

Sabbatical Proposal 2015-2016

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Background

Biotechnology is a rapidly growing industry with projections for continued growth and exciting opportunities for employment. The Moorpark College Biotechnology Program is one of three in the state with a comprehensive curriculum in biomanufacturing. This program was designed in consultation with members of local industry (Baxter, Amgen, and others) to provide the essential technical experiences and training needed for this thriving field. The curriculum balances basic science courses with practical laboratory applications. Along with the creation of this much acclaimed program, the founder of the program (Professor Maureen Harrigan) also published a comprehensive Training Manual (Industrial Biotechnology: A Training Manual – ISBN0-7593-0514-5). The book was put together with the help of several contributors from the industry. This manual has served as the text book for some of our courses for the past 13 years. The content of the book has never been revised since its original publication in 2001. There have been many advancements in Industrial Biotechnology since the publication of this book. We have provided our students with knowledge of these advancements through the use of guest speakers from the industry and through our own lecture notes. However, it behooves us to completely revise and update this excellent text book so that students of Industrial Biotechnology have a concise, yet comprehensive resource to go to for practical knowledge of this important field.

I have taught Biotechnology courses at Moorpark College for over 7 years now and have acted as the lead faculty for the Biotechnology Program at Moorpark College for all those years as well. My knowledge of this field comes not only from my education, but also from over 20 years of hands-on experience in the Biotechnology industry. In addition, I have kept up with the advancements in this field through extensive networking with industry professionals, active memberships in professional organizations, and through other professional development activities such as attending conferences and reading trade journals. I have over 20 peer reviewed publications to my credit (Appendix I). John Wiley & Sons recently asked me to contribute an article on Cell Culture Technology to their “Kirk-Othmer Encyclopedia of Chemical Technology” (Appendix II). E-mail communication from the publisher of the Industrial Biotechnology textbook (Cengage) agreeing to the revision of the text is also attached (Appendix III). I provide this information as background to establish my qualification as the right person to take on the project of revising the aforementioned text book.

Proposal

I propose to utilize the sabbatical leave of one semester (Spring 2016) to completely restructure and revise the book entitled "Industrial Biotechnology: A Training Manual" published by Cengage Learning in order to bring the content of the book up to date with current state of the art in this industry and to introduce new technologies that have become part of this field since the original publication of the book in 2001. I have not applied for a sabbatical leave any time in the past. The last time anyone from the Biology/Life Sciences department was granted a sabbatical leave was in the spring of 2008 (Professor Marie Panec). The process of revising this book will entail meeting with several industry experts and attending appropriate industry conferences such as those organized by IBC Life Sciences (www.ibclifesciences.com) and California State University Program for Research and Education in Biotechnology (CSUPERB).

Detailed Plan: The book, as it is currently written, follows a reasonably logical sequence of topics involved in biological manufacturing. The sequence was based on the way the program was taught in its original form (a 12 unit course over one semester). The table of contents of this book is given below:

Table of Contents

TOPIC	AUTHOR	SECTION
Good Documentation Practices	Amgen	1
Facility Design and Environmental Controls	Amgen	2
Facility Design: A Case Study	Amgen	3
Control Systems	Steven Seltzer	4
Gowning	Amgen	5
Environmental Process Monitoring	Amgen	6

Laser Particle Counters	Amgen	7
Manual Labware Cleaning	Amgen	8
Equipment Preparation and Assembly	Amgen	9
Autoclave and Labware Handling	Amgen	10
Clean Room Conduct and Aseptic Technique	Amgen	11
Lot Track Trace	Amgen	12
Buffer and Media Batching	Amgen	13
Clean-In-Place	Amgen	14
Steam-In-Place	Amgen	15
Clean-Out-of-Place	Amgen	16
Sterility and Contamination Control	Pauline Groll	17
Mammalian Cell Culture	Alison Moore, Bob Pendleton	18
Molecular Overview	Jeff Lewis	19

