Shalabh Gupta, M.S.

Abstract (1996)

PULMONARY DELIVERY OF HUMAN PROTEIN C AND FACTOR IX

Inhalation offers some exciting possibilities as an alternate drug delivery system for high molecular weight proteins. The objectives of the work were three fold:

- To show that aerosolization can potentially destabilize proteins.
- To demonstrate the feasibility of protein delivery through the lungs.
- To develop an alternate delivery system that could be used for other Vitamin K dependent proteins.

Both human protein C and Factor IX were provided by American Red Cross. Commercially available nebulizers in combination with a novel drying chamber were utilized for all the experimental procedures. Pulmonary delivery of proteins is a function of two parameters - device transfer efficiency and protein activity. Optimization of both these parameters is essential to develop a robust nebulizer delivery system for proteins. Two nebulizers were tested - one manufactured by Pari, the other a Side Stream. The Side Stream caused minimal protein denaturation but had low respirable output (2-5micron aerosol droplets), while the Pari had a high respirable output but denatured approximately 35% of the protein dose. Bovine serum albumin in the formulation played a significant role in shielding the proteins from surface denaturation. In vivo studies on rats administered protein C and Factor IX by inhalation showed that approximately 2-4% of the protein dose was delivered systemically.

Career Vision

To excel in the healthcare arena and to strategically position my services in the area of pharmaceutical and biotechnology industries.

Education Summary

- 1997 - 1999, Wharton Business School Philadelphia, PA. Graduate of the evening part time management program. This program helped me to critically evaluate the drug development cycle at Merck from all aspects of team dynamics, finance & marketing, enhance my cross functional team skills, and improve my project leadership abilities. As a whole, this program built my foundation in the areas of accounting, financial management, business policies, human resource management and marketing.
- 1993 -1996, University of Maryland, Baltimore, MD. M.S. Chemical & Biochemical Engineering. Demonstrated the feasibility of using a nebulizer delivery system for administration of high molecular weight proteins. Project required cross-functional teamwork, effective team management and creative application of total quality management tools.
- 1989-1993, University of Roorkee, Roorkee, India. B.S. Chemical Engineering, Graduated in the top 10% of the class. A national level entrance exam admits only the top 2-3% into this prestigious program.

Employment Summary

- June 2000 - Present, Project Engineer / Consultant in Management Engineering / Internal Consultant to Merck. Goal is to assist Merck Manufacturing achieve operational excellence through business process re-engineering & change management. Presently leading the efforts to reengineer the bulk drug manufacturing and finished goods release process for Merck's Rahway plant. Primary objective is to develop a reliable and robust business process for Merck's chemical manufacturing sites worldwide. Leading the implementation of "ASPEN Engineering suite technology". A revolutionary technology that will integrate technology transfer and information sharing between research, manufacturing, strategy teams and marketing. Process information to manufacturing and product information to marketing and strategy teams will now be accessible early in the product development stage allowing for longer lead times. This would not only shorten the product development timelines but also give the company a "competitive advantage" in speeding a new product to the market.
- 1996 - June 2000, Research Chemical Engineer (Pharmaceutical Development) Scaled-up and built robust manufacturing processes for critical Merck compounds. Skills strengthened: analytical, research, problem solving, team building and project management. Introduced the application of NIR (near infra red technology) as an in-line process monitoring tool for tablets and roller compacted ribbons. Invited as an honorary speaker to AAPS (American Association of Pharmaceutical Scientists) to discuss the application of this novel technology in pharmaceutical processing. Skills strengthened: Innovation, creativity and project leadership. Designed & fabricated a novel 3-D mass distribution spray patternator for Merck in 1998. The patternator has proved to be extremely useful tool for spray characterization (critical information for process development). Skills strengthened: Creativity & problem solving. Lead the Merck team in a collaborative research project with Carnegie Mellon University. Goal was to optimize and scale-up pharmaceutical coating sprays using solution rheology and nozzle characteristics as variables. Skills strengthened: team management, project leadership, and change management. Represented Merck Research in cross-functional teams of marketing, validation, clinicians, finance, and manufacturing. Skills strengthened: team work, leadership, effective communication. Appointed as a lead from Merck research for its Work-Life committee. Developed innovative and creative approaches to help balance the work-life of research employees. Skills strengthened: organizational abilities, work-life balance.

Publications, Abstracts and Presentations

- **S. Gupta** *et al*. Pulmonary delivery of Protein C and Factor IX. Presentation at the AAPS annual meeting in 1995.
- **S. Gupta** *et al*. Scale-up and development of Wurster coating process for tablets. Presentation at the AAPS annual meeting 1998.
- **S. Gupta** *et al*. Near Infra Red as a powerful process tool in the pharmaceutical industry. Presentation at the AAPS annual meeting 1998.
- **S. Gupta** *et al*. A case study to evaluate sticking during tableting. (In preparation for a pharmaceutical development journal).
- **S. Gupta** *et al*. Chromatographic process identification via pulse testing. Journal of chromatography 1995.

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