publications or a veterinary medical library at a college. You may ask a consultant for the answer to a question, but in doing so you are abdicating your own critical appraisal of the evidence. If you want the best evidence you must obtain the source of the evidence and critically evaluate it yourself. For example, you may want to know the role of the bovine virus diarrhea virus (BVDV) in the pathogenesis of pneumonic pasteurellosis in cattle. You may begin by looking in your files for the most recent reviews of the literature of bovine virus diarrhea

and pneumonic pasteurellosis which may provide some answers or other references which should be obtained and read. You could telephone a veterinary virologist or clinician at a veterinary college or research institute who may give you the answer and refer you to some useful references. However, you must critically appraise the evidence for validity and applicability in your practice.

Creating and Running Your Own Library. Your own library has the potential to become the most valuable means of keeping up to date. Because individual practices are different there is no single right way. Practitioners usually ask two questions about a personal filing system, "What should I put in my library?" and "How do I find it when I need it?" (23).

A personal library would contain all or some of the following: textbooks, journal articles filed according to subject headings, Reference cards for recording journal articles, titles of textbooks, and occasional publications, lecture notes and proceedings of conferences, summaries of your clinical cases.

The selection of textbooks to purchase, use and rely on can be perplexing. There is now a flood of textbooks many of which are repetitious of information published elsewhere. A good textbook is one which assists the reader in the diagnosis, treatment and control of the common diseases of cattle. The book should provide a clear and concise overview of each aspect of each disease and should indicate what is not understood about each disease. The book should reflect the current state of the science of each disease so that it can be used as a basis for professional recommendations. It should provide complete coverage of the discipline indicated in the title. The index should be comprehensive and should lead the reader to the part of the book which contains the most important aspects of the subject. The reference lists for each topic should be current and chosen critically by the authors. A list of selected recent review articles, if available, for each major subject should be included in the reference list. Good textbooks are written by authors who are dedicated to mastery of the subject and who have credibility because they practice the discipline. The best test for the quality of a textbook is to use it when questions arise about a clinical case. If the needed information can be found easily, if it is clear and concise, if it is relevant and really helps the clinician to make a diagnosis, recommend treatment, or explain etiology, epidemiology and pathogenesis and does it regularly, then it is a good reference textbook. Book reviews are also helpful guides to textbooks but unfortunately many book reviews are not well done because the reviewers do not read and critically evaluate the entire book and assess the index. Many textbooks in veterinary medicine are now written by multiple authors which may result in gross repetition, lack of uniformity in the subjects covered, gross omissions of certain subjects, poor indexes,

long delays in publication because of delinquent authors and unnecessarily high costs which dissuages students and practitioners from buying them.

The selection of journals the bovine practitioner should read, how to read a journal article, how to file journal articles for future reference, and making time for these activities is a major chore which usually receives lower priority than it should. Nevertheless, the development and maintenance of a personal system of keeping informed of useful developments in bovine animal health and production and being able to access the relevant published literature for assistance in solving specific problems is a necessary prerequisite for the modern bovine practitioner. It is an activity which veterinarians in general do not do well because their undergraduate veterinary education did not train them to read journals on a regular basis and to access the relevant literature to apply to the solution of problems. The emphasis in veterinary education has been on conveying information to the students. **Knowledge is best learned when applied to the solution of a problem.** Veterinarians read journals to keep abreast of professional affairs, to understand the pathogenesis of disease, to determine how other clinicians manage a particular problem, to determine if a new diagnostic test should be used, to determine new developments on the etiology or epidemiology of disease, to obtain new information on therapy and to learn about new developments in animal production. Bovine practitioners read journals primarily for new information which will improve any aspect of the management of animal health and production of cattle.

The bovine practitioner should read and study those journals which by experience have shown to yield the most useful information for their work. The most useful journals will soon become obvious to the reader. Those journals which are refereed by peers are considered to publish articles which are more valid than articles from non-refereed journals. However, there is no assurance that refereed articles are more useful or scientifically valid than non-refereed ones.