Microbial Media Design and Preparation	Joe Pope	20
Fermentation of <i>Escherichia coli</i>	Ian Leslie, Craig Curless	21
Integrity Testing	Amgen	22
Tangential Flow Filtration	Greg Titus, Millipore	23
Protein Recovery	John Ogez	24
Cell Disruption	Darrell Lewis-Sandy, Chris Rosenfeldt, John Ogez, Mark Byers, Maria Caicedo, Adrian Distler, Michelle Dowling, Bill Entrup	25
Centrifugation	Darrel Lewis-Sandy, Chris Rosenfelt, John Ogez, Mark Byers, Maria Caicedo, Adrian Distler, Michelle Dowling, Bill Entrup	26
Chromatography	Daphne Feng, Oliver Kaltenbrunner, Mike Mills, John Ogez, Bob Seely, Ali Siahpush, Peter Watler	27

Protein Formulation-Fill-Finish Operations	Sugu Patro	28
Investigations	Lisa Severy	29
Mycoplasma Detection	James Harber	30
Enzyme-Linked-Immunosorbent-Assay	Charles Sernberger	31
Radial Immunodiffusion	Khaled Quaderi	32
SDS-Polyacrylamide Gel Electrophoresis	Susanne Meyer, James Harber	33
Western Blots	Susanne Meyer	34
Introduction to Validation	Amnon Eylath	35
Cleaning Validation	Bob Seely	36
Process Validation	Bob Seely	37
Metrology and Calibration	Amnon Eylath	38
Controlled Temperature Chamber Validation	Julie Mark, Patrick Smith	39

As can be seen, the book has extensive information provided by industry experts and is organized in a logical sequence. However, it does not organize these topics into major categories that could correspond with the way the program is currently conducted at Moorpark. In 2006 Professor Mary Rees led a major revision of the Biotechnology program to separate the original 12 unit course into 5 shorter courses that are now taught over 2 semesters. These courses are:

BIOT M02A: Environmental Monitoring and Process Support

BIOT M02B: Quality Control and Validation

BIOT M02C: Cell Culture and Microbial Fermentation

BIOT M02D: Bioprocessing: Recovery and Purification

BIOT M02E: Business and Government Regulation

I propose to organize the topics in the book (along with many new ones) into chapters within the book. The proposed outline of the book is given below:

Proposed Table of Contents

Core Concepts

Biotechnology Process Overview (New)

Good Manufacturing Practices Overview (New)

Environmental Monitoring and Process Support

Facility Layout and Environmental Controls (Section 2, 3)

Clean Rooms and Gowning Practices (Section 5)

Environmental Monitoring (Section 6, 7))

Equipment and Sanitary Design (New section on single use equipment, some Section 9)

Cleaning and Sterilization of Equipment and Containers (Sections 8, 10, 14-16)

Buffer and Media Batching (Section 13)

Control Systems (Section 4)

Quality Control and Validation

The Quality Unit: QA and QC (New section on organization of the Quality departments)

Good Documentation Practices (Section 1)

Investigations (Section 29)

Introduction to Validation (Section 35)

Computer Validation (New concepts and some Section 4)

Equipment Qualification (New section on IQ, OQ, PQ)

Process, Cleaning, and Transportation Validation (Sections 36 and 37)

Analytical Method Validation (New)

Process Characterization (New)

Continuous Process Monitoring (Section 40)

DMAIC (Six Sigma) (New)

Lean Manufacturing (New)

Cell Culture and Microbial Fermentation

Overview (New)

Cell Biology (New)

Industrial Microbiology (New)

Clean Room conduct and Aseptic Technique (Section 11)

Mammalian Cell Culture (Section 18 + new material on stem cell culture)

Single use bioreactors and media tanks (New)

Biofuels (New)

Microbial Fermentation (Sections 20-21)

Recovery, Purification, and Formulation

Protein Chemistry and Structure (New; Some from Section 27)

Goals of Protein Recovery (Section 24)

Cell Disruption (Section 24)
Centrifugation (Section 26)
Precipitation, Unfolding, and Refolding (New)
Chromatography (Section 27)
Tangential Flow Filtration (Section 23)
Normal Flow and Sterile Filtration (Section 22)
Formulation, Filling, and Packaging (Section 28)

Analytical Methods in Biotech Manufacturing

pH and DO Detection (New)
Cell Enumeration (New)
Mycoplasma Detection (Section 30)
ELISA (Section 31)
LAL and Microbial Analysis (New)
High Pressure Liquid Chromatography (New)
Electrophoretic Methods (Sections 33, 34)

I believe organizing the content in the manner outlined will make the book more user-friendly and the addition of new topics will bring the content on par with the state of the art as of now. I am aware that this is a major undertaking. However, a lot of the proposed content currently exists in the form of lecture notes and Power Point presentations. I also have an extensive network of potential contributors for the various topics that I can rely on to bring this work to fruition in a semester's time.

