



CHEM MASTERY



DEPARTMENT OF PHARMACEUTICAL CHEMISTRY - NEWS LETTER

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ISSUE HIGHLIGHTS

- ☞ Synthetic genomics - making life's building blocks
- ☞ New trends in pharma industry after covid-19
- ☞ Department activities



Mrs. Ayswarya K.
Assistant Professor

SYNTHETIC GENOMICS - MAKING LIFE'S BUILDING BLOCKS

Synthetic genomics has been defined as the engineering and manipulation of an organism's genetic material on the scale of the whole genome, based on technologies to design and chemically synthesize pieces of DNA and to assemble them to long, chromosome sized fragments. These can serve as entire genomes of viruses or bacteria. Compared with traditional genetic engineering, where typically only very few nucleotides or genes in an organism are altered (mostly based on recombinant DNA technology), synthetic genomics thus allows to simultaneously change a large number of nucleotides or gene loci all over the genome by gene synthesis.

METHODS FOR CONSTRUCTING A SYNTHETIC GENOME

Gene synthesis methods are not able to replace each other, and each occupies its own niche depending on the requirements of the project. The following is a brief overview of several common gene synthesis methods:

Solid phase synthesis

The traditional oligonucleotide synthesis uses a small volume of solution processed in a column full of chemicals. The oligonucleotides are synthesized by attaching nucleotide residues stepwise to the end of the chain, one by one. The addition of each oligonucleotide consists of four steps: deblocking, coupling, capping, and oxidation. The integrity of the sequence and the productivity of the synthesis are hindered for products longer than 200bp, and thus this method is generally limited by DNA sequence length. The primary advantage of this method is its high accuracy, compensating for its high expense and low output.

Chip based DNA synthesis

As the name implies, Chip-based synthesis utilizes microarray chips utilizing a series of electrochemical techniques. Different kinds of oligonucleotides are able to be synthesized in different specific parts of the chips, called assembly subpools. Following this piecewise synthesis, gene fragments in subpools are amplified and then aggregated and assembled into the finished product. Chip based DNA synthesis is cheaper than solid phase synthesis and can yield a larger amount of the target gene, but its accuracy suffers in comparison.

PCR based enzyme synthesis

PCR based enzyme synthesis generates gene fragments through a variety of cell systems. Using the



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Shri. K.V. Sankaranarayanan
(01.01.1948 - 12.07.2013)
Founder, Devaki Amma Memorial Institutions

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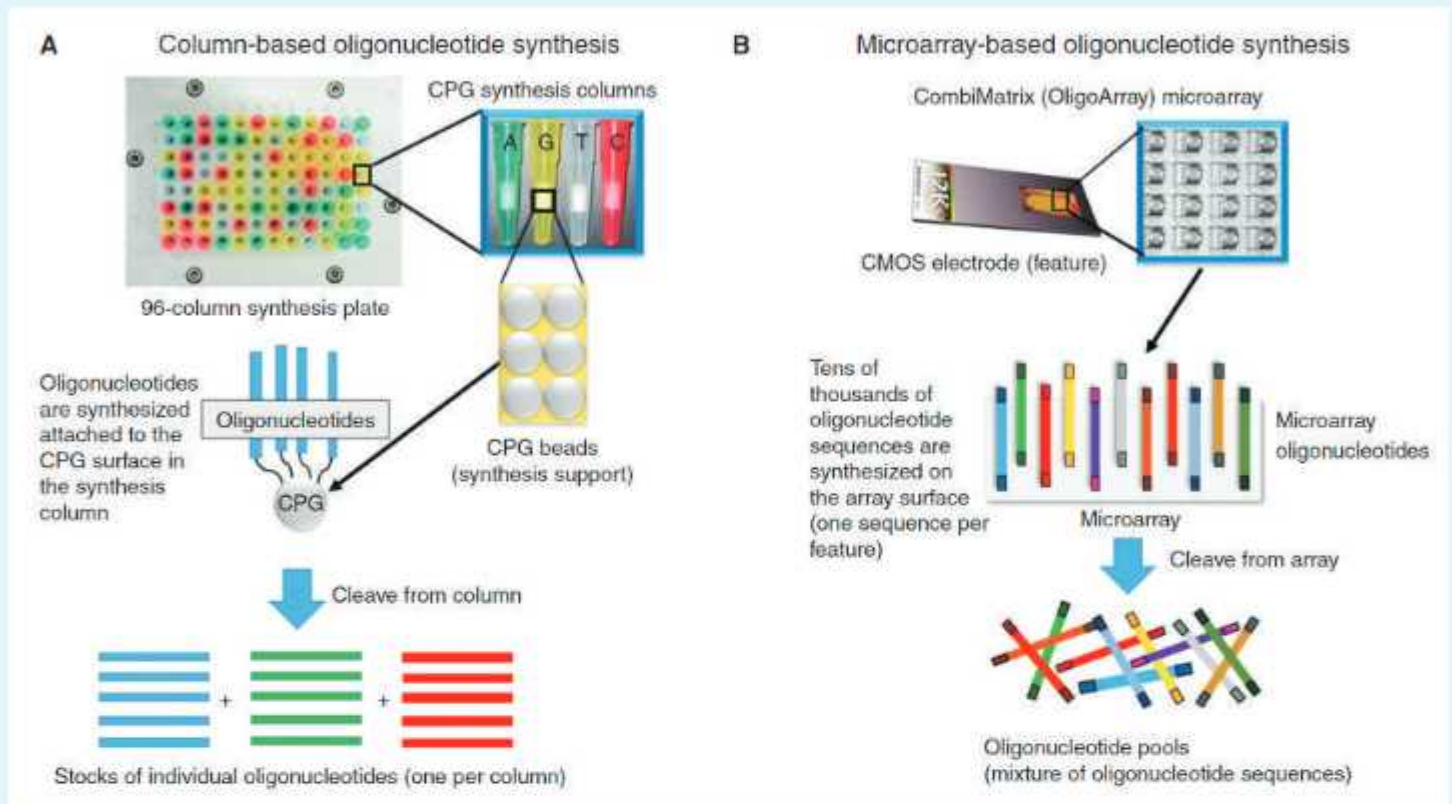
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yeast system as an example, by using different incision enzymes and label markers, different kind of genes can be added to yeast chromosomes. Due to the nature of gene insertion the target gene could have no limit to its length as long as the chromosomes can accommodate. This method performs well in synthesizing large gene fragments, and with the help of the cell systems the accuracy of the gene sequence is guaranteed.



