



INDUSTRY VISIT TO BIOCON SDN BHD: INTEGRATING BIOTECHNOLOGY AND COMPUTING SYSTEMS

SECP1513 - 01 TECHNOLOGY AND INFORMATION SYSTEM



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INTRODUCTION

The industry visit to Biocon Sdn. Bhd. had given me an invaluable experience as one of the largest biopharmaceutical companies worldwide. I gained insights into Biocon's research and development initiatives, manufacturing processes, quality control practice and its contribution to manufacturing quality biopharmaceutical products.

DATE

23 DECEMBER 2025

LOCATION

Kawasan Perindustrian SILC, 1, Jln Bioteknologi 1,
79200 Iskandar Puteri, Johor

PURPOSE

To gain basic exposure to biopharmaceutical industry operations and understand the practical application of biotechnology concepts.

COURSE RELATED TO THE VISIT

- Biology
- Computer Science

COMPANY BACKGROUND

Biocon Limited is an Indian biopharmaceutical company based in Bengaluru, with U.S. headquarters in Bridgewater, New Jersey. This company was founded by Kiran Mazumdar-Shaw in year 1978. They manufactures generic active pharmaceutical ingredients (APIs) that are sold in approximately 120 countries, including the United States and Europe.

OBJECTIVES

- Close-up exposure to biotechnology operations
- Understanding how laboratory research is translated into real-world products
- Exposure to integration of computing, network system and biology with a major biotech setting
- Understand computer-assisted manufacturing

DRIVEN BY OUR PASSION FOR EXCELLENCE & COMMITMENT TO FIND SOLUTIONS THAT HEAL THE WORLD

BIOTECHNOLOGY OPERATIONS OBSERVED

Biocon is well-known in insulin manufacturing. There are **four main steps** in producing drug, which are as follows :

- Formulation
- Filling
- Visual Inspection
- Packaging

The **biotechnology activities** involved in Biocon industry are insulin production, drug manufacturing and even quality testing. By using the precision machine , the quality of product can be examined. In drug manufacturing, the enormous "robot's hands" were created to insert the insulin into the pen. This gigantic machine widened my eyes and stunned me.

Sterile product facilities are classified into four grades: A, B, C, and D. The department we visited had category D, the least strict category. Although it is the lowest grade, we also need to wear protective suit (coat), shoe covers and hair covers. This has increased my awareness of the significance of cleanliness in the production of pharmaceuticals. Indeed, drugs must be completely safe and hygienic because they are substances that humans consume.

ROLE OF COMPUTING AND INFORMATION SYSTEMS

Computing and information systems play an important role in supporting Biocon's biopharmaceutical operations. From research and development to large-scale manufacturing and quality assurance, digital technologies enable efficient data management, precise process control, and informed decision-making. Systems such as bioinformatics platforms, automated manufacturing controls, LIMS, ERP, and electronic quality management systems ensure high data integrity, traceability, and compliance with strict Good Manufacturing Practices (GMP) and global regulatory requirements. Furthermore, the use of data analytics and digital dashboards enhances operational transparency and continuous improvement. Overall, the integration of advanced computing and information systems allows Biocon to maintain product quality, improve productivity, reduce risks, and deliver safe and effective biopharmaceutical products to meet global healthcare needs.



LAB-TO-MARKET TRANSLATION

Throughout this tour, I gained an understanding of **how laboratory research is transformed into commercial products**. They conducted their research at a laboratory scale by making use of the systematic procedure, optimization and scale-up in order to boost the reproducibility and efficiency of drugs produced per day. The transition made it possible to successfully commercialize the drugs while preserving their integrity.

Furthermore, the visit had emphasized on the **importance of validation, testing and regulatory compliance** in a biopharmaceutical industry. Validation process is carried out to demonstrate that manufacturing systems are consistently producing products that meet the desired quality. They using Marchesimi machines and Ima machines to produce their drug on a daily basis. The machine will run twice a day with an eight-hour break in between. In order to examined the quality, comprehensive testing is performed to ensure the safety and standard of drugs that going to sell in the market.

On the other hand, the **role of data, documentation and traceability** is important for a big company. Each drug is labelled with their own code by using the laser machine. This allow the company to track the drug easily once the drug is sell in the market. The data of the drug will be stored for further analysis. As a consequence, the process in producing insulin will be transparent, accountable and rapid corrective action can be taken if unexpected condition occur.



Biocon

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INTEGRATION OF COMPUTING, NETWORKS AND BIOLOGY

Digital & Data-Driven Biology (Artificial Intelligence & Machine Learning in R&D)

- Predictive modeling uses historical experimental data and algorithms to forecast product stability and behavior, helping scientists design better experiments and reduce trial-and-error cycles.
- AI/ML tools assist in tasks such as reviewing investigation reports and analyzing experimental outcomes, improving accuracy and shortening development timelines.
- These digital systems support cell line development and analytical data interpretation, meaning computational models and analytics are linked with biological experimentation.

Network-Enabled Data & Systems (Cloud, BPM, Digital Platforms)

- Enterprise resource planning (ERP) and cloud-based platforms support seamless data flow across research, manufacturing, supply chain and commercial functions.
- Biocon also uses advanced digital dashboards (built with tools like Power BI and Python scripts) that pull real-time experimental and operational data to give scientists and decision-makers up-to-date insights.

