SYMPOSIUM: FUTURE OF EDUCATION PROGRAMS IN ANIMAL BREEDING

The Potential of Open Learning in Animal Breeding

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ABSTRACT

Animal breeding education is presently facing many challenges. These include rapid changes in breeding knowledge and technology, resource and funding restrictions, and altering demographics of the learner and the animal breeding industry. These challenges can be met via an open learning educational format. This nontraditional approach is based on the needs of individual learners, not the interests of the teacher or the institution. An important feature of open learning is its appropriateness for the professional development audience. Delivery methods include interactive distance courses on the Web, computer-assisted learning, and team-based study. The Canadian dairy breeding industry has expressed the need for ongoing professional development to understand and adopt new animal breeding technologies. The University of Guelph responded by delivering a series of animal breeding short courses (Executive Certificate Program in Animal Breeding) to industry decision makers in 1997. A version modified specifically for farmers and breeding industry personnel was offered in 1998. Through the collaboration of experts from various agricultural institutions and the use of a learner-centered format, this professional development initiative was a pedagogical and financial success. This paper describes how the open learning approach differs from traditional university teaching. Using the University of Guelph example in animal breeding professional development, the framework for a successful open learning program will be examined. The best practices for effective adult education will also be identified and discussed within this case study.

(Key words: animal breeding, open learning, professional development)

INTRODUCTION

Animal breeding is an applied science that draws on principles in quantitative and population genetics, statistics, computing, and, more recently, molecular genetics. Because of the specialized nature of animal breeding, relatively few academic groups actively carry out research and teaching in this area compared with the broader fields of science, such as medicine, law, and chemistry. Over the last 40 yr, the number of livestock farms has dropped substantially, causing a reduction in the number of students pursuing degrees and diplomas in animal agriculture. Similarly, at the University of Guelph, enrollment in undergraduate animal breeding courses has dropped by approximately 50% over the past 20 yr. Presumably this decrease is due to the reduced employment prospects in the field or perhaps negative reaction to the increasing statistical and mathematical content of animal breeding courses. Nevertheless, animal breeding education and research continues to have a large impact on the genetic improvements that are happening in the animal breeding industry. Simultaneously, developments, such as the use of molecular genetic techniques, are occurring rapidly, and interest in technology transfer to industry partners has increased. By broadening the scope of education in animal breeding, institutions offering curriculum in animal breeding can capitalize on this demand to stimulate both learner interest and industry awareness.

Open learning is an educational concept that expands the scope of education beyond the traditional diploma or degree-credit classroom into areas such as continuing education, distance education, and professional development. This paper looks at the concept of open learning from its broadest interpretation to its application at the University of Guelph and subsequent use within continuing education and professional development programs in animal breeding. The paper examines challenges facing higher education, in general, from difficulties in moving beyond the traditional classroom to facing business competition. Discussion is provided regarding the differences between typical undergraduate students and the open learner. Necessary ingredients of a successful open learning
program are described. A case study using a recently completed professional development program at the University of Guelph is used to describe approaches to open learning and best practices that can be followed to improve the likelihood of success. Because of the nature of the target audience, distance education was not deemed to be an appropriate format and will not be discussed in significant detail.

**DISCUSSION**

**Open Learning**

**Definition.** The concept of open learning is as diverse as the practices it encompasses. In its broadest definition, open learning is the provision of greater learner access to, and choice over, learning (3). Open learning requires a learner-centered culture that values continuous learning opportunities, increased flexibility, and user choice. And a range of strategies must be adapted to a variety of learning environments to allow for different learning styles, interests, and needs with an equality of opportunity. Open learning is consistent with current developments in teaching and learning that are characterized by more self-directed, interactive, and independent learning approaches (12). Within individual institutions worldwide, the term implies a variety of meanings including resource-based learning, independent learning, flexible learning, and non-traditional learning. Whatever the specific application, open learning has two main thrusts: enhanced learner access and development of learner autonomy.

**Open learning at the University of Guelph.** The University of Guelph uses open learning to encompass the delivery of degree credit and nondegree credit (continuing education) courses to learners not enrolled in undergraduate and graduate degree programs, as well as the delivery of degree credit courses in undergraduate programs via the distance format. Open learning was adopted as one of the University of Guelph’s five strategic directions in 1995 as part of a concerted effort to become a more learner-centered institution. The goal was to extend the intellectual reach and power of the institution to contribute to the common good and allow for new revenues to be generated for the university (11).

