Agricultural Education in the 21st Century: North American Perspective

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Outline of Talk

• One size does not fit all – North America large scale farms
• Evolution of agricultural schools/faculties in North America
• The Bioeconomy – an area of emerging opportunity?
• Importance of soft skills – results of APLU study
“Personally, I am astonished when I contemplate the simple fact that since I was born in 1920, the world’s population has more than quadrupled and in less than four decades it will grow by half, to 9 billion”

Donald McQueen Shaver, O.C

Source, The Gene Scene, Summer 2012
The Paradox of Hunger and Obesity

• Over a billion people suffer from obesity with the number growing rapidly in developing countries
• Another billion+ suffer from some form of malnutrition
THE GRAND CHALLENGE

Feeding 9+ billion by 2050

One billion+ malnourished

One billion+ obese

Environmental sustainability
“The sheer diversity of family farms and the complexity of their livelihoods mean that one-size-fits-all recommendations are not appropriate”

“Each country and each region needs to find the solutions that best respond to family farmers’ specific needs and the local context”
USA and Canada: Agriculture Overview

- USA – 900 million acres, two million farms (Avg. farm size 430 acres)
- Canada – 170 million acres, 200,000 farmers (Avg. farm size 750 acres)
- In 1931 32% of Canadian population lived on farms, today 2%
- In US and Canada 4% of farms (sales of $1+ million) produce 66 and 50%, respectively, of the total farm gate value

Source: Robertbody.com
US – Land Grant Universities

- **Morrill Acts** of 1862 and 1890. Federally controlled land donated to states to provide funding to establish “Land Grant” universities (total of 70 institutions established) most of whom have become comprehensive universities.

- Land Grant universities included: WSU, Cornell, MSU, Rutgers, Texas A&M, NDSU, Nebraska, MIT, Iowa State, Illinois, UC-Davis.
Agriculture Faculties in Canada are also part of comprehensive universities

- UBC
- UAlberta
- U of Calgary (Veterinary)
- U of Saskatchewan
- U of Manitoba
- U of Guelph, Ontario
- McGill, Quebec
- Laval, Quebec
- Dalhousie, Nova Scotia
- U of PEI (Veterinary)
Evolution of Agricultural Universities/Faculties

- Bioresource Innovation
- Nutritional Security
- Environmental Sustainability
- Agriculture - Food Security

providing solutions to global challenges
University of Alberta – from one to nine undergraduate programs

- Nutrition and Food Science
- Environmental & Conservation Sciences
- Agriculture
- Animal Health
- Human Ecology/HECOL-Bed
- Ag/Food Business Management
- BA, Environmental Studies
- Forestry
- Forest Business Management

17% International students
“Food” includes dietetics and nutrition; “Engineering” includes biosystems engineering; “Environment” includes ecology.
Developing the Alberta Bioeconomy – Background

- Feedstock availability
- Building the bioeconomy is a private and public sector priority
- Unique facilities
- Conversion technology initiatives
- Bioproduct development opportunities
- Companies are investing
- Communities are engaged
Alberta Natural Resources

Value of Alberta Manufacturing Shipments in 2011
Total: $70.9 Billion

- Refined Petroleum: $18.8 Billion
- Chemical Products: $12.8 Billion
- Food & Beverage: $12.2 Billion
- Machinery: $8.3 Billion
- Fabricated Metals: $5.4 Billion
- *Forest Products: $4.0 Billion
- Construction Materials: $2.0 Billion
- Plastics: $1.5 Billion
- Electrical & Electronic Products: $0.9 Billion
- Furniture and Fixtures: $0.8 Billion
- Other Manufacturing*: $4.2 Billion

*Includes wood and pulp & paper industries
Source: Statistics Canada
Bioindustrial Program - Case Study

The Alberta Biorefining Conversions Network brought together 85 senior leaders from industry, government and academia “to discuss the current global bioindustry landscape, the projected bioeconomy workforce and existing bioindustrial education programs; and to develop a path forward for program development and workforce creation in Alberta”.
Questions for Workshop Participants

- What are the core competencies and skills that industry is looking for in High Quality Professionals (HQP) and skilled labor for the emerging bioeconomy?
- Current and forecasted local demand for a bioeconomy workforce?
- Review the bioindustrial landscape, in regards to workforce in other jurisdictions; and thus what is it projected to look like in Alberta.
- What institutions have programs dedicated to training HQP in the bioindustrial space? Have they been successful?
Questions Contd.