Digital Laboratory Infrastructure (LIMS & Paperless Labs)

- Laboratory Information Management Systems (LIMS) to handle sample metadata, test results and experimental tracking.
- Electronic batch records, electronic quality systems and management systems (eQMS) replace paper logs, making data more searchable, and auditable.
- These digital tools improve data integrity, compliance and efficiency throughout R&D and manufacturing.

KEY LEARNING OUTCOMES

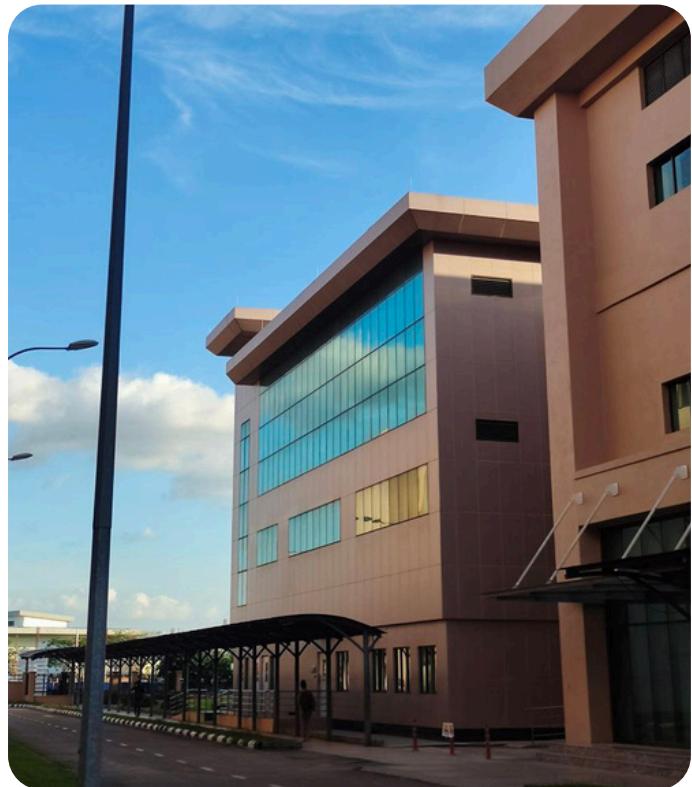
Even though Biocon Johor only manufactures insulin, we got to see the complexity of the manufacturing process by using the advanced technology Biocon used in making the fermentation, downstream, and upstream processes, extraction, filtration, and crystallization to create the insulin product. A lot of quality control and safety protocols are in place at Biocon to make sure the purity of the product is pure and the safety of the staff is ensured. On the site visit, the tour guide gave a brief explanation of the work culture of the site and how it's competitive for employees to climb up the ranks. They also explain how they accepted internships from chemical engineering and computer science undergraduates. This shows how the academic relevance of developing a clearer understanding of theoretical chemical engineering, bioinformatics, and computer science courses. Biocon also shows how it's important to have waste management of product defects or cross-contamination failures to minimize the environmental impact.

RELEVANCE TO ACADEMIC STUDIES AND CORNER

Although Biocon focuses on the biotechnology of insulin production, bioinformatics is used as a tool to validate and improve their products in drug discovery, biologics, and R&D. Students got a clearer insight into how roles beyond laboratory work, including bioinformatics and data analytics, and how professionals in this field contribute indirectly but critically to drug development. This helped students visualize practical career paths after graduation. Knowledge related to protein structure, gene expression, and biological data analysis was directly connected to the processes. It motivated us, students, to improve our technical and analytical skills, as the visit shows how bioinformatics and biotechnology play a crucial role in supporting drug development and improving healthcare solutions in the biopharmaceutical industry.

SKILLS AND KNOWLEDGE DEVELOPMENT

This industrial visit gives students more exposure to soft skills and technical skills related to the biotechnology industry. By observation, we got to know how insulin production happens in real life since all this time we have only studied in textbook pages. This gave us a clearer picture on how biopharmaceutical production occurs practically in industries. We also learned the importance of teamwork, communication and professionalism among different departments such as R&D, Drug & substance and quality assurance. Furthermore, Good Manufacturing Practices (GMP) and strict regulatory compliance increased my awareness of industrial standards and the disciplined work culture maintained in a global biopharmaceutical company like Biocon.



CONCLUSION

In conclusion, the industrial visit to Biocon provides a lot of valuable insight into how advanced the technology is used and the marketing strategies to ensure the insulin is manufactured with the highest quality and is being marketed effectively throughout the whole country, based on the received data used for analysis. This industrial visits also let us experience a bit of the real work environment and work culture, on how it's important to keep up with the latest market trends.



ACKNOWLEDGEMENT

We would like to express our sincere appreciation to Biocon Sdn. Bhd. for allowing us to visit their company and gain valuable exposure to the biotechnology industry. The visit was insightful and helped us better understand how theoretical knowledge is applied in real-world research and production.

We would also like to extend my heartfelt thanks to the lecturers, organisers, and staff involved for their guidance, effort and continuous support in organising this industrial visit. Their dedication made the experience smooth, meaningful and enriching.

We are truly grateful to everyone who contributed to making this visit a valuable learning experience that will benefit us in our academic and professional journey.