Purdue's Engineer of 2020
Seed Grant Funding for 2008-2009
Purdue University

Project Title: *Spiraling towards 2020:* Project centered multidisciplinary spiral curriculum as a model for developing Purdue's Engineer of 2020

Target Attribute(s) to be studied/implemented: This proposal targets all attributes listed under PE2020 headings *Abilities* and *Qualities* as well as *Knowledge Areas* (open ended design & problem solving skills; multidisciplinary within and beyond engineering: integration of analytical, problem solving & design skills).

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A. Project Description:

A1 Objectives of the study

This project begins with the hypothesis that a project centered spiral curriculum is an exciting way to effectively incorporate Purdue's Engineer of 2020 Target Attributes in many of the College's engineering programs. PE2020 offers graduates the characteristically strong technical foundation along with a dynamic set of 'soft skills' which are not traditional hallmarks of an engineer. Revolutionized teaching methods must be in place to create this emerging leader and the Schools of Agricultural and Biological Engineering and Chemical Engineering are seeking funds to create a project based spiral learning curriculum incorporating the PE 2020 target attributes as a model for other schools to follow.

Project based spiral learning will allow students to work in multi-disciplinary teams that will incorporate different 'design' projects that will increase in complexity and sophistication throughout the curriculum. Engineering students continue to build strong technical skills and will be introduced to the larger picture of the problem statement by working with students from disciplines. The PE2020 grant will provide essential start-up funding to conduct pilot studies in the areas of the target attribute development; substantial funding has been provided from the National Science Foundation (NSF) through their Department Level Reform program and additional, substantial funding will be sought from the USDA Challenge Grant Program and from NSF. The result of this project will produce an environment that students will more likely encounter when entering the workforce. Leadership, teamwork, communication, and decision making will not only be formally introduced, but also will evolve from these experiences as students work together to achieve the goal of creating a functional industrial product.

The pilot study has the following specific objectives:

1. To critically evaluate project centered and spiral curricula from other institutions and their ability to be transferred to the Purdue environment.
2. To develop, teach and evaluate two prototype courses in BFPE and Chemical Engineering that demonstrate the integration of a select number of targeted PE2020 attributes in practice.
3. To design a prototype project based spiral curriculum that incorporates the target attributes of the Purdue University Engineer of 2020 into the BFPE program.
4. To develop a "lessons learned" data base to guide CoE in wider adoption of spiral curriculum.
5. To seek funding from outside sources such as from foundations, USDA, and NSF

A2 Literature Review: Project based courses, spiral learning and target attributes

Since the late 1990's, fewer students are enrolling in engineering, both nationally and at Purdue University (Engineering workforce commission). Engineering education is facing a pivotal time as it seeks to reverse these trends. This proposal focuses on attracting and retaining students by enhancing their understanding of the relationships between engineering and its impacts on real world needs/challenges through the development of project-based spiral curricula.

Several universities are investigating and implementing project-based, spiral curricula to attract students to engineering and sustains interest and motivation. Spiral based curricula takes current and prior course concepts and applies problems that build on each other with increasing complexity. Aalborg University in Denmark has implemented project based learning techniques throughout the entire engineering curriculum (Mills and Treagust, 2003). Technion- Isreal Institute of Technology developed mechanical engineering project based courses (Frank et. al., 2003). Worcester Polytechnic Institute (WPI) has taken this theory and applied it to their sophomore level Chemical Engineering curriculum (Clark et. al. 2000, Dixon et. al., 2000, and DiBiasio et. al., 2001). At Stevens Institute of Technology (SIT), project based learning was implemented into a junior level mechanical engineering design course where the students were given 6 projects with a 2 week duration each (Esche, 2002). Both WPI and STI focused on the real-world application of the projects. Students at both institutions spent the same amount time in class for spiral based learning compared to traditional lecture and lab setup. Virginia Tech has also been working to introduce spiral learning throughout their entire Biological Systems Engineering curriculum by identifying top skills for their graduates and then implementing and incorporating those ideas down through their course work (Lohani et al, 2005).

Purdue University currently offers a multidisciplinary, project based course in the form of division of the national Engineering Projects in Community Service (EPICS) program. EPICS is a unique program in which teams of undergraduates, advised by faculty, staff, industrial partners, and TAs, design, build, and deploy real systems to solve

engineering-based problems. EPICS students gain several of the PE2020 attributes including: long-term project technical knowledge, communication skills, experience on multidisciplinary teams, and leadership and project management skills. Additionally, they gain an awareness of professional ethics, the role of the customer in engineering design, and the role that engineering can play in the community.

The University of Queensland (UQ) developed and implemented a new, innovative, Project Centered Curriculum (PCC) for the 4 year Bachelor of Engineering (Chemical) degree. Driven by desire to significantly improve the undergraduate experience, students were challenged and engaged with relevant learning experiences that better prepared and equipped them for an increasingly diverse and demanding work place. The PCC was the basis for a deliberate and systemic development of a comprehensive suite of competencies and skills, both technical and non-technical. The first students graduated from the PCC program in 2001. Data collected since 2002 demonstrates the very positive outcomes. A number of measures ranging from student surveys such as the nationally administered annual CEQ show a progression from being below the national average to well above it. National awards such as the Australasian Association for Engineering Education's 2004 Award for Excellence in Curriculum Innovation have been received (AAEE, 2004). All point to greatly improved student learning, student satisfaction and quality outcomes in the teaching program.

The ABE department has recently completed an NSF Depart Level Reform grant titled 'Development of a Comprehensive, Fully-Integrated Biological Engineering Curriculum. The overall objective of the planning grant was to facilitate significant reform on a department wide basis by developing a biological engineering curriculum that effectively integrates the teaching and learning of engineering principles with biological sciences. As a result the BFPE curriculum was extensively revised to include more biological sciences and plans are underway to include the basic elements of a project based spiral curriculum.

Although much has been done, no one program has developed a truly integrated curriculum encompassing the 2020 target attributes into an effective learning experience. Project based learning courses can be the basis for an effective integration of the PE 2020 Target Attributes. A project based curriculum should be developed, founded on constructivist and spiral learning principles, with the purpose of enhancing the learning experiences of undergraduate engineers. The courses should be designed with decreasing structure, yet still guided by graduate students and professors. Additional resources are needed, including personnel training on how to successfully guide project based learning courses. Once the program is successfully launched, students will be introduced to industry-based problems and laboratory equipment at an earlier stage in their college careers. Students will be better prepared for senior capstone courses and their future careers. The courses are proposed to be initially implemented in the BFPE and CHE courses in relation to the class size, a successful NSF grant (ABE), and leadership by Dr. Litster, who was key to the UQ project centered curriculum development. After demonstrating effectiveness, the teaching and learning strategies developed in these courses are to be a model for all other Colleges in Engineering at Purdue University.

A3Evaluation plan: approach and implementation, assessment, and expected results

A3-1 Approach and Implementation

Our approach is to pilot spiral curriculum approaches at the level of individual course implementation (using two existing pilot courses in ABE and CHE), and at the whole of program level (the BFPE program). At the single course level we will be evaluating "on the ground" approaches to training of teaching assistants, forming running and evaluating student teams, learning specific soft attributes in the context of real engineering projects, and so on. At the whole of program level, we are looking to evaluate a "top down" approach to integration of technical and other skills into a spiral curriculum.

Our approach is to build on work already done and existing expert skills in the project team, specifically:

1) The significant progress already made by the ABE team through the NSF DRL planning grant on "Development of a Comprehensive, Fully-Integrated Biological Engineering Curriculum" Award Number: 0431886
2) The expertise in designing and implementing major curriculum reform at UQ bought to Purdue by Litster and Radcliffe.