- What are the short and long term forecasts for both education and industry requirements?
- What can we learn from existing examples of programming in this space?
- What are the steps and timelines around implementing new programming? Do these align with industry?
- Is there any alignment between bioindustrial skills required by industry and current programs offered?
Many skills required but workshop participants decided to focus on...

- Primary producers: agriculture, forestry & biomass farmers/crop managers
- Trades: electricians, plumbers, machinery, other
- Technologists (primarily) and technicians
- Engineers
- Research scientists
Technologists skill sets

- More multi-disciplinary technologies & instrumentation
- Some added economics/business, project management competency
- Support system for small and mid-sized enterprises (SME’s)
- More responsibility for problem-solving so as to handle ‘routine’ challenges (whereas difficulties or exceptions to routine go to engineers to handle)
- Work in/lead cross-functional teams
- Potentially move in from other sectors and need “re-set”
- Rapid re-training & re-tooling mechanisms
Engineers skills set...

- Need to understand more bio-processes, build this into 4-year B.Sc. programs
- Raw materials coming in, biomass handling & transport
- Plant-wide process knowledge: know petro/chemical AND bio-systems
- Adaptability, added knowledge in business, communications, economics
- Multi-disciplinary in thinking and experience/assignments
Scientists Skills set:

- “Green” chemistry, lifecycle analysis, water efficiency
- Reducing environmental impact
- High-value end of biomass opportunities
- Wide variety in Bioindustry – fermenting, virology, biotech
- Conventional Focus, expanded/applied to new areas, natural health products
- Again, multi-disciplinary, theoretical + practical application
Recommended Courses

- Broad science background (microbiology, organic chemistry, analytical chemistry, engineering, mechanical aptitude – including practical courses), statistics
- Commercialization and innovation, patent knowledge, writing proposals
- Business, financials, accounting, resource economics, management, entrepreneurship and innovation skills, new product development (business pitch/plan/patent competitions), presentations, team project work
- Drama/improvisation

**Classroom Ideas/Suggestions:** cross-appointed professors, guest speakers (from industry), mentoring (from companies, older students, etc.), run challenges (business pitch, team work, presentations, etc.)
Soft Skills

- Leadership, communication (written, verbal), problem solving, critical thinking, self-learner, team work, adaptability, independence, “real world experience”
- Taught through courses or work experience?
- Include soft skills and deliverable as part of the curriculum, not as separate courses.
- Look for extracurricular activities in students to show engagement (for employers/entry requirements)
## Generalist Bio-Resources Degree

### Core Program

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<thead>
<tr>
<th>1st &amp; 2nd Year Basic Elements</th>
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<tbody>
<tr>
<td>statistics</td>
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<tr>
<td>microbiology</td>
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<tr>
<td>molecular biology</td>
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<tr>
<td>genetics</td>
</tr>
<tr>
<td>organic chemistry – extraction/purification</td>
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<tr>
<td>chemical/biochemical conversions</td>
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<tr>
<td>genetically modified organisms</td>
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<tr>
<td>entomology</td>
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### Minors/Majors

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<tr>
<th>3rd &amp; 4th Year Specialization/Focus</th>
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<tbody>
<tr>
<td>synthetic biology</td>
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<tr>
<td>fermentation</td>
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<tr>
<td>industrial microbiology</td>
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<tr>
<td>life cycle analysis</td>
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<tr>
<td>advanced materials science/handling</td>
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<tr>
<td>capstone: systems thinking type</td>
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<tr>
<td>processing/transformation of biomass</td>
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<tr>
<td>biofuels</td>
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### Options/Electives