Some indication of the journals which yield the most information can be gleaned from an analysis of the veterinary journals which were cited most frequently for the development of the Cornell Consultant computer-assisted diagnosis program (43). Eighty percent of the citations for large animal diseases were from 17 journals and 90% from 25 journals. The top 6 journals ranked from highest to lowest frequency were as follows:

- Journal of the American Veterinary Medical Association
- Veterinary Clinics of North America (Food Animal Practice)
- Compendium on Continuing Education for the Practicing Veterinarian
- Veterinary Record
- Australian Veterinary Journal

American Journal of Veterinary Research

In addition to the above journals, bovine practitioners should read and select production-oriented articles from the Journal of Dairy Science, Journal of Animal Science and the Canadian Journal of Animal Science. A recent analysis of journal use in a library of a veterinary college revealed that of 49 journals used most frequently during a one-year period, not one animal production-oriented journal was included (48). Of the 49 journals, 44% were biomedical research or multidisciplinary in their coverage but did not include any of the animal production disciplines.

To remain well informed the bovine practitioner should read and select articles for filing from the following journals:

- Journal of the American Veterinary Medical Association
- The Bovine Practitioner
- Proceedings of the Annual Meeting of the American Association of Bovine Practitioners
- Compendium on Continuing Education for the Practicing Veterinarian
- Canadian Veterinary Journal
- Veterinary Clinics of North America (Food Animal Practice)
- Journal of Dairy Science
- Journal of Animal Science
- Canadian Journal of Veterinary Research
- American Journal of Veterinary Research
- The Veterinary Record
- Theriogenology
- Preventive Veterinary Medicine

The reading of journals and the selection of articles for careful study and filing in your personal library is a task which requires time and discipline. When you have browsed through the journal and identified the articles of interest, you can make a reference card of the article which is then filed by subject. If the article is of no interest, discard it. If the article appears to be important, it should be read and studied carefully.

Guidelines for reading journal articles are available and include some of the following suggestions (23):

1. Read and consider the title. (is it interesting or useful?)
2. Who are the authors? Do they have a track-record?
3. Read the summary. Would the information be useful in your practice? If the summary contains useful information then proceed to read the paper carefully.
4. Read the introduction. Good quality papers contain a concise up-to-date review of the salient features of the literature on the topic.
5. If it is a clinical research paper, make sure the objectives of the experiment are stated clearly.
6. The materials and methods should clearly describe the experimental design and adequate control animals should be included.
7. Examine the results carefully.
8. Read and consider the discussion. Do you accept that

the conclusions are supported by the results of the experiment? If not, discard the paper or file it with your comments noted directly on the paper. If the results and conclusions can stand critical appraisal, file the article for future reference and attempt to apply the new information in your practice at the first opportunity.

Being able to browse through your journals and identify quickly and efficiently those articles which contain usable information for your practice is vitally important because of the large volume of published information which is available. In recent years it has been commonly said that there is an "information explosion" and that it is impossible for a veterinarian to remain current in his field. However, much of this published literature is of questionable quality and redundant (49). Bovine practitioners must identify the scientifically valid and useful literature of the area of their interest from the literature of the entire area of interest, which when viewed from that perspective, rather than all of the published information, makes it possible to keep current.

The filing of articles requires an indexing system and filing them in appropriate file folders (47). One recommendation is to tear out articles from journals, sort out the articles and group them according to subject headings which makes sense to you and reflects your intention to go to the library when you want access to the relevant information. You may use headings from a textbook. Write the subject headings on individual file folders and put the sorted papers into the file folders and into a filing cabinet. When the file becomes too thick, either cull the redundant papers or make new sections. If an article belongs in two sections, put the original article in one section which makes most sense, or photocopy it and place the copy in a second section where the cross-referencing is required. Computer software programs are now available for the computerization of bibliographic literature.

When you encounter a clinical problem you can consult your collections of articles which have been filed according to subject and review them to obtain the necessary information.

On-Line Computer Search of the Literature. If the information for a clinical problem cannot be found in one's personal library of textbooks or journal articles, an on-line computer search of the literature may identify useful references (39). Within the last several years there has been a remarkable growth in computerized bibliographic data bases which can now be accessed by long-distance telephone line using a personal microcomputer. In 1988, the Commonwealth Agricultural Bureaux bibliographic data base processed 130,000 items from 14,000 books, journals, conferences and reports published worldwide. It is now possible to subscribe to Selective Dissemination of Information in which subscribers decide their own search

profile and receive search results at intervals of their own choice, eg. monthly, quarterly, even weekly. The search print-out contains full bibliographic details and an informative abstract for each record retrieved. Thus it is possible for a bovine practitioner to ask for all of the references dealing with bovine animal health and production which are published on a world-wide basis. You will receive a list of references with abstracts and can then select those for which you would like to receive a copy of the original paper. Successful computer searches of these literature bases depend on the selection of the key words of the article which were used for entry of the citations into the computer bank. Finding the "pearls of useful knowledge" from the large amounts of literature which are published on a regular basis is a satisfying experience.