To ensure buy in from the broader college community, an advisory board will be formed from key educators in several of the schools within the college. This group will be engaged at all stages of the project.
The implementation plan is now considered in relation to each of the four project objectives.

1) To develop a review summarizing the various methods used to effectively achieve 'target attributes' Build student competence in critical engineering skills through the experience of using equipment and processes related to academic research and/or industry.

a) Solicit examples of target attribute methods being considered/implemented at Purdue.
b) Review literature to summarize successful techniques that incorporate target attributes.

2) To develop, teach, and evaluate prototype courses that demonstrate the integration of a select number of target attributes and challenge students to work in multidisciplinary teams, and use knowledge from previous and future classes to fully understand engineering design principles.

It is envisioned that a standalone course similar to the prototype project based course will be offered each semester throughout the curriculum. It is also envisioned that the courses will incorporate the multidisciplinary skill based nature of the Purdue EPICS program along with the project based framework of the University of Queensland curriculum. Although the specifics of the prototype project based course will developed during the summer of 2008, it is envisioned that the project based course offered to BFPE students will involve three major themes, A) the development and production of a 'real life' industrial food pharmaceutical or biological product B) the introduction and application of selected target attributes and C) the availability of the course to be eventually open to students inside and outside of engineering.

a) ABE course ABE 1st semester sophomore level prototype course A prototype course, outlined in Figure 1, is being developed for 3rd semester BFPE students (1st semester sophomores) and will be offered in Fall Semester 2008. The course project, assigned the first day of class meeting, will be a group project that uses knowledge areas from current or previous courses and integrates PE2020 attributes and qualities into students' learning experience. The Figure 1 shows attributes and qualities that will be focused on in black and those that will be suggested or mentioned in gray. Of particular emphasis in this course is the development and practice of effective leadership skills in a team environment, as well as continuous learning, innovation, and strong work ethics. These attributes will be formally introduced through the reading of selected articles and books such as Patrick Lencioni's "5 Disfunctions of a Team: A Leadership Fable," and Spencer Johnson's "Who moved my cheese?" These attributes then implemented and assessed during the execution of the project. The project will focus on solving an open ended engineering problem as a team that requires student the use of science (biology, chemistry and physics) and engineering fundamentals (thermodynamics, material and energy balances, etc.) emphasized in the other, traditional lecture-based courses from that semester, augmented by self-study through library, industry, and other resources.

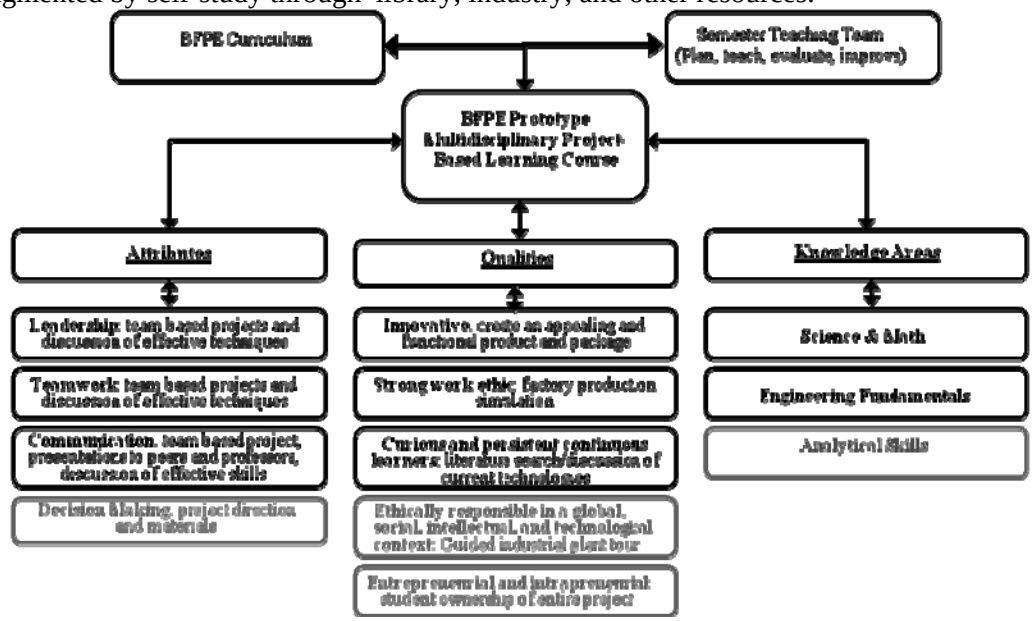

Figure 1 Prototype project based learning course in a semester structure

As an example, in the fall 2007 semester, students in ABE 201 as part of the NSF DRL revision, completed semester projects in teams of 3-4 students on a process of their choice (subject to approval by the instructor). One of the first steps of the design of any process is to define the process parameters (how big, how much, at what rate, etc.) and to then develop a preliminary material and energy balance that will aid in the further design. The students developed a

computer model of the material and energy balance for their selected process and performed “sensitivity analyses” that determine what the impact on the overall picture changes to particular aspects of the system have. The outcomes from this project were:

1. Outline basic process in a process flow diagram – major processing steps with inputs and outputs (both material and energy)
2. Outline basic process parameters – yields, efficiencies, extents of conversion, etc
3. Develop preliminary model that will be used for sensitivity analyses, including material and energy costs, in the final project report

In order to develop their material and energy balances, the teams were required to find the relevant parameters (materials, unit operations, energy, etc) from published literature or from industry contacts. A few groups took the initiative to make contacts in the relevant industry, visit production facilities, and gain further insight into production costs. In addition, students gained experience working in teams and meeting deadlines with concrete deliverables (preliminary report, preliminary model, final report). The final two deliverables from each team was a written report (10-20 pages) and an oral presentation before the entire class. Examples of processes that were analyzed include wine production, ketchup production, chocolate production, beer brewing, pickles, and ice cream.

b) A prototype course titled "Applications of Chemical Engineering Principles" is currently in development and is being taught this semester for the first time. The course is team-based with design projects in many application areas of engineering. Many of the design projects would benefit from multidisciplinary team composition as the specific physical processes cover a wide range of technical material. The applications are based on undergraduate course topics and the projects take two to three weeks. Teams must submit professional written reports and will be expected to give oral reports. Industrial involvement is anticipated to present students with currently-relevant problems involving environmental and globally-relevant situations.

3) To develop a project based spiral curriculum that incorporates the target attributes of the PE2020. The prototype curriculum will be initially directed toward students in BFPE program.

An example of incorporating all PE 2020 target attributes into a three year time span is shown in Table 1. In Table 1, the black shaded areas represent emphasized skills, white denotes a skill that has not been learned, and light Gray indicates the skill is suggested or reinforced. The proposed integration of PE2020 attributes into a spiral undergraduate curriculum will formally introduce one or two target attributes into a standalone course offer each semester of the curriculum while reinforcing previously introduced target attributes. The students will be expected to demonstrate mastery of the target attributes focused on during the semester. Extensive review of techniques from projects currently being conducted at Purdue and other institutions that effectively incorporate the target attributes will be performed and selected methods will be integrated in the proposed curriculum. In addition to traditional school year course work, students will be strongly encouraged to take a study abroad or research opportunity the summers after freshmen and sophomore years. Students will also be encouraged to pursue industrial summer internships after sophomore and junior years. These experiences have the potential to further equip students with both technical skills and Purdue Engineer of 2020 skills. The students will work closely with a faculty and graduate student mentor to develop and produce a selected industrial product in the lab and be expected to use the technical tools that they are currently learning that semester, while reinforcing the tools they learned previously and being introduced to selected technical topics they will receive formal training in the future. Each project based course will formally introduce one or two ability based and quality based target attributes while reinforcing previously introduced target attributes. The students will be expected to demonstrate mastery of the target attributes focused on during the semester. Similar to the EPICS program, students from other disciplines can receive credit from cross listed courses from participating departments and contribute to the project based on the requirements of the faculty participating in the cross listed course. It is anticipated that some of the project based courses will be organized to be certified by Purdue's Entrepreneurship program and would count toward their entrepreneurship certificate. This concept will incorporate multi-disciplinary education through meaningful industrial product-based experiences that integrates a wide variety of disciplines in order to solve a problem. Students would experience all stages of the product development life cycle with the goal of producing a real product that includes a business plan.