The creation of the University’s Office of Open Learning (OOL) provided an institutional focus for the three major activities of open learning at Guelph: continuing education and professional development programs, degree-credit distance education, and the open learning program. Continuing education and professional development programs are for nondegree credit with teaching formats that include short courses, distance learning, workshops, conferences, symposiums, seminars, residential programs, and certificate programs. The teaching media are chosen to create a learning environment, be it in a classroom or by distance education. The media may include manuals, audio and video cassettes, computer-assisted learning, selected texts, case studies, and the Web. The open learning program allows individuals to take degree credit courses without being enrolled in a degree program. These courses can be taken for personal enrichment or professional development and can later be applied toward a degree program, if desired. The number of open learning course offerings and registrations at the University of Guelph during the 1997–1998 academic year are given in Table 1.

University of Guelph continuing education and professional development programs were developed to reflect the unique teaching expertise and research strengths of the university in fields such as food science, agriculture and agribusiness, environmental studies, rural extension studies, turf management, human behavior and health, and business and management. Typically, offerings are sponsored by an academic unit whose primary responsibility is overseeing and endorsing the academic content and design of the offering and the selection of teaching personnel. The OOL provides client services that include needs assessment, market research, program design, development, implementation and evaluation, financial administration and management, marketing and program management. The University of Guelph has chosen a strategic approach in recent years to focus on professional development training needs. This decision has been mandated by the recognition that the current and future workforce is in need of

<table>
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<th>Offerings</th>
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advanced and directed training that the university is uniquely able to provide.

Trends in Education

Professional development. Changes in demographic characteristics of our communities, explosive growth of new knowledge, and the effect of rapid technological advances on professional competence are major factors that have contributed to the pressing need for life-long learning. In the 1960s, almost half of all workers in industrialized countries were involved in production. By the year 2000, no developed country will have more than one-eighth of its workforce in the traditional roles of making and moving goods. Studies have indicated that the proportion of the population in Canada with a university degree has increased dramatically in the last 40 yr [Figure 1, (2)]. Despite the need for a highly educated population, the gross domestic product spent on education by public sources within Organisation for Economic Co-operation and Development (OECD) countries decreased between 1975 and 1994, as shown in Figure 2 (5). This reduction in total funding has had an effect on professional development training at universities. Competing interests have entered the marketplace of learning, causing institutions of higher learning to adopt more business-oriented practices to remain competitive and relevant.

New institutional competition. Postsecondary education and training are now seen as an “addressable market opportunity at the dawn of a new paradigm” (4) with for-profit, “brand name” institutions expanding aggressively into many areas. These include the DeVry Institute of Technology and the Sylvan Learning Systems/MCI created Caliber Learning Network.

Another phenomenon is the emergence of industry-specific educational bodies such as The Michigan Virtual Automotive College and the IBM Global Campus.

Within the realm of for-profit, private universities, the University of Phoenix represents a new and burgeoning phenomenon. As a distance-based university aimed at working adults in the corporate economy, the university is set up to resemble a corporate structure with no tenure or published research.
described by its President, William Gibbs, “The people who are our students don’t really want the education. They want what the education provides for them—better jobs, moving up in their career . . . They want it to do something for them” (9). This changing landscape of higher education in North America illustrates that the status quo can no longer be maintained. Open learning can be one tool universities can employ to allow for innovation and increased accessibility while still maintaining pedagogical standards.

Identifying and Targeting the Adult Learner

The field of adult learning has evolved greatly over the last 20 yr, but some basic tenets have been established regarding how and why adults learn. Adults who are motivated to seek out a learning experience do so primarily because they have a use for the knowledge or skill being sought. Learning is a means to an end, not an end itself (1). Adults need to be able to integrate new ideas with existing knowledge if they are going to keep and use the new information. If this information conflicts sharply with what is already held to be true, and thus forces a reevaluation of the old material, the knowledge will be integrated more slowly (10). Adults tend to take errors personally, and are more likely to let them affect self-esteem. Therefore, they tend to apply tried-and-true solutions and take fewer risks. The curriculum designer must know whether the concepts or ideas will be in concert or in conflict with the learner when developing the learning materials.