Proposed Timeline:

January 2016: Contact and enlist potential contributors for various topics

- Research topics in cell culture (which will be written by Subhash Karkare).
- Face to face meetings with several other industry experts to provide them with guidance on the writing of their topics.
- Attend annual CSUPERB conference

February - March 2016: First drafts of all new material completed and ready for editing

- Subhash Karkare will be doing a lot of writing on cell culture topics.
- Follow-up phone calls and meetings with other contributors to keep project on track for completion.
- Attend Bioprocessing conferences as appropriate

April 2016: Editing of the material to make it cohesive

- Subhash Karkare will do the bulk of editorial work to make sure that all disparate chapters are well linked and are presented in a coherent manner.

May 2016: Final version of the book sent to publisher for editing

- Final drafts of all individual topics to be sent back to contributors for final check
- Obtain consent from original publishers of work cited
- Correspond with publisher to get the book in its final form

Outcomes

At the end of the sabbatical leave, I expect to have a newly revised and updated version of the book "Industrial Biotechnology: A Training Manual" available for students at Moorpark and at other institutions (including biotech industry training departments). The book would be used as a text in four of our five courses without the need for additional notes provided by the instructor. The benefits of this sabbatical are manifold and address several constituencies:

Benefits to students and instruction: The book will be used as a text for 4 courses at Moorpark College (BIOT M02A, BIOT M02B, BIOT M02C, and BIOT M02D). Two of these courses are taught in the fall and two are taught in the spring semester. Average enrollment in the courses is about 16 per course. Having one inexpensive textbook for four courses in the program provides students with continuity and flexibility. Although I have been with the program for several years, and teach one of these courses (BIOT M02C), the other courses are taught by adjunct faculty. There is a fair amount of turnover in adjunct faculty members. Having an up to date text book will help tremendously in helping new incoming faculty to come up to speed in the subject matter for each course and make the instruction much more consistent.

Benefits to the College: Moorpark College will benefit from the enhanced reputation of the Biotechnology Program. Moorpark College name is prominently displayed on the book cover along with pictures of our students at work in the laboratories. This should help in recruitment of students and faculty to the program.

Benefits to the District: The primary mission of the District is to produce student learning in lower division level academic transfer and career/vocational degree and certificate programs. The biotech program supports this mission by preparing students for careers in the local Biotech industry by obtaining degrees and certificates in this area. Making sure that our textbooks and faculty have the latest information about industry practices is vital in keeping the program relevant to the local industry and is therefore fully aligned with the mission of the district.

Moreover, the reputation of our program attracts many industry partners that offer monetary and in-kind support. For example, we currently have a collaboration agreement with PBS Biotech of Camarillo. This company pays the district a monthly rent for use of our facilities and hires interns from our program. In the past, companies like Amgen have provided letters of support in grant applications for the college and the district. Our ability to garner continued support from local companies is enhanced by having faculty members at the forefront of current technology used by these companies and students who are well versed in the technology.

Benefits to the candidate: As a result of my research and interactions with industry experts during the course of this semester, I personally will have a much better appreciation and understanding of bio-manufacturing and will be able to teach students better with the newly gained perspectives.

Conclusion

As a result of the work done during the sabbatical leave, we will have a text book that our students can use to gain state of the art knowledge of industrial biotechnology. In addition, publication of this book will have a significant multiplicative effect by enabling teachers, students, and practitioners all over the world to learn from the revised book.

Appendix I

Subhash B Karkare

Publications

Karkare, S. B.: Cell Culture Technology; in *Kirk-Othmer Concise Encyclopedia of Chemical Technology Fourth Ed.*; John Wiley & Sons Inc., New York, pp. 363-365 (1999).