A3-3 Expected Results

We expect to see similar results to WPI, who showed that project based, spiral taught students performed at a higher technical level in an open-ended design competition, in addition to an increase in student retention [Dibasio et al, 2001; Lohani et al, 2005]. Specifically, spiral taught students performed at parity or higher than other students on a

comprehensive exam, achieved higher grades in subsequent junior and senior level engineering courses, and were more confident and positive in their choice of the engineering discipline. Students will gain the same benefits through implementation of project-based spiral learning and through modeling their success in the Purdue CoE.

T able 1 Proposed curriculum incorporating all Purdue Engineer of 2020 target attributes

PE2020 Attribute(s)	Sophomore			Junior			Senior	
	Fall	Spring	Summer	Fall	Spring	Summer	Fall	Spring
Leadership, Teamwork, & Communication								
Decision-making								
Recognize & manage change								
Work effectively in diverse & multicultural environments								
Work effectively in the global engineering profession								
Synthesize engineering, business, and societal perspectives								
Science & Math								
Engineering Fundamentals and Analytical Skills								
Open-ended design & problem solving skills								
Multidisciplinarity within & beyond engineering								
Integration of analytical, problem solving, & design skills								
Innovative and Strong work ethic								
Ethically responsible								
Adaptable in a changing environment								
Entrepreneurial & intrapreneurial								
Curious & persistent continuous learners								
Research (SURF Program) or Study Abroad Encouraged								
Industrial Internship Encouraged								

A3-4 Assessment Methods

The student experience is the focus of project centered learning. Assessment needs to come from all levels touching this development to artfully gain insight into development. Students will be required to complete a self-assessment of course skills, with regard ABET guidelines and course expectations. Students will rate their skills before and after the course. A control group of students will consist of the ABE 205 students, who learn parallel concepts to the students in ABE 201, and the recently completed ABE 201 students. This will allow us to look horizontally at the ABE 205 students and vertically through the ABE students to see how this course has impacted students in the short term. All will be required to complete self-assessment surveys. External guidance through the Division of Instructional Services will be used to formulate questions that can draw out qualities and attributes gained through the course. It may not possible to measure the true longitudinal impact of this course until students reach the workplace. However, vertical measurement of student responses should reflect their increased confidence and abilities. Feedback from the faculty, instructors, and advisory group will be valuable as this project is to be used as a model for the entire College of Engineering. The advisory group will also give a perspective that is not as engrossed in the project. Response from students, faculty, and the advisory group can be collected to best describe successes and areas for change.

During the course, students will be required to submit regular critical incident reports that will be graded as they reflect upon their team experience. This will focus on the impact of their role against their team and reward them for evaluating interactions. This will provide written documentation of the leadership and teamwork progression throughout the semester. It is also a consideration to have a graduate student from Engineering Education participate in this course to better student understanding and evaluation strategies. We will also consult with Professor Deborah Bennett as effective evaluation strategies.

In addition to project-centered class learning, students will be encouraged to participate in University competitions, such as the Indiana Soybean Board Student Competition. The percentage of students entering these competitions can be tracked to determine if student participation increases due to more positive exposure to teamwork and open-ended projects. Students will be rewarded for their extra efforts through bonus points and potentially financial prizes.

A4 Plan for Dissemination - Engineering Advisory Committee

Lessons Learned from adoption of spiral curriculum.

a) Formation of CoE advisory group and their role in assessing outcomes
b) Progressive evaluation of operation of course using reflective instruments by faculty and students with assessment by advisory group.
c) Presentation at regional and national meetings

B. Timeline and Implementation Strategy

b.1 March 2008 to Aug. 2008: To develop a review summarizing the various methods used to effectively achieve 'target attributes' Build student competence in critical engineering skills by use of equipment and processes related to academic research and/or industry.

a) Solicit examples of target attribute methods being considered/implemented at Purdue.
b) Review literature to summarize successful techniques that incorporate target attributes

b.2 May 2008 to Feb. 2009: To develop, teach and evaluate prototype courses that demonstrate the integration of a select number of target attributes that challenge students to work in multidisciplinary teams, and use knowledge from previous and future classes to fully understand engineering design principles.

a) ABE course
b) CHE course

b.3 Aug. 2008 to Feb. 2009: To develop a project based spiral curriculum that Incorporates the target attributes of the Purdue University Engineer of 2020 into the BFPE program.

a) Example curriculum that Incorporates all target attributes
b) Example of how curriculum can be made entrepreneurial/multidisciplinary

b.4 Lessons Learned from adoption of spiral curriculum.

a) March 2008 Formation of CoE advisory group and their role in assessing outcomes
b) Fall 2008 Progressive evaluation of operation of course using reflective instruments by faculty and students with assessment by advisory group.

b.5 Jan. 2009 Seek funding from outside sources: Once completed we feel that the CoE will be favorably positioned to obtain funds for foundations, private industry, and federal grants. A major goal of this phase of the project is to secure further funding to facilitate the completion of the proposed project

C. Personnel Requirements

Please indicate the portion of FTE that each faculty member will dedicate to the project

Faculty member	Summer 08	Fall 08	Spring 09
Martin Okos	10%	10%	10%
Nate Mosier	10%	10%	5%
Neal Houze	5%	10%	5%
Jim Litster	5%	5%	5%
David Radcliffe	5%	5%	5%
Osvaldo Campanella	5%	5%	5%
Bernie Tao	5%	5%	5%

D. Budget

Faculty/Staff Member Funding

Please indicate the funding (dollars and time) you are requesting for the grant for this project)

	Grant funds requested		
Faculty/Staff Name:	% Time	Fringe Benefits	$$
Martin Okos	1.5%	$ 613	$1,514
Nate Mosier	4.0%	$1,162	$3,300
Neal Houze	3.0%	$1,080	$3,069
Subtotal Faculty/Staff Funding		$ 0.00	$ 10,928

Graduate Students

	Grant funds requested			
Type of position	% Time	Insurance + Fee Remit	Fringe Benefits	$$
Teaching Assistant	50%	$7,646	$ 107	$25,515
Subtotal Graduate Student Personnel		$ 7,646	$ 107	$25,515

Undergraduate Student Funding

Please indicate the student resources (funding and time) you are requesting from the grant for this project.