When venturing into adult education as in continuing education or professional development, educators are forced to teach a new audience of learners. Facing time constraints, university professors often attempt to save time by simply converting undergraduate or graduate courseware to the new format. This approach tends to be inappropriate for adult learners and is normally doomed to failure. Adult learners are commonly motivated by different factors than are undergraduate or graduate students. According to the 1994 Adult Education and Training Survey by Human Resources Development Canada (8), “in general, adult learners are not studying to obtain a degree or diploma. They are involved in part-time courses to acquire specific skills.” The survey also found that “the majority of adult learners (71%) participated in job-related education or training. Among these learners, 70% received some or total sponsorship from their
employers.” Because of these different motivations, the content of the course must be directed more toward applications in the workplace. In the field of animal breeding, professional development courses should highlight the areas that affect learners in their everyday lives. For example, if courses dealing with genetic evaluation are offered to AI stud personnel, focus on the statistical underpinnings should be limited to allow expansion on inputs and outputs of evaluations.

Continuing education and, particularly, professional development courses are usually forced to cover broad topics in a relatively short period of time, which presents a problem with the amount of detail that can be handled and the lack of time available to reinforce the material. In a traditional course, the student has time to work on exercises, contemplate the material, and ask further questions between lectures. Interaction with the course content is vital in the adult learning process, yet forcing the same material into a 1 or 2-wk course would remove the time for this interaction. This dilemma can be avoided by judiciously selecting a more limited range of topics and allowing time within the course for discussion, problem solving, and lab exercises. This approach also allows the instructor to spontaneously pursue certain paths of discussion that are of particular interest to the participants.

Adults have expectations, and it is critical for curriculum developers to clarify and articulate these expectations before developing the content. Adults bring a great deal of life experience into the classroom, which is an invaluable asset to be acknowledged and used. Instructors who have a tendency to lecture, rather than facilitate, can become more learner-centered by concentrating on the use of open-ended questions to draw out relevant student knowledge and experience. For new knowledge to be integrated with previous knowledge, learners must actively participate in the learning experience. The learner is dependent on the instructor for feedback on skill practice, and the instructor is dependent on the learner for feedback about curriculum and in-class performance (6). By discussion of the subject matter in a context more relevant to the learner than the instructor, the subject matter is more easily understood. This learner-centered approach treats the learner as an equal, helps create a two-way dialogue and flow of information that benefits learners and instructors, and increases the overall enjoyment of the course.

Precourse survey. A precourse survey is a particularly valuable tool in a new course offering because many decisions are necessary while establishing the curriculum for a continuing education or professional development course. If particular sectors have been identified (e.g., dairy cattle breeding) the matching magazines, newsletters, and mailing lists are ideal vehicles for performing surveys. Recently, Internet discussion and news groups have become more far reaching and have been able to provide more immediate feedback. However, it must be recognized that these media can provide results that may not necessarily be representative of the sector.

Open learning courses are budgeted on a cost recovery basis and, in the majority of cases, are intended to generate profits for the institution and sponsoring agencies. Therefore, knowledge of the degree of interest and willingness to attend is of primary importance prior to spending a great deal of time in the development stage. Understanding which topics are of particular interest and what degree of detail is desired is vital in establishing a tentative curriculum. At that stage, instructors suited to the topics and audience can be chosen rather than in the reverse order.

In 1994, the Centre for Genetic Improvement of Livestock (CGIL) performed an ad hoc survey via its mailing list of industry partners. The purpose of the survey was to determine the level of interest in animal breeding continuing education courses according to animal species, occupation, and level of job responsibility. Preference of course variety, format, duration, timing, and location was solicited. The survey also asked about interest in six suggested subject areas: animal breeding basics, animal breeding applications, global selection, computer and Internet technology, use of reproductive biotechnologies, and molecular genetics. The respondents were enthusiastic in their interest in all of the suggested courses, particularly animal breeding applications and computer and Internet technology. The largest indication of interest was expressed by those involved in the development and sale of dairy genetic products (e.g., AI stud personnel). The majority of respondents were employed in the dairy cattle breeding sector and had a medium to high level of job responsibility. In general, classroom based, executive-style courses were favored to distance education or computer-based delivery formats. The preferred duration was 1 to 3 d with summer and winter being more desirable times than spring and fall. Fortunately, this preference coincided with the availability of instructors, teaching locations, and other teaching resources.