How can the Bovine Practitioner Get the Most From and Give the Most to Continuing Veterinary Education Programs? Among the knowledge, attitudes and skills that are essential for continued effectiveness as a bovine practitioner there are three:

1. Clinical skills.
2. Skills in critical appraisal of clinical evidence.
3. Self-directed learning skills.

Clinical skills can be improved by the regular evaluation of those skills which most interest you. Concentrate on those continuing veterinary education courses which focus on the skills which you need in practice. Hands-on courses complete with feedback in comparison with an acceptable standard of performance are most effective. We need a revolution in continuing veterinary educational conferences. Some conferences do not have clearly defined objectives, there is too much repetition, too many anecdotes and opinions, there are too many poor presentations, and there is a lack of active participation by the audience. There is insufficient hands-on experience and lack of interaction between the speaker and the audience.

The *critical appraisal* of clinical evidence is the application of certain rules of evidence to clinical, paraclinical and published data in order to determine their validity and applicability. The most powerful stimulus for learning and retention of knowledge is the actual sick animal or the herd problem. The technique of critical appraisal seeks hard evidence applied to clinical and laboratory findings and to published data in order to determine their validity and applicability.

Self-directed learning skills are the most effective method of keeping up to date and insuring continued professional growth. These skills include the following:

1. Formulating clear learning objectives.
2. Reading to solve problems.
3. Highly selective browsing of journals.
4. Establishing and maintaining a personal information system.

5. Carrying out regular self-assessments.
6. Executing personal behaviour modification.

Someone has said that if you are not sure where you are going, you are liable to end up some place else. The more that learning experiences are generated from and lead to the resolution of specific problems, the more effective and relevant the learning will be. Learning is best when it takes place in real life; the best learning experience takes place where what it to be learned is also applied.

Professional Development Time. The development and maintenance of competent bovine practitioners who can perform at a level to meet the needs of the modern cattle producer will depend on the availability of professional development time. Gone are the days when society can expect young veterinarians to do physically demanding clinical work for 60-70 hours per week and assume that professional development gained from reading and studying will be done during the evenings and weekends when the veterinarian is not on duty. Veterinarians in private practice typically work longer hours per week and earn less professional income per hour than veterinarians not in private practice (70). Why should it be that way? Young veterinarians subjected to such rigor become disillusioned within a few years after graduating and lose their professional feeling. The successful satisfied bovine practitioner of the future will be one from a multiple-person practice which makes a commitment to the pursuit of excellence over the long term. There must be professional development time as part of the working day for the summarization and follow-up of clinical cases, time to browse journals and select articles for filing, time to search the literature to access knowledge for solving problems, time to select appropriate veterinary conferences, time and opportunity to excel at meetings and a private office for doing these stimulating activities.

“To study the phenomena of disease without books is to sail an uncharted sea, while to study books without patients is not to go to sea at all” —*Sir William Osler (1901)*

Vision of the Future

What a remarkable and exciting challenge faces the bovine practitioner of the future!

Just imagine the satisfaction we will enjoy to see contented dairy cows producing nature's most perfect food—milk, the beef cow with her contented nursing calf, the healthy weaned calf who has finally left home and is doing well on its own and not suffering from pneumonia, the feedlot steer eating and sleeping and lying around in retirement free of respiratory disease, grain overload, bloat and foot rot. Our complete animal health and production program has also satisfied the animal welfare and animal rights activists. The happy bovine practitioner is the one who believes he or she has contributed to this success story

and more particularly to helping to provide an excellent source of protein to mankind.

“And he gave it for his opinion that whoever could make two ears of corn or two blades of grass grow on a spot of ground where only one grew before would deserve better of mankind and do more service to his country than the whole race of politicians put together.”—*Jonathan Swift, The Voyage to Brobdingnag in Gulliver's Travels.*

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*Preg-Guard 9[®] and Leptoferm-5[®] help protect against all five major strains of leptospirosis — *L. pomona*, *L. grippityphosa*, *L. hardjo*, *L. icterohaemorrhagiae* and *L. canicola*.

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