Profile of Dr. Digvir S. Jayas

1. When did you start to develop an interest in Engineering?

Dr. Digvir S. Jayas, *Vice President (Research and International)*

I grew up on a mixed farm in India. Being on the farm, I was helping first and then fixing farm machinery and other systems. Therefore, my interest in engineering probably developed when I was four or five years old however, my real decision was made when I entered grade 9 because I chose physical sciences for my high school years. Main reason for choosing physical sciences was my strong love for mathematics instilled in me by my grandfather. He strongly believed that if someone is strong in mathematics then he/she should have no trouble in any field. From a very early age, he gave me reasonably complex mathematical problems to solve in my head while simultaneously helping him with farm work. In other words I became multi-tasker at an early age.

2. Tell us about the path you took to get to where you are.

After completing my grade 12 education from a high school in Mant (my home town), I joined the G.B. Pant University of Agriculture and Technology in Pantnagar, India to obtain my bachelor's degree in agricultural engineering (1980) followed by master's in agricultural engineering from the University of Manitoba in 1982 and joining the University of Saskatchewan in 1982 for my PhD study. I began working at the University of Manitoba as an Assistant Professor in 1985, while completing my Ph.D., which I received in 1987. I rose through academic ranks quickly becoming an Associate Professor in 1989 and Professor in 1993. I was selected to become Head of the Department of Biosystems Engineering in 1997, the Associate Dean (Research) in the Faculty of Agricultural and Food Sciences in 1999, and Associate Vice-President (Research) in 2001. I also served as Interim Director of the Richardson Centre for Functional Foods and Nutraceuticals during this appointment. In 2009, I was appointed as Vice-President (Research) and in 2011 my portfolio was expanded to include international relations to become Vice-President (Research and International) at the University of Manitoba.

3. Briefly tell us about your research - what role(s) do undergraduate students play in it (if any)?

My love for mathematics continued in my research. During both masters and doctoral studies a component of the work involved the simulation of the flow of gases through porous media (bulk grain). My continuously funded NSERC Discovery Grant program (since 1986) has been on mathematical modeling of stored-grain ecosystems. A stored-grain bulk is a man-made ecological system in which deterioration of the stored product results from interactions among physical, chemical, and biological factors. The important factors are: temperature, moisture, carbon dioxide (CO_2), oxygen (O_2), grain characteristics, microorganisms, insects, mites, rodents, birds, geographical location, and granary structure. Heat, moisture, and CO_2 are produced during the deterioration of grain; and heat, moisture, and gas transfer occur simultaneously in stored-grain ecosystems. The predicted abiotic factors (temperature, moisture content, and gas concentration) interact with biotic factors (grain, insects, mites, fungi, and bacteria) in a grain bin at any geographic location. The interactions between biotic and abiotic factors make the mathematical modelling of stored-grain ecosystems a challenging problem. My team is the first group in the world to develop three-dimensional mathematical models of heat, moisture, and CO_2 transfer in grain bulks.

My overall research program has focused on reducing the qualitative and quantitative losses in grains. In addition to enhancing the understanding of and managing the interactions among biotic and abiotic variables in the grains, I have done research on: (i) developing soft X-ray and thermal imaging-based techniques to detect low levels of hidden infestation by insects in grains; (ii) developing machine vision and hyperspectral imaging based solutions for detecting fungal, sprout, midge and beetle damage in grains; (iii) understanding the mechanism of flow of air through grain using computed tomography to develop a prototype grain dryer which forces air horizontally and dries grain more uniformly with less energy compared to currently used near-ambient air dryers which force air vertically through grain. Through the execution of the overall research program, (i) my team has significantly advanced the scientific knowledge in the field, (ii) has developed innovative engineering solutions to problems encountered during drying, handling and storing of grains and (iii) has shared our knowledge with designers of grain drying, handling and storage systems and with farmers and storage managers in Canada and around the world.

4. What does it take to be a successful Engineer?

To be a successful engineer, one has to be passionate about the project or program being pursued at a given time. Being able to listen and value the opinion of others with respect and dignity along with being willing to work collaboratively with people from different disciplines and backgrounds helps in being a broad-minded engineer to solve complex problems.

5. Describe your overall lifestyle (work-life balance, family time, leisure time...etc).

I probably do not do a good job at work-life balance in a traditional sense but for me my work became my hobby. To me a hobby is what gives one the most pleasure and no number of hours are enough for that hobby. Most of my free-time is devoted to volunteering for technical and professional organizations. Occasionally, I exercise, watch movies, listen music, write poems and travel for leisure.

6. What advice would you give to undergraduate students currently working in your area of Engineering?

Love wholeheartedly and be passionate about whatever you are working on. Life is too short to waste on projects one does not like. If the job you currently have does not give you complete joy, then look for another job.

7. What advice would you give to undergraduate students that are looking for an Engineering job?

Try different jobs until you find a perfect match. It could the first job or some other number. Ask for help when in doubt. You are never alone.

8. What kind of jobs can undergraduate students, who have research experience in your field of Engineering, have upon graduation?

They can certainly pursue graduate study at the masters or doctoral level but research experience gives them skills in carefully stating a problem, planning a systematic approach to solve the problem by collecting and interpreting data. These skills are transferable to almost any job in the industry, government or academia. Also, as our economy transforms from “resource economy” or “knowledge economy” demand for people with research and development exposure will grow exponentially.

9. How do you foresee the future of your specific field of Engineering?

The future for “bio” engineers, engineers who understand biology, is very bright. Many problems require knowledge of biology for their solutions. Bio-based problems are more complex due to inherent variability and inhomogeneity of biological systems than physical systems. Engineering properties of biological materials are also more complex than physical materials. This is further illustrated by the fact that many engineering disciplines are being modified by incorporating biology in the curriculum such as biochemical engineering, biomechanical engineering, and biomedical engineering.

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