Industry links. To further refine the details of the curriculum and learning format, some of the respondents were asked to be part of an advisory committee.
along with animal breeding faculty and a program development coordinator from the OOL. Committee members were chosen according to their availability and representation and their ability to promote industry awareness of the initiative. The committee provided an invaluable link to industry groups and was a major factor in course approval. Improved links with industry had a significant influence on course curriculum, the choice of instructors, and choice and timing of course offerings. The industry indicated a preference for a classroom-based, executive-style program format with limited enrollment. This format required that the program be offered at a premium registration fee to recover costs and realize profits.

To guarantee successful attendance of continuing education or professional development offerings, linkage to recognized industry groups can be very beneficial. A successful approach involves the sequestering of endorsements from industry associations or societies. Not only does this approach add legitimacy to the course offerings in the eyes of industry, but it also substantially increases awareness among members of the group. Often, those directly involved with societies enroll in the open learning program or subsidize enrollment of others. In many cases in both Canada and the US, regular updating of skills through continuing education or professional development is a common and required feature of professional associations (e.g., the Quebec Society of Agronomists, Canada). If the continuing education or professional development offerings meet association standards, the members may become an important and sustained source of course participants.

**Postcourse evaluation.** Similar to precourse surveys, postcourse evaluation in the form of a questionnaire can be extremely useful in terms of targeting and satisfying the adult learner. A fundamental difference between traditional classroom teaching and professional development is that the learner is not just a student but also a client. Asking for the client’s opinions and suggestions is not only courteous but also a sound business practice. The conclusion of an individual course offering is one of the best times to solicit opinions about various topics covered, teaching format, individual instructors, and the course in general. During and after professional development courses offered by CGIL, results from questionnaires led to several changes in the use of various teaching formats, length and timing of the sessions, use of instructors, and emphasis given to certain topic areas.

Part of the evaluation process can include questions regarding how the course content will be used in the place of work. The results can provide useful information about both the impact of the curriculum and how it can be further targeted to the needs of the learner. In addition, these types of questions cause reflection and reinforcement of what was learned. Furthermore, the learner is asked to begin thinking about how the information will be transferred to others and to everyday practices. Therefore, the evaluation itself can become part of the learning process. Additional questions regarding how the participant will describe the course to colleagues may provide useful insights into how the program could be marketed in future offerings.

### Professional Development Courses in Animal Breeding

The CGIL at the University of Guelph has offered continuing education and professional development courses in animal breeding for a number of years. The earliest offerings began with courseware that was designed for the graduate-training program. Often, continuing education courses were initiated by foreign academic institutions requesting that individual faculty offer preexisting graduate courses in a condensed format (e.g., 1- or 2-wk course) at an overseas location. Usually, this was a cost-effective method of educating foreign graduate students and animal breeding professionals. In time, reciprocal arrangements were arranged with foreign academics in the offering of intensive short courses of in a highly specific topic area (e.g., marker-assisted selection). This arrangement allowed local graduate students greater access to a wider variety of courses and a richer graduate training experience.

**Certificate program in animal breeding.** In 1994, CGIL received requests for professional development from the domestic animal breeding industry, but the wide range of previous academic training and the variety of job responsibilities made it difficult to assess the type of training that was required. However, the precourse surveys (discussed earlier) allowed the focus to be targeted toward training industry decision makers such as general managers, sire analysts, technical support personnel, sales managers, and extension agents. As a result, the Certificate Program in Animal Breeding (CPAB) was created and offered during the 1996 and 1997 period. Responding to requests for courses to be only short in duration, the program was constructed as a series of four courses, 2.75 d in duration each. The courses are described in Table 2.