	Grant funds requested		
Type of position	Hrs/week	Fringe Benefits	$$
2 Undergraduate Assistants	20 (12 weeks)		$4,500
Subtotal Undergraduate Student Personnel			$4,500

Equipment $ Software Funding

Please list all specialized equipment and software required for the project. (Do not include standard computer equipment and commonly-available software, e.g. Microsoft Office, Microsoft

Windows). Mark whether any of the equipment or software is provided by the department. (Note that only 10% of the funds can be used to purchase equipment and it needs to be dedicated to the goals of the project.	
Name of Equipment	Funds Requested
Project equipment and supplies	$4,057
Subtotal Equipment	$4,057
Name of Software	
Subtotal Software	$0.00
Other miscellaneous items (Computer media, cables, etc)	
Subtotal miscellaneous	$0.00
Other expenses	
Travel for Professor from University of Queensland	$5,000
Subtotal other expenses	$5,000

E. Budget Justification

Martin Okos: will be responsible for the overall implementation of the project and specifically for the formation and implementation of advisory group, assessment of the prototype courses and development of integrated project based spiral curriculum

Nate Mosier: will be responsible for the development of the prototype BFPE project based class

Neal Houze: will be responsible for the development of the prototype CHE class

Teaching Assistant: will assist in the development and evaluation of the BFPE prototype course and assist in the development of the integrated curriculum

Undergraduate students: will assist the setting up and implementation of the BFPE prototype course

Project equipment and supplies: product raw materials and ingredients, glassware, balances, pH meters, airflow meters, thermistors

Travel for Professor from University of Queensland

Professor Caroline Crosthwaite, of the University of Queensland, is the Director of Studies and Associate Dean at the Faculty of Engineering, Physical Sciences and Architecture (EPSA) and has won several awards as coordinator of the innovative Project Centred Curriculum (PCC) in chemical engineering. She has acted as a consultant to Imperial College (one of the world's top 10 engineering universities) and has been invited to give plenary talks at MIT, Travel for Professor Crosthwaite to Purdue University as a project consultant would be of great benefit because of the following:

1. Professor Crosthwaite's high level advice on embedding attributes in the spiral curriculum for the whole program.
2. Advice on how to assess success of the implementation.
3. International partnership formation with UQ and Imperial College and other universities.

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G. PI Biosketch

Vita and Publications

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Education:	Ohio State University	Food Science	B.S.	1967
	Ohio State University	Chemical Engineering	M.S.	1972
	Ohio State University	Chemical Engineering	Ph.D.	1975

Professional Experience:

1983-Present	Professor, Department of Agricultural Engineering and School of Chemical Engineering, Purdue University
1979-83	Associate Professor, Department of Agricultural Engineering and School of Chemical Engineering, Purdue University
1975-79	Assistant Professor, Department of Agricultural Engineering and School of Chemical Engineering, Purdue University
1968-70	Laboratory Instructor, Department of Mechanics, U.S. Military Academy, West Point, NY

Industrial Experience:

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Publications

Hailemariam, L., M. Okos and O. Campanella. 2006. A mathematical model for the isothermal growth of bubbles in wheat dough. Journal of Food Engineering.

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Campanella, O.H., P.X. Li, K.A. Ross and M.R. Okos. 2002. The role of rheology in extrusion. In "Engineering and Food for the 21st Century" Welti-Chanes, J., Barbosa-Canovas, G.V. and Aguilera, J.M. Eds. Technomic Publishing.

Levine, L., Campanella, O.H., Corvalan, C.M., Okos, M.R. and Symes ST. 2002. A model for the formation of multiple flakes during cereal flaking. Cereal *Foods World*, 47(6):210-213.

Levine, L., C. M. Corvalan, O. H. Campanella, and M. R. Okos. 2002. A model describing the two-dimensional calendering of finite width sheets. Chemical Engineering Science 57:643-650.

Ahmad, Saiyad, M. T. Morgan, and M. R. Okos. 2001. Effects of microwave on th drying, checking and mechanical strength of baked biscuits. Journal of Food Engineering 50(2001):63-75.

Willis, B. and Okos, M. 2001. Properties of Seminola.. Chapter in Characterization of Cereals and Flours: Properties, Analysis, and Applications. Kaletunc and Breslauer (eds.). Marcel Dekker, Inc., New York, NY.

Burgos-Rubio, C. N., M. R. Okos, and P. C. Wankat. 2000. Kinetic Study of the Conversion of Different Substrates to Lactic Acid Using Lactobacillus bulgaricus. Biotechnology Progress 16(3):305-314.

Synergistic Activities

Dr. Okos is active in an administrative role in various professional organizations. 1) He has been the co-editor of the Journal of Food Engineering since 1988. 2) Dr. Okos has held many positions in AIChE, ASAE, and IFT. Some of these include Chairman of the Food Engineering Division of the IFT 1997-1998, Chairman of Food

Pharmaceuticals, and Bioprocess Engineering (FPBE) division of AIChE 1989-1990. Dr. Okos has been the Program Chair of FPBE from 1984-1992, organized COFE, as well as the chair of the Food Process Engineering Institute of the ASAE from 1988-1989. Dr. Okos received the AIChE Food, Pharmaceutical, and Biological Engineering Outstanding Service Award in 2003. 3) Dr. Okos is currently leading an NSF funded program to develop a new biological engineering curriculum at Purdue.

H. Co-PI Biosketchs

BIOGRAPHICAL SKETCH

NAME James D. Litster	POSITION TITLE Professor of Chemical Engineering Professor of Industrial and Physical Pharmacy Purdue University

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE	YEAR(s)	FIELD OF STUDY
University of Queensland	B.E.	1979	Chemical Engineering
University of Queensland	Ph.D.	1985	Chemical Engineering

A.
APPOINTMENTS:

Aug 2007-present	Professor of Chemical Engineering; Professor of Industrial and Physical Pharmacy, Purdue University
2005-2007	Head of School of Engineering, The University of Queensland
2002-2007	Director, Particle and System Design Centre, University of Queensland
2002-2005	Distinguished Visiting Professor, University of Delaware
2000-2004	Professor and Chair, Chemical Engineering, University of Queensland
1998	Visiting Research Engineer, Merck& Co., West Point, PA.
1996-1999	Associate Professor, Chemical Engineering, University of Queensland
1990-1995	Senior Lecturer, Chemical Engineering, University of Queensland
1987-1989	Lecturer, Chemical Engineering, University of Queensland
1984-1987	Research Officer, BHP Ltd, Newcastle, NSW, Australia

SELECTED PROFESSIONAL ACTIVITIES

Editorial Boards and Reviewing

Member, NSF Panel for Particulate and Multiphase Processes Program, October 2007.

Member, Expert Advisory Committee for Engineering and Environmental Sciences, Australian Research Council 2002-2004

Member, Editorial Board of (1) *Powder Technology*; (2) *Particle and Particulate Systems Characterisation*

Regular reviewer for the following international journals: *AIChE J, Powder Technology, Chemical Engineering Science.*

Reviewer of grants for ARC, NSF and EPSRC

Honors and Awards

1980	The University of Queensland Medal
1990	Inaugural Sawamara Award for the best original paper in the journal *ISIJ International* in 1989.
1993	Physical Sciences and Engineering Group Teaching Excellence Award within The University of Queensland
1994	The University of Queensland Special Commendation for Teaching Excellence
1997	Coauthor of chapter on Size Reduction and Size Enlargement in Perry's Chemical Engineers Handbook, 7th edition.
1998	National Orica Award for Services to Chemical Engineering Education in Australia
2001	Appointed Distinguished Visiting Professor at the University of Delaware
2003	University of Queensland Award for Enhancement of Student Learning awarded for implementation of Project Centred Curriculum (PCC) in Chemical Engineering
2003	Elected Fellow of the Institution of Chemical Engineers
2004	Australasian Association of Engineering Education Award for Teaching Excellence (PCC in Chemical Engineering)
2005	Australian Award for University Teaching (Project Centred Curriculum in Chemical Engineering)

B. Representative Publications from previous five years

Representative Journal Articles

Dombrowski, RD, **Litster, JD**, Wagner, NJ and He, Y (2007). Crystallisation of Alpha-Lactose Monohydrate in a Drop Based Microfluidic Crystallizer. *Chemical Engineering Science*, 62, 4802-4810.