Lu, H.S., Hsu, Y-R., Narhi, L.O., Karkare, S., and Lin, F-K.: Purification and characterization of human tissue prokallikrein and kallikrein isoforms expressed in Chinese hamster ovary cells; *Protein Expression and Purification*; 8: 227-237 (1996).

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Karkare, S. B.; Cell Culture Technology; in *Kirk-Othmer Encyclopedia of Chemical Technology Fourth Ed.*; 5; John Wiley & Sons Inc., New York, pp. 461-476 (1993).

Karkare, S.B., Cole, S.T., Sachdev, R.K., Satyagal, V.N., Williams, L.R., and Fieschko, J.F.: Production of rat stem cell factor from BRL cells by microcarrier perfusion culture; *Annals of New York Academy of Sciences*; 665: 371-379 (1992).

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Dean, R.C., Jr., Grela, P.V., Karkare S.B., Runstadler, P.W., Jr.: Fluidized Cultivation Process; United States Patent # 4,978,616 ; Dec. 18, 1990.

Ray, N.G., Karkare, S.B., and Runstadler, P.W., Jr.: Cultivation of hybridoma cells in continuous cultures: Kinetics of growth and product formation; *Biotechnol. Bioeng.*, 33: 724-730 (1989).

Dean, R.C., Jr., Karkare, S.B., Ray, N.G., Runstadler, P.W., Jr., and Venkatasubramanian, K.: Large scale culture of hybridoma and mammalian cells in fluidized bed bioreactors; *Annals of New York Academy of Sciences*, 506: 129-146 (1987).

Dean, R.C., Jr., Karkare, S.B., Phillips, P.G., Ray, N.G., and Runstadler, P.W., Jr.: Continuous cell culture with fluidized sponge beads; in *Large Scale Cell Culture Technology*; B.K. Lyderson Ed.; Carl Hanser Verlag Publishers, Munich, pp.145-167 (1987).

Karkare, S.B., Venkatasubramanian, K., and Vieth, W.R.: Design and operating strategies for immobilized living cell reactors: Part I: Candidicin biosynthesis; *Annals of New York Academy of Sciences*, 469: 83-90 (1986).

Karkare, S.B., Burke, D.H., Dean, R.C., Jr., Lemontt, J., Souw, P., and Venkatasubramanian, K.: Design and operating strategies for immobilized living cell reactors: Part II: Production of hormones by recombinant organisms; *Annals of New York Academy of Sciences*, 469: 91-96 (1986).

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Karkare, S.B., Dean, R.C., Jr., and Venkatasubramanian, K.: Continuous fermentation with fluidized slurries of immobilized microorganisms; *Bio/Technology*; 3: 247-251 (1985).

Bailey, K., Venkatasubramanian, K., and Karkare, S.B.: Immobilized live cell reactor dynamics following dilution rate shift to growth condition: Cell synchrony effects; *Biotechnology and Bioengineering*; 27: 1208-1213 (1985).

Venkatasubramanian, K., and Karkare, S.B.: Process engineering considerations in the development of immobilized living cell systems; in *Immobilized Cells and Organelles*; B. Mattiason Ed.; CRC Press (1983).

Venkatasubramanian, K., Karkare, S.B., and Vieth W.R.: Chemical engineering analysis of immobilized cell systems; *Applied Biochemistry and Bioengineering*; 4: 311-349 (1983).

Editor: Biochemical Engineering VIII: Annals of the New York Academy of Sciences, 1993

Member of the Editorial Board for Encyclopedia of Bioprocess Technology, Wiley, 1999

Appendix II

Correspondence from John Wiley & Sons

20-Sep-2014

Dear Dr. Karkare,

Thank you for agreeing to contribute an article on the topic of Cell Culture Technology to the Kirk-Othmer Encyclopedia.

We are using the online tool Scholar One Manuscripts for manuscripts submission and review. Please direct your browser to <http://mc.manuscriptcentral.com/koe> and use the following case-sensitive USER ID and PASSWORD to access your account:

USER ID: skarkare@aol.com

PASSWORD:

The first time you log in, you will be prompted to complete your account information, you will also be able to set a new password.