The advisory committee indicated that cutting-edge technology transfer was desired but should be taught...
in layman’s terms. In addition, the ability for the participants to discuss and interact with the course content and the instructors was mandatory to achieve success. Requests for expertise in areas outside of animal breeding (e.g., molecular biology and corporate strategy) required that instructors from outside the department be asked to lead some of the sessions. From the outset, a distinct effort was made to reduce the time spent on lecture-style presentations. One of the best received sessions was called Breeding Strategy Tactics, which was a series of 5-min vignettes, each describing a particular tactic that could be used by animal breeding organizations to capitalize on biotechnologies or breeding strategies.

The results from CPAB were an unqualified financial and pedagogical success. With 90 participants, the courses were at 94% capacity (2 of 4 were sold out). The costs of both developing and delivering CPAB were recouped in the first offering of the series, and no outside support or subsidization was required. Revenues were used to cover the costs of program development, instructor fees, hospitality and room fees, printing costs, and management and overhead costs. Participant response was enthusiastic and appreciative about what had been gained from the program and the effort put into the development. Many respondents suggested that attempts should be made to make the courses available on a wider basis. This suggestion is presently being acted upon but in the form of corporate and group training as described below. The CPAB was designed to allow participants to be tested on the material after each course and at the end of the program. If participants successfully met the course requirements of all four courses, an official certificate of achievement was granted by the university. University requirements for each course consisted of 5 h of prereading, 30 h of in-class instruction, and 5 h spent working on a postcourse project. Of the 90 program registrants, not surprisingly, only 4 opted to complete the requirements for the certificate.

### Dairy breeders workshops and corporate training.

In the first half of 1998, the Canadian Dairy Breeders Workshop on Genetic Improvement was offered. This workshop was an attempt to select course material from CPAB and to further condense the program into a single, 1.5-d format aimed at advanced dairy farmers and AI technical and sales personnel. However, much of the previous material was inappropriate for presentation to this new audience and, therefore, most teaching materials had to be redeveloped. Even though these courses were offered at a reduced rate and in multiple locations across Canada, this reincarnation was less successful in terms of relative interest from the market. Although the responses from participants were very favorable regarding the course materials and instruction, there were simply too few participants to make the exercise financially viable.

Because of the increasingly competitive nature of the animal breeding industry, several groups have asked for more training along corporate or organizational lines. To respond to this request, a customized corporate and group training program in animal breeding will likely be offered in 1999 by the University of Guelph. The program and materials will be developed at a level more similar to the original certificate program with the exception that the client will select which topics will be included. This 2.5-d program will be offered at a location of the client’s choice and will have a flat group fee schedule.

### Best practices.

From the courses offered, instructors learned a variety of useful lessons. In terms of the actual course delivery, a variety of presentation formats was important to maintain. The creation of a learning environment was much easier when industry decision makers were brought into the university setting or, more importantly, away from the business setting. Seminar or lecture-style presentations could not be avoided but were kept to a maximum of 20 to 30 min in length and were made progressively shorter as the day progressed. Normally, more was gained from the material if seminars were reserved for the morning and early afternoon sessions. Interspersing seminars with question and answer periods, group discussions, individual or group problem solving, and hands-on labs allowed the participants to absorb and interact with the material. Clearly, the ability to openly ask questions and discuss concepts with the instructors and other participants added to the amount of material that was retained by the learner.

This two-way flow of ideas also showed that not all of the learning was in one direction. Useful ideas for research and teaching were gained by many of the participants.
instructors. The use of smaller groups for problem solving and discussion allowed more participation from all individuals. If groups were asked to report to the entire group, more effort and imagination was put forth.

The development of courseware for continuing education and professional development is time consuming because the learner has sophisticated interests but lacks the proper training to understand the jargon that typically accompanies the field. Conveying scientific content using layman’s terms and choosing relevant industry examples is a significant challenge for course developers. This challenge is particularly true when producing material for computer or Web-based learning. In the computer lab sessions of CPAB, development time was approximately five times that required for classroom-based instruction. Successful open learning programs arise from the efforts of three major stakeholders: the discipline experts, the industry audience, and the academic services and support unit. At the University of Guelph, the OOL was instrumental in assisting in the development and implementation of both CPAB and the Canadian Dairy Breeders Workshop on Genetic Improvement. The CGIL instructors concentrated on curriculum development and delivery, and OOL dealt with areas such as marketing, financial management, registration, logistics coordination, and overall program management. The OOL provided guidance and leadership to CGIL instructors in the philosophy and practice of adult education and provided direction in development and implementation of open learning programs.