- macro/micro Economics
- business/marketing
- strategic communications
- international trade & regulatory environ
- ethics

### Non-Thesis M.Sc. - BioProcess Engineering?
Conclusions

- This kind of program IS possible – and there is a strong desire to advance
- It might be an adaptation of an existing degree – i.e. a new “major”
- Could be a new cross-faculty “program”
- Clarify target audience, then build the “business case”
- Involve leaders from industry & government and other external partners
- Bring together resources from various faculties – joint programing, perhaps across 3 universities. Lab space is already available

Program development currently on hold due to budget cuts
Comparative Analysis of Soft Skills: What is Important for New Graduates?


Slides on Soft Skills Survey kindly provided by Wendy Fink, APLU
Soft Skills Survey

Original Question: What soft skills are employers looking for?

Why do the survey?
• Identify soft skills for successful transition to employment
• Gain employers, students, faculty, and alum perceptions
• Compare and contrast perceptions, identify misconceptions, and rank priorities for soft skill development
• Illuminate areas for curriculum revitalization

Research partners:
• Michigan State University (MSU)
• Association of Public and Land Grant Universities (APLU)
• University/Industry Consortium (UIC)
Soft Skills Clusters

1. Communication Skills
2. Decision Making / Problem Solving Skills
3. Self-Management Skills
4. Team Skills
5. Professionalism Skills
6. Experiences
7. Leadership Skills

Based on Cluster Analysis, all of the soft skills are considered valuable and each descriptive phrase within the clusters represent a positive characteristic!
Soft Skills Survey

- Three sections:
  - About you / your organization
  - Perceptions of soft skills important for new employees
  - How you learn, including the most important thing you / students do / do not learn in college

- Online Survey Monkey™ March 21 – July 3, 2011 (15 weeks)
- Nationwide with 31 Universities: 2,700 students, 4,000 alum, 900 faculty
- 282 Employers
- Total of over 8,000 respondents
The majority, 87%, of the alum respondents are employed.

Over half (56%) of the alum received their Bachelor’s degree in the last 10 years.
Soft Skill Responses – Skill Types

A difference in world views between different stakeholders.

• Soft skills - most important for employers and alum

• Discipline Knowledge - most important for faculty and students

Skill Types Importance
Forced Rank Order: 1 to 4, with 1 most important

- Student
- Faculty
- Alum
- Employer

Soft Skills
Discipline Knowledge
Discipline Technical Skills
Project Management Skills
Soft Skill Responses – Cluster Ranking

Soft Skill Clusters: Forced Rank Order: 1 to 7

- All groups rank communication and decision-making as the most important skill clusters
- 52% of Employers Rank Communication as 1 or 2
- The greatest variation: Experiences
Soft Skill Responses - Communication

- 1/3 of Employers value listening effectively as the most important characteristic of Communication skills
- Oral communication ranks higher than written
- Faculty emphasize written skills in comparison to all other stakeholders

Communications Soft Skill Cluster
Forced Rank Order: 1 to 7, with 1 most important

- Listen effectively
- Communicate accurately and concisely
- Effective oral communication
- Communicate pleasantly and professionally
- Effective written communication
- Ask good questions
- Communicate appropriately and professionally using social media
Skill Responses – Decisions & Problem-solving

- Students and employers agree on the importance of identifying the problem, taking effective action and realizing the effects of decisions.
- Life-long learning and abstract thinking are not as highly valued at the entry level.
Soft Skill Responses - Leadership

Seeing the “big picture” is the most important Leadership characteristic, yet Leadership was ranked as the least important soft skill for new employees.
Guided, active learning environments are ranked as more effective than self-directed and informal learning experiences.
Soft Skill Responses

Who should be responsible for soft skill training?

Over half the survey participants agree soft skill training is a shared responsibility between universities and employers.
Our accomplished past ... our limitless future