As I mentioned, the contribution may be a revision of the earlier article, if one exists. In that case and at your discretion, text, tables, and figures from the previously published article may be used in the revised manuscript for the new edition. We expect you to submit your article within about three months. You may check the Author Center of the online submission site (see above) for the due date for the submission of the article.

The attached Author's Guide provides guidelines for preparing the manuscript. It is available also in the Author Center, Resources, under Instructions & Forms. Please find attached the Contributor Agreement, which we ask that you complete, sign and return to our office by mail, fax, or email to the below address.

We will be happy to assist in the process, so please contact us by phone or email (koe@wiley.com). We welcome you to our distinguished circle of contributors and look forward to a rewarding collaboration.

Sincerely,

Arza Seidel

John Wiley & Sons
111 River St., 8-01
Hoboken, NJ 07030-5774

Phone: 201.748.6587
Fax: 201.748.8888
koe@wiley.com

Appendix III

Correspondence with Cengage Learning

From: Benjey, Kathleen [<mailto:kathleen.benjey@cengage.com>]
Sent: Tuesday, October 14, 2014 9:47 AM
To: Subhash Karkare
Cc: Stephens-Greer, Spring
Subject: Updating of Biotech Training Manual

Hello Professor Karkare,

My name is Kathleen Benjey and I will be the Custom Project Manager that will be assisting you with the revision of: *Industrial BioTechnology: A Training Manual*. I am happy to hear that you will be able to take leave to be able to work on the revision, I know that it is a lengthy process, but I will be happy to support you as you go through it.

I will continue to reprint the current edition of the text as necessary and assume that the new edition will be ready for Fall 2016. Please let me know if there is anything else that I can assist you with.

Kathleen Benjey

Student Engagement Coordinator

Cengage Learning

5191 Natorp Blvd, Mason, Ohio 45040

(o) 513-229-1407

(e) kathleen.benjey@cengage.com

From: Benjey, Kathleen [mailto:kathleen.benjey@cengage.com]
Sent: Friday, October 24, 2014 9:39 AM
To: Subhash Karkare
Subject: RE: Updating of Biotech Training Manual

Hello Subhash,

The agreement to publish the revision of: *Industrial BioTechnology: A Training Manual*, will not include any compensation for the text.

There is no payment for the revision of the text as well as there are no royalties associated with the text when the book is completed and published.

Thank you for your time and effort,

Kathleen Benjey

Student Engagement Coordinator

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October 26th, 2014

MOORPARK COLLEGE

Moorpark College

7075 Campus Road

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www.moorparkcollege.edu

805 378 1400

Regarding: Subhash Karkare, Ph.D.

To: Members of the Sabbatical Committee:

I would like to briefly address the need for sabbatical for Subhash Karkare. Subhash's goal is to create a new and up to date textbook/lab manual for Moorpark College's Biotechnology program. The need for a new text is simple, the current book was originally published in 2001 and the Biotechnology industry is a rapidly evolving area that requires its employees to have the latest in information and training. Significantly, as the author, Subhash will be able to update the text to maintain its currency in the future. Further, this text will serve four separate Biotechnology courses which between the common usage and in house production will save students in the program a significant amount towards completing the program.

In regard to the need for a sabbatical, the creation of a new text is an arduous task at best. Whereas assembly of a new custom text or lab manual, such as for Biology is generally performed by selecting from existing chapters from a publisher's library and can be completed within the realm of school service requirements, Subhash will have to write this book from scratch. Further, in order to ensure that it contains the most up to date techniques and current best lab practices, Subhash will have to travel to attend several Biotechnology conferences and visit industry peers at production sites for consultation/observation of current industry standards.

Ever since Subhash began with the program, he has worked tirelessly and well above the call of his position to provide students with the most realistic industry experiences that a two year public institution can provide. Based on this standard that Subhash has set for himself, I have absolutely no doubt that Subhash will complete the new text and that the finished product will serve to ensure that Moorpark is putting out the best trained Biotech students in the region if not the state that a two year program can do.

Sincerely,

Norman W. Marten, Ph.D.
Chair, Department of Life Sciences
Moorpark College
7075 Campus Road,
Moorpark, CA 93021
Phone: 805-378-1400 ext. 1657
E-mail: nmarten@vcccd.edu