A realistic and businesslike attitude is vital when venturing into the open learning field. Educational ventures do not easily produce profits; therefore, it is unlikely that all costs will be recouped in the first offering. However, because of the uncertainty of future demand, set price schedules that, at least, allow for the possibility of producing profits in the first year if the courses are successful is most advisable. In highly specialized fields such as animal breeding, the size of the potential market is relatively small and, therefore, successfully offering the same course several times is not likely. However, by surveying the market and targeting the material well, costs can certainly be recovered. Regardless of short-term financial challenges, reaching out to industry partners in the form of open-learning activities can immediately strengthen ties with industry. By familiarizing themselves with the researchers and research results, open learning participants become more interested in the academic process and more willing to fund future research projects.

CONCLUSIONS

Demand for traditional diploma and undergraduate courses in animal breeding has been on the decline over the past 20 yr. Correspondingly, academic institutions have been facing real financial and enrollment challenges. Open learning approaches can help address some of these challenges. The use of the open learning format encompasses a broad variety of learning methods for the ultimate goal of increased access and demand as well as flexibility in course delivery methods. Institutions offering animal breeding programs can choose to increase the appeal of courses or to expand the scope of their animal breeding teaching programs beyond the traditional classroom. The collaboration between academic departments and an open learning administrative unit can help to offer nontraditional educational programs in an efficient and professional manner.

The rapid pace of technological change in today’s industrial economic reality means that lifelong learning is essential to job proficiency and corporate competitiveness. By strategically surveying the demand and targeting the potential learner, open learning programs can be designed to be financially self-sustaining and attractive. Professional development in animal breeding, as shown for the University of Guelph case study, can be pedagogically and financially successful. Success, however, depends on the ability to develop the learner-centered curriculum. This approach should incorporate the specific learning needs of the adult learner such as highly focused topic areas, more interactive teaching styles, opportunities for reinforcement and retention of course material, and respect for the learner. Distance education is an alternative mode of delivery for professional animal breeding education and training that would benefit international audiences but would require significant resources of time and development funds. Although, the opportunity for profit from open learning activities exists in animal breeding, the primary benefits are increased demand for educational programs, symbiosis with other teaching activities, and improved ties with industrial partners.

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APPENDIX I

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<tr>
<th>CPAB-1</th>
<th>Computer Technologies And The Animal Breeding Industry (offered June 10–12, 1996)</th>
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| Sessions: | A. The Internet: Getting Started  
B. The New Paradigm in Marketing  
C. Internet Resources Available to Animal Breeders  
D. Useful Software/Hardware for Animal Breeders  
E. Features and Benefits of Creating a "Home-Page"  
F. Learning Technologies: Keeping Your Organization at the Edge |

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<th>CPAB-2</th>
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| Sessions: | A. The Basics; Eliminating the Noise  
B. How Our Evaluations Work in Your Industry  
C. International Comparisons  
D. Valuable New Traits  
E. Molecular Information: A New Era or a New Tool?  
F. Using Evaluations in Your Field  
G. Evaluations for the 21st Century |

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<th>CPAB-3</th>
<th>Optimizing Genetic Improvement (offered March 19–21, 1997)</th>
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| Sessions: | A. Genetic Basics: Everything You Wanted to Know but Were Afraid to Ask  
B. Selection: The Basis of Improvement  
C. Measuring Genetic Change  
D. Optimizing Genetic Change  
E. Finding the Right Breeding Goal  
F. Selection Lab  
G. Molecular Tools to Accelerate Genetic Gain |

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<th>CPAB-4</th>
<th>Competitive Breeding Strategies (offered May 27–29, 1997)</th>
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| Sessions: | A. An Overview of Breeding Strategies  
B. Building Molecular Genetics into your Strategy  
C. Relative Effectiveness of Breeding Strategies  
D. Sharpening the Decision Making Process  
E. Breeding Strategy Tactics  
F. Developing a Winning Breeding Strategy  
G. Combining Breeding Strategies with Corporate Strategies |

REFERENCES