Wildeboer, WJ, Koppendraaier, E, **Litster, JD**, Howes, T and Meesters, G (2007). A Novel Nucleation Apparatus for Regime Separated Granulation, *Powder Technology*, 171(2), 96-105.

Crosthwaite, C, Cameron, IT, Lant, PA and **Litster, JD** (2006). Balancing Curriculum processes and content in a project centred curriculum – in pursuit of graduate attributes. *Chemical Engineering Research and Design*, **84**, 619-628.

Gantt, JA, Cameron, IT, **Litster, JD** and Gatzke, EP (2006). Determination of coalescence kernels for high shear granulation using DEM simulations, *Powder Technology*, 170, 53-63.

Wildeboer, WJ, **Litster, JD** and Cameron, IT (2005). Modelling nucleation in wet granulation, *Chemical Engineering Science*, **60**, 2751-3761.

Hapgood K, **Litster JD**, White ET, Mort PPR and Jones D (2004). Dimensionless spray flux in wet granulation: Monte-Carlo simulations and experimental validation. *Powder Technology*, **141**, 20-30.

Golchert, DJ, Moreno, R, Ghadiri, M and **Litster, JD** (2004). Effect of granule morphology on breakage behaviour during compression. *Powder Technology*, **143**, 84-96.

Iveson, SM, Page, NW and **Litster, JD** (2003). The importance of wet-powder dynamic mechanical properties in understanding granulation, *Powder Technology*, **130**, 97-101.

Litster, JD (2003). Scale up of wet granulation processes: science not art, *Powder Technology*, **130**, 35-40.

Liu, LX, Golchert, D., Page, NW and **Litster, JD** (2003). Strength and attrition resistance of agglomerates and particulate coatings, *Powder Technology*, 130, 415-420.

Forrest, S, Bridgwater, J, Mort, PR, **Litster, JD** and Parker, DJ (2003). Flow patterns in granulating systems. *Powder Technology*, **130**, 91-96.

Hapgood, KP, **Litster, JD**, Smith, R (2003). Nucleation regime map for liquid bound granules. *AIChE Journal*, **44**, 350-361.

Litster, JD, Hapgood, KP, Kamineni, SK, Hsu, T, Sims, A, Roberts, M and Michaels, J (2002). Scale-up of Mixer Granulators for Effective Liquid Distribution, *Powder Technology*, **124**, 272-280.

Hapgood, KP, **Litster, JD**, Biggs, SR and Howes, T (2002). Drop Penetration in Porous Powder Beds, *Journal of Colloid and Interface Science*, **253**, 353-366.

Liu, LX and **Litster JD** (2002). Population Balance Modelling of Granulation with a Physically Based Coalescence Kernel, *Chemical Engineering Science*, **57**, 2183-2191.

Books and Book Chapters

Iveson, SM, Liu, L.X., Hapgood, K. and **Litster, JD**, (2006). Chapter 23 *Granulation Mechanisms*, In *Handbook of Granulation* A. Salman(ed.), Elsevier.

He, Y, Liu, LX and **Litster JD**, (2005). Chapter 16 *Scale-up Consideration in Granulation*, In *Handbook of Pharmaceutical Granulation Technology* (2nd Edition, D.M. Parikh Ed.),. Marcel Dekker, Inc., New York.

Litster, JD, and Ennis, BJ, (2004). *The Science and Engineering of Granulation Processes*, Kluwer Powder Technology Series, B. Scarlett (ed.).

C. Collaborators and affiliations

Collaborators: Frank Doyle III (UCSB), Norman Wagner (UD), Bramie Lenhoff (UD), Jonathan Seville (Birmingham University, UK), Ted White (University of Queensland, Australia), Tony Howes (UQ), Ian Cameron (UQ), Lian Liu (UQ), Fu Yang Wang (UQ), Ed Gatzke (University of South Carolina), Carl Wassgren (Purdue), Lynne Taylor (Purdue)

Graduate Advisors: Bob Newell (UQ, retired), Peter Bell (UQ)

Former graduate students (all from University of Queensland): Dr L.X. Liu (1991), Dr A.A. Adetayo (1993), Dr Komari, (1993), Mr J. Hinkley,. (1993), Mr R. Sarwono (1994), Dr B. Elliot (1996), Mr K. Dasgupta, (1996), Dr S. Iveson (1997), Dr Dean Liu (1999), Dr S. Wijeratne (2002), Dr S. Rigby (2000), Dr K. Hapgood (2000), Dr A. Pratseya (2002), Dr Hans Wildeboer (2002), Dr Dennis Golchert (2003), Dr Dora Lui 2005) Dr Stephan Tait (2007), Dr Rich Dombrowski (2007)

Biographical Sketch Nathan S. Mosier

Assistant Professor
Department of Agricultural and Biological Engineering
Purdue University
500 Central Drive
Potter Engineering Center
West Lafayette, IN 47907
Phone: (765) 494-7022
Fax: (765) 494-7023

a. Education and Training

University of Nebraska-Lincoln	Biological Systems Engineering	B.S.	1997
Purdue University	Ag. and Bio. Engineering	M.S.	2000
Purdue University	Ag. and Bio. Engineering	Ph.D.	2003

b. Professional Experience

March 2003 – Present Assistant Professor of Ag. and Bio. Engineering
Laboratory of Renewable Resources Engineering
Purdue University

c. Publications

1. Ximenes, Eduardo A.; Dien, Bruce S.; Ladisch, Michael R.; Mosier, Nathan; Cotta, Michael A.; and Li, Xin-Liang "Enzyme Production by Industrially Relevant Fungi Cultured on Co-Product from Corn Dry Grind Ethanol Plants," Applied Biochemistry and Biotechnology 136-140:171-183 (2007).

2. Zeng, M.; Mosier, N. S.; Huang, C.-P.; Sherman, D. M.; and Ladisch, M. R. "Microscopic Examination of Changes of Plant Cell Structure in Corn Stover Due to Cellulase Activity and Hot Water Pretreatment," Biotechnology and Bioengineering 97(2):265-278 (2007).

3. Lu, Y.; Mosier, N.S. "Biomimetic Catalysis for Hemicellulose Hydrolysis in Corn Stover," Biotech. Prog. 23(1): 116 -123 (2007).

4. Kim, Y.; Hendrickson, R.; Mosier, N.; and Ladisch. M.R. "Plug Flow Reactor for Continuous Hydrolysis of Glucans and Xylans from Pretreated Corn Fiber," *Energy and Fuels* 19(5):2189-2200 (2005).

5. Mosier, N.; Hendrickson, R.; Ho, N.; Sedlak, M.; and Ladisch, M. R. "Optimization of pH Controlled Liquid Hot Water Pretreatment of Corn Stover," *Biores. Tech.* 96, 1986-1993 (2005).

6. Mosier, N. S.; Hendrickson, R.; Brewer, M.; Ho, N.; Sedlak, M.; Dreshel, R.; Welch, G.; Dien, B. S.; Aden, A.; and Ladisch, M. R.. "Industrial Scale-Up of pH Controlled Liquid Hot Water Pretreatment of Corn Fiber for Fuel Ethanol Production," *Appl. Biochem. Biotech.* 125(2), 77-98 (2005).