APPLICATIONS

- A. Development of microbes for improved energy production, carbon sequestration and bioremediation
- B. Genetically modified organisms (genetic engineering)
- C. Gene therapy
- D. Pharma & industrial production of enzymes, single cell protein, protein drugs (protein engineering)
- E. Vaccine development and diagnostics
- F. Antibody development
- G. Bioterrorism
- H. Ownership and access

RECENT TRENDS

The time when there have been controversies around the technology and lost interest in genomics gained scientists' attention during the COVID conditions. The highly contagious property and lethal consequences restrict scientific research around COVID. However, synthetic genomics opened doors for new research. Companies like "CODEXDNA" offer identical synthetic genomes of recent SARS-CoV-2. On a technical note, they provide full genome, promoters, mouse-adapted genome, replicons and reporters which allow scientists to research without fear.



Mr. Arunlal V. B.
Assistant Professor

NEW TRENDS IN PHARMA INDUSTRY AFTER COVID-19

2022 has opened up as many new possibilities for the pharmaceutical industry, as it has introduced in the form of obstacles. The COVID-19 pandemic has put a spotlight on the pharma industry, becoming a disruption that has upturned many conventional and existing channels and methods of industry operations from introducing new projects and performing clinical trials to manufacturing and supply chain management.

As pharma companies continue to adapt to the unforeseen challenges, let's take a look at seven pharma trends that will dominate the future.

1. Advanced drug discovery using applied intelligence

According to a study by the Tufts Centre for the Study of Drug Development, the estimated discovery and development cost of each FDA approved drug is around USD 2.6B. The use of AI in drug discovery can expedite the overall R&D process. Applied intelligence can improve drug discovery success rates by 8-10%, resulting in savings worth billions of dollars for the industry. AI can be used to find candidate molecules for drugs, develop compounds from scratch, and aid the process of synthesizing the molecules, with better efficacy.

As per Netscribes' research, most of the AI-pharma partnerships as of August 2020 have been in the field of drug discovery and development.

AI can be used to find candidate molecules for drugs, develop compounds from scratch, and aid the process of synthesizing the molecules, with better efficacy. Currently, this technology is being leveraged across various pharma processes, giving way for partnerships between AI firms and pharma companies.

2. Automation in the pharma supply chain

Technological innovation impacts not only drug development but also the drug supply chain in aspects ranging from speed to safety to manpower. Investments in automation systems are crucial to accelerating the supply chain for personalized healthcare by ensuring that the precision required for patient safety is consistently achieved. The application of automation in pharma manufacturing can help build more resilient and flexible supply chains, reduce costs, diversify and help build stronger, more efficient, and cost-effective supply chains.

Novartis' use of cloud platform-as-a-service (PaaS) to develop new technologies is another example of automation in the supply chain. It helps to get better insights and recommendations, whether commercial data, marketing data, or clinical trials, from the data that is placed on the cloud. Novartis has also partnered with Microsoft Azure to use robotics throughout its pharmacovigilance processes.