7. Mosier, N.; Wyman, C.; Dale, B.; Elander, R.; Lee, Y. Y.; Holtzapple, M.; and Ladisch, M. R. "Features of Promising Technologies for Pretreatment of Lignocellulosic Biomass," *Biores. Tech.* 96(6), 673-686 (2005).

8. Mosier, Nathan S.; Wilker, Jonathan J.; and Ladisch, Michael R. "Rapid Chromatography for Evaluating Adsorption Characteristics of Cellulase Binding Domain Mimetics," *Biotech. Bioeng.* 86(7), 756-764 (2004).

9. Weil, Joseph R.; Dien, B.; Bothast, R.; Hendrickson, R.; Mosier, N.S; and Ladisch, M.R. "Removal of fermentation inhibitors formed during pretreatment of biomass by polymeric adsorbents," *Ind. Eng. Chem. Res.* 41, 6132-6138 (2002).

10. Mosier. N.S.; Ladisch, C.M.; and Ladisch, M.R. “Characterization of acid catalytic domains for cellulose hydrolysis and glucose degradation,” *Biotech. Bioeng.* 79(6), 610-618 (2002).

d. Synergistic Activities

1. Symposium on Biotechnology for Fuels and Chemicals – Co-Chair (2007) of the topical session “5B: Feedstock Fractionation and Hydrolysis.”

2. American Institute of Chemical Engineers (AIChE) – Chair (2007 and 2006) and Co-Chair (2005) of topical session “Separations of Processing Streams from Renewable Feedstocks” at annual meeting of AIChE.

3. Proposal Review Panelist: NSF SBIR Bioprocess Engineering Program (2005 and 2006), NSF Engineering (Bio/Chemical Catalysis) Program (2006).

4. Project Reviewer: Biomass Initiative project funded by USDA CSREES and NRCS mid-project review and site visit (2005).

5. Developed and taught ABE 591M – Engineering Approaches to Systems Biology (2005 and 2006). This course focuses on the development of mathematical models for intercellular (metabolic) biochemical reactions. Students leave the class able to use mathematical simplification methods for these systems of equations and evaluate of the complex, non-linear behavior of these systems.

Biographical Information - R. Neal Houze

1. Personal

Birth Date: October 2, 1938
Birth Place: Atlanta, Georgia
Address: Home: 3342 Division Rd., West Lafayette, Indiana 47906
Phone No: (765) 743-4469
Office:Forney Hall of Chemical Engineering
Purdue University
480 Stadium Mall Drive
West Lafayette, Indiana 47907-2100
(765) 494-4076

2. Professional Experience

a. Education Background:

Doctor of Philosophy, University of Houston, Houston, Texas, 1968
Master of Science, University of Houston, Houston, Texas, 1966
Bachelor of Science in Chemical Engineering, Georgia Institute of Technology, Atlanta, Georgia, 1960

b. Academic Appointments:

NASA Trainee, University of Houston, 1963-1966
NSF Trainee, University of Houston, 1966-1967
Assistant Professor, Purdue University, 1969-1974
Coordinator, Cooperative Engineering Education Program in Chemical Engineering, 1973-1982
Associate Professor, Purdue University, 1974-1982
Professor, Purdue University, 1982-present
Director, Cooperative Engineering Education Program, Purdue University, Schools of Engineering, 1982-2002
Director, Purdue University Cooperative Education Program, 1984-2002
Coordinator, Cooperative Engineering Education Program in Chemical Engineering, 2005-present
Mediator, College of Engineering, 2005-present
Faculty Affiliate, Center For Instructional Excellence, Purdue University, 2004-present

c. Industrial and Governmental Positions:

Research Engineer, Esso Research and Engineering Co., Baytown, Texas, 1960-1963
Consultant, Thermon Manufacturing Co., Houston, Texas (Heat Transfer Equipment), 1966-68
Consultant, U.S. Department of the Interior, Office of Saline Water, 1972-73
Consultant, AMEX Corporation, 1975-76
Consultant, USAMEX Fertilizers Inc., 1978-79
Consultant in Cooperative Education to E.I. duPont, General Dynamics, Union Carbide, Ball Corporation, Memorex, National Security Agency, NASA, IBM, Tektronix, University of Michigan, Penn State University, Case Western Reserve University, University of Massachusetts-Dartmouth, Syracuse University, and Colorado State University. (continuing activities)

d. Other Experience:

NSF Post-doctoral Fellow, Technische Hogeschool, Delft, The Netherlands, Laboratorium voor Aero- en Hydrodynamica, 1968-69
Sabbatical with Tektronix, Beaverton, Oregon, in developing and expanding Cooperative Education programs, June - December, 1987.

3. Academic, Professional and Scholarly Societies

American Institute for Chemical Engineers
American Society for Engineering Education
Tau Beta Pi
Phi Kappa Phi
Sigma Xi
Omega Chi Epsilon
Mortar Board, Honorary Member

4. Published Papers

"Cooperative Education: Three on a Tightrope," R.N. Houze and R.J. Simon, Engineering Education 71, No. 4, pp. 283-287, 1981

"The Employer's Challenge: Developing a Quality Co-Op Program," R.N. Houze and R.J. Simon, J. College Placement, pp. 30-33, March 1981

"God Bless the Beasts and the Co-Ops," R.N. Houze, ASEE/Cooperative Education Division Newsletter, Spring 1981

"Career Guidance and Planning for Chemical Engineering Students at Purdue University," P.C. Wankat and R.N. Houze, Proc. 2nd World Congress of Chem. Eng., Montreal, Canada, Vol I, pp. 559-562, 1981

"The Academic Coordinator's Challenge: Employing Work Reports to Enhance the Co-Op/Academic Experience," R.N. Houze, Proc. ASEE Annual Conf., pp. 521-523, 1980

J.A. Knight*, F. Sicilio, and R.N. Houze, "Gas Chromatographic Analysis in Fractional Distillation of Multicomponent Systems," J. Chromatog., 5, pp. 179-183, 1961

R.N. Houze* and A.E. Dukler, "The Effect of a Moving Interface on Gas Phase Turbulence," Proc. of the Two-Phase Flow Symposium, Exeter, England, pp. 110-121, 1967

D.M. Johns, T.G. Theofanous, and R.N. Houze*, "Turbulent Characteristics of Two-Phase Gas-Liquid Stratified Channel Flow," Proc. of Symposium on Turbulence in Liquids, Rolla, Missouri, pp. 250-258, September 1973

T.G. Theofanous*, R.N. Houze, and L.K. Brumfield, "Turbulent Mass Transfer at Free, Gas-Liquid Interfaces, with Applications to Open-channel, Bubble, and Jet Flows," AIAA/ASME 1974 Thermophysics and Heat Transfer Conf., Boston, Mass., pp. 208-219, July, 1974

L.K. Brumfield, R.N. Houze and T.G. Theofanous*, "Turbulent Mass Transfer at Free Gas-Liquid Interfaces with Application to Film Flows," Proc. AIChE-VTG Meeting, Munich, Germany, 1974

L.K. Brumfield, R.N. Houze, and T.G. Theofanous, "Turbulent Mass Transfer at Free Gas-Liquid Interfaces with Applications to Film Flows," Intern. J. Heat Mass Trans., 18, pp. 1077-1080, 1975

D.M. Johns, T.G. Theofanous, and R.N. Houze*, "Turbulent Characteristics of Two-Phase, Gas-Liquid Stratified Channel Flow," Proc. III Sym. Turbulence in Liquids, pp. 250-258, 1975.

T.G. Theofanous, R.N. Houze, and L.K. Brumfield, "Turbulent Mass Transfer at Free, Gas-Liquid Interfaces with Applications to Open-channel, Bubble and Jet Flows," Intern. J. Heat Mass Trans., 10, pp. 613-623, 1976

J.P. Sullivan, R.N. Houze, D.E. Buenger, and T.G. Theofanous, "Turbulence in Two-Phase Flows," Proc. Intern. Specialists Meeting on Transient Two-Phase Flow, Paris, France, pp. 583-608, June, 1978

5. Unpublished Papers

"The Co-Op's Choice: The Thrill of Victory or the Agony of Defeat," R.N. Houze, J.D. Bublitz and S.L. Warner

"The Winning of Roger Whitcomb," R.N. Houze

"Push Them Out of the Nest," R.N. Houze

"The Challenge of Supervising Co-Op Students," R.N. Houze

"A Roadmap for Cooperative Education into the Twenty-First Century," R.N. Houze

"Analysis of Employer Cooperative Education Programs - Program Objectives, Characteristics and Strategic Planning," R.N. Houze

6. Honors

Omega Chi Epsilon Mentoring Award, 2000, 2003

Shreve Undergraduate Teaching Award, School of Chemical Engineering, 1998, 2001, 2003

ASEE Illinois/Indiana Section Outstanding Teaching Award, 2000

M.B. Scott Award for Excellence in Education, Purdue Chapter of Tau Beta Pi, 1998

A.A. Potter Teaching Award, Schools of Engineering, 2003

Charles B. Murphy Award for Outstanding Undergraduate Teaching, Purdue University, 2002

Selected as one of three senior faculty for "Teaching For Tomorrow," Purdue University, 2003-2004

Fellow of the American Society For Engineering Education, June 1999

7. Other Evidence of National Recognition

Panel Member, National Science Foundation, CCLI Program, August 2004, August 2005

Reviewer, Journal of Engineering Education, 2004-present

Reviewer, McGraw-Hill Company, 2003 – present

Reviewer, J. Wiley & Sons, 2004 – present

Reviewer, Chemical Engineering Education, 2002 - present

Invited Speaker at Symposium celebrating the 60th Anniversary of Cooperative Engineering Education Program at Northwestern University, October 1999.

Recipient of the Alvah K. Borman Award of the Cooperative Education Division of the American Society for Engineering Education, February 1989.

Recipient of the Clement J. Freund Award of the American Society for Engineering Education, June 1990.

Chairman, Cooperative Education Division of the American Society for Engineering Education, 1984-85.

Archivist, Cooperative Education Division of the American Society for Engineering Education, 1986-2002.

Member, Executive Board of Cooperative Education Division of the American Society for Engineering Education, 1993-2002.

Chair, Awards Committee, Cooperative Education Division of the American Society for Engineering Education, 1995-2002.

Member, C.J. Freund Award Committee of the American Society for Engineering Education, 1994-2003.

Invited participant in Cooperative Education Experienced Persons' Workshop, 1984-1996.

Founder, organizer, and moderator of Cooperative Education Leadership Forum, 1987 - 1996.

Member National Advisory Committee for Cooperative Education Communications Network (CECONET), 1987-1989.

Invited member of Advisory Committee to U.S. Office of Personnel Management to review federal cooperative education programs and recommend revisions to regulations, 1987-1989.

Invited member of Advisory Committee to the National Commission on Cooperative Education for the National Co-Op Advertising Campaign, 1986-87.

General Conference Chairman for 1989 College-Industry Education Conference of American Society for Engineering Education.

Biographical Sketch David Radcliffe, PhD

(i) Professional Preparation

University of Queensland (Australia), Mechanical Engineering, BE 1972.
University of Queensland, Mechanical Engineering, M.Eng.Sc. 1974.
Strathclyde University (Scotland), Bioengineering, PhD 1978.

(ii) Appointments

Epistemology Professor of Engineering Education, Purdue University, 2007-
Thiess Professor of Engineering Education, University of Queensland, 2000-07.
Boeing Welliver Fellow, Boeing Corp (Seattle and LA) !999
Associate Professor, Mechanical Engineering, University of Queensland, 1989-2000
Visiting Scholar, Stanford University, Design Division 1991-92 and
Consultant, Xerox PARC, Consultant, Systems Science Lab, Palo Alto, 1992-92
Assistant Professor in Mechanical Engineering, University of Adelaide, 1984-88.
Senior Research Fellow, Mechanical Engineering, University of Queensland, 1981-83.
Assistant Professor, Chemical Engineering, University of Melbourne, 1979-1980.

(iii) Publications

Five Publications Closely Related

Miller, A., Radcliffe, D.F. and Isokangas, (in press) A perception-influence model for the management of technology implementation, *Journal of Construction Innovation*,

Radcliffe, D.F. (2006) Global Challenges facing Engineering Education: Advance Engineering Capability Network , Keynote presentation, *Proceedings 35th International IGIP Symposium* in cooperation with IEEE / ASEE / SEFI, Sept, Tallinn, Estonia

Radcliffe, D.F. and Clark, N. (2003) Collaborative design of a global sustainability knowledge network for engineers, *Proceedings 14th International Conference on Engineering Design (ICED'03)*, Stockholm, 19-21 August.

Humphries, J. and Radcliffe, D.F. (2004) Development of an Online Environment for Small Design Teams. *Proceedings Advanced Engineering Design*, Glasgow, Sept.

Radcliffe, D.F. (2002) Formal Learning within a Community of Practice", *Proceedings American Society of Engineering Education*, Montreal, Canada, June.

Five Other Publications

Robertson, B., Walther, J and Radcliffe, D.F (2007) Creativity and the Use of CAD tools: Lessons for Engineering Design Education, *ASME Journal of Mechanical Design*, 129 (7), 753-760, July.

Jolly, L., Radcliffe, D., Smith, A., Nycyk, M. and Andersen, J. (2006) Techno-social systems in organizations, *Int. J. .Technology, Knowledge and Society*, Vol l.

Radcliffe, D.F. (2005) Innovation as a Meta Attribute for Graduate Engineers, *Int. J. Eng. Educ*, 21(2), 194-199.

Humphries, J. and Radcliffe, D.F. (2004) Development of an Online Environment for Small Design Teams. *Proceedings Advanced Engineering Design*, Glasgow, Sept.

Logan, G.D. and Radcliffe, D.F. (2000) Supporting communication in rehabilitation engineering teams, *Telemedicine Journal*, Vol 6 (2), pp225-236.

(iv) Synergistic Activities

Founder, *Catalyst Research Center for Society and Technology*, to conduct inter-disciplinary research at the intersection of design and anthropology to improve our understanding of the factors that influence the successful diffusion of new practices & new technologies in engineering that lead to more sustainable outcomes for society. The Center was awarded Affirmative Action Award in 2002 at UQ.

PI, *Advanced Engineering Capability Network*, funded under the Australian Federal Department of Education, Science and Training (DEST) (2006-2007). A virtual network of industry-education-community partners.

PI, *Designing Next Generation Learning Places: Collaboration at the Pedagogy-Space-Nexus* funded by the national Carrick Institute for Learning and Teaching in Higher Education.(2006-2007)

PI *Australian Virtual Engineering Library* (AVEL) / *Sustainability Knowledge Network* Project, collaboration with university libraries Australia-wide, CRC's and Engineers Australia (1999-2004).

President, Australasian Association for Engineering Education, 2005.

(v) Collaborators & other Affiliations

(a) Collaborators

Addison, V., University of South Carolina
Anderson, J., University of Queensland
Atman, Cindy, University of Washington
Clarke, N, University of Queensland
Humphries, RMIT University, Melbourne, Australia
Isokangas, E, Thiess Pty Ltd., Australia
Jolly, L. University of Queensland, Australia
Kallem, N., University of Georgia
Mann, L., Purdue University
Mayer, M., University of South Carolina
Miller, Andrew, University of Queensland, Australia
Peters, W. University of South Carolina
Powell, D., University of Queensland
Robertson, B., University of Queensland
Tu Vuong, University of Queensland, Australia
Walther, Jo, University of Queensland, Australia
Wilson, H, Wilson Architects

(b) Graduate Advisors

John Gaylor, Strathclyde University (UK does not have a graduate committee system)

(c) Thesis Advisor for

Anderson, J., University of Queensland
Humphries, RMIT University, Melbourne, Australia
Mann, L., Purdue University
Miller, Andrew, University of Queensland, Australia
Robertson, B., University of Queensland
Tu Vuong, University of Queensland, Australia
Walther, Jo, University of Queensland, Australia

Total number of Graduates or Postdoctoral Students Directed: ***35***

Bernard Y. Tao
Dept. of Agricultural and Biological Engineering
Purdue University
tao@purdue.edu
765-494-1183

Education:

Ph.D. Chemical Engineering, Iowa State University
M.S. Chemical Engineering, Massachusetts Institute of Technology
B.S. Chemical Engineering, Massachusetts Institute of Technology

Professional Experience

Engineering Mgmt. Trainee, Specialty Material Div. General Electric Co. 1977-79
Group Leader, R&D Engineering, Foods Division, Proctor & Gamble Co 1979-82
Assistant Professor, Ag. and Biological Eng. Dept. ,Purdue University. 1988
Associate Professor, Ag. and Biol. Eng. Dept., Purdue University 1994
Professor, Ag. And Biol. Eng. Dept., Purdue University 2004
Indiana Soybean Alliance Endowed Chair for Soybean Utilization, 2004

Refereed Journal Publications (recent)

Kim, Chang Sup, N. S. Han, I. Keum, B. Y. Tao, and J. Seo, Megaprimer PCR for Site-Directed Mutagenesis of Cyclodextrin Glucanotransferase, Food Sci. Biotechnol. 12(1) 2003

Chang Sup Kim, N. S. Han, I. Keum, B. Y. Tao, and J. Seo, Cyclodextrin Glucaontransrease: Acceptor Binding Site Affecting Cyclization Reaction, Food Sci. Biotechnol. 11(6) 2003

Allen, D. K., M. R. Okos, and B. Y. Tao, The Evolution of Biological Engineering, Int'l J. Eng. Ed., 22(1) 2006, 43-52.

Tao, B. Y., Empirical Measurements of M&Ms Contained in a Standard Bottom-Mouth Erlenmeyer Klein Flask and Comparison to Theoretical Models, J. Irreprod. Results 50(2) 2006 23-25

Allen, D. K and B. Y. Tao, Kinetic Characterization of Enhanced Lipid Activity on Oil Bodies, Bioprocess and Biosystems Engineering, 30(4) 2007 271-279.

Kim, Hyun, S. Y. Kim, N. S. Han, and B. Y. Tao, Solubilization Conditions for Hydrophobic Membrane Protein, Oleosin, in Soybeans, Biotechnol. Bioprocess Eng. 12 (5) 2007 542-547.

Invited Book Chapters/Other Publications (recent)

Biofuels for Home Heating, Industrial Uses of Vegetable Oils, S. Erhan, ed., AOCS Press 2005

Industrial Applications for Plant-Based Oils and Lipids, Bioprocessing for Value Added Products from Renewable Resources, S. T. Yang, ed., Elsevier, 2006

Conley, S. P.and Tao, B. Y., What Is Biodiesel?, Purdue Extension BioEnergy Series (ID-337) 2006

Conley, S. P.and Tao, B. Y., Biodiesel Quality: Is All Biodiesel Created Equal?, Purdue Extension BioEnergy Series (ID-338) 2006

Awards & Honors

IN Soybean Utilization Endowed Chair, 2004
CIC Academic Leadership Fellow, 2005-06

Charles B. Murphy Teaching Award, 2005-06
LANGURRE Senior Fellow (2005-2008)

USDA LEAD21 Fellow, 2006

USB National Excellence in New Uses Award, 2006
PUCESA Team Award, 2006
Purdue University Teaching Academy Fellow 2006
Dean's Team Award, (College of Agriculture) 2007

Invited Speaker

109th International Meeting of Ass'n of Operative Millers, Nashville, TN, 2005
Commencement Speaker, International School of Indiana, Indianapolis, IN 2005
2005 Annual Meeting, United Farmers of Alberta , Calgary Canada 2005
National Faculty Leadership Conference, Washington, DC, 2005
National Council of Farmer Cooperatives Annual Meeting, La Costa, CA 2005
Biological Engineering: Future Trends, ASAE National Meeting, Tampa, FL 2005
VII International Soybean Symposium, Foz do Iguasu, Brazil, 2005
International Symposium of the International Oil Chemist's Society, Turkey, 2006
International Oil Chemists Society, Biodiesel Symposium, Vienna Austria 2007

University and Community Service

Chair, Faculty Presidential Search Committee, 2006-07
Chair, University Senate, 2006-07
Vice-Chair, University Senate 2005-06
President's Advisory Council, 2005-08
University Senate Steering Committee, 2004-07
GSIS Engineering Signature Area Co-Chair
Chair, ABE Awards Comm. (1998-present)
Advisor, Society of Business Engineers (2001-present)
Advisor, Colleges Against Cancer (2003-present)
Deacon, Covenant Presbyterian Church (1998-2001)
Missions Committee, Cov. Pres. Church (1996-2003)
Ministry Committee, Cov. Pres. Church (2003-present)

Membership in Academic, Professional and Scholarly Societies

American Oil Chemists Society (AOCS) since 2000
American Institute of Chemical Engineers (AIChE), since 1975
American Chemical Society (ACS), since 1985
American Society of Agricultural Engineers (ASAE), since 1988
American Association. for the Advancement of Science (AAAS), since 1988
American Society of Engineering Educators (ASEE), since 1991
Institute of Food Technologist (IFT), since 1992
Institute for Biological Engineering (IBE), since 1996

Current and Pending Support

(See GPG Section II.D.8 for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: Martin Okos

Other agencies (including NSF) to which this proposal has been/will be submitted.

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Development of a Small Scale Multi-Purpose Seed Processor

Source of Support: Triple F Inc.

Total Award Amount: $298,551 Total Award Period Covered: 01/02/2006-01/01/2008

Location of Project: Ag & Biological Engineering

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Source of Support: Griffith Laboratories

Total Award Amount: $20,000 Total Award Period Covered: 04/28/2003-12/31/9999

Location of Project:

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Fundamental Design, Characterization and Manufacturing Science of Biocompatible Engineering Composites

Source of Support: State University of Rutgers/NSF

Total Award Amount: $790,492 Total Award Period Covered:07/01/06-06/30/08

Location of Project: Ag & Biological Engineering

Person-Months Per Year Committed to the Project. Cal: Acad: .45 Sumr:

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Development of Comprehencive, Fully-Intergrated Biological Engineering Curriculum

Source of Support: NSF/DRL
Total Award Amount: $100,000 Total Award Period Covered: 08/01/05-07/31/07
Location of Project: Ag & Biological Engineering
Person-Months Per Year Committed to the Project. Cal: Acad: .45 Sumr:

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Source of Support: Ross Graduate Fellowship/Assistantship
Total Award Amount: $15,748 Total Award Period Covered: 06/1/2007-07/31/2012
Location of Project: Ag & Biological Engineering
Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.