3. Accelerated digitization post COVID-19

Digital transformation in the pharmaceutical industry was already happening before the pandemic; however, it received a sudden boost since the beginning of 2022. Several pharmaceutical giants, including Novartis, Pfizer, and Sanofi have taken positive steps towards digitization, such as appointing chief digital officers to their boards and implementing a data-first approach.

When COVID-19 initially turned into a global health crisis, Pfizer was able to roll out remote communication tools within two weeks, which allowed employees to train through smart glasses and mobile phones, with global subject matter experts via augmented reality (AR).

Digital technology has also enabled the company to remotely access shop floor data as it extended its security investment to ensure remote access data safety, which became essential for continuing operations amid the pandemic. The digital preparedness of Pfizer was the result of a working partnership with Rockwell that has grown along with technology for nearly two decades.

4. Move towards patient-centric care model

The COVID-19 pandemic has driven the pharma industry towards more patient-centered care. This approach requires a deep understanding of the patient's medical condition and needs based on new knowledge sources is essential to deliver more efficient treatment and ensure better availability of those treatments.

Pharmaceutical companies may have more evidence-based treatment choices, as genetic, proteomic, and metabolomic pathways of diseases are better understood. UCB Pharmaceuticals, for instance, has leveraged patient and HCP insights to address the unmet needs of those who were prescribed their Briviact medicine.

5. Continued focus on oncology and immunotherapy

There has been some substantial advancement in other fields of medicine, even with COVID-19 diverting the industry's focus. Oncology, for one, has risen to the forefront, with many clinical trials making strong progress and even some major acquisitions taking place.

The 2020 American Society of Clinical Oncology (ASCO) conference included critical findings of the lung cancer trial presented by AstraZeneca. Some of the first "tumor agnostic" cancer drugs were also introduced in 2020, with Bayer's Vitravki (larotrectinib) obtaining support in the UK for tumors with reported gene fusions of neurotrophic tyrosine receptor kinase.

Oncology has also driven some of the largest pharma mergers and acquisitions of 2022, which shows its potential for continued growth.

6. A paradigm shift in how clinical trials are conducted

The COVID-19 pandemic has underlined the need for clinical trial procedures to be streamlined. Decentralized clinical trials have seen a rise since the beginning of the pandemic, due to social distancing and quarantine measures. Various clinical trials have transitioned to more advanced technologies such as telemedicine platforms. Pharma companies are also paying more attention to common bottlenecks in the clinical trial process.

Types of new age clinical trials

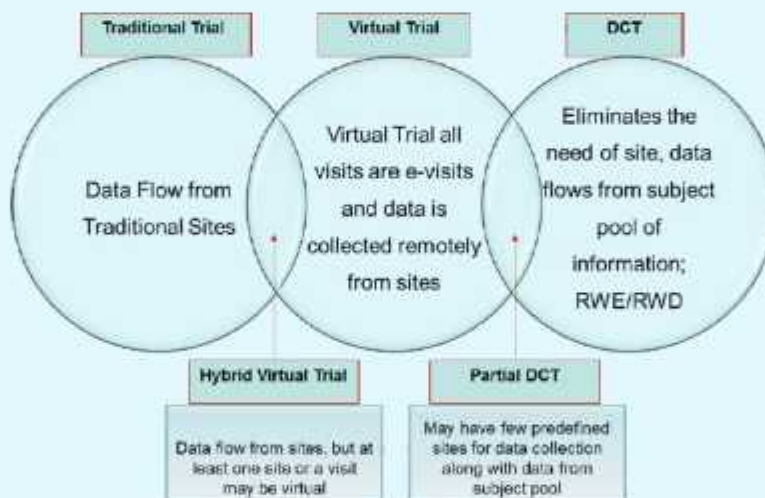


Illustration courtesy of the terms Virtual Trials & DCT Whitepaper

As a result, several techniques are being used by pharmaceutical companies to improve clinical trials, including the discovery of new patient entry points, the use of AI to compress the screening process, the development of a public understanding of the benefits of participation, the encouragement of participation by physicians and the expansion of patient diversity.

7. M & A activity to bounce back

Compared to 2019, 2020 and 2021 was a slow year for mergers and acquisitions in the pharma industry, due to the economic instability brought about by COVID-19. It saw nearly USD 184B in M&A deals for the industry, which was one of the lowest years in almost a decade.

In 2021, pharma companies mainly focused on establishing partnerships to help fight the pandemic and develop vaccines. Pharma and biotech companies of all sizes have not only partnered together but also established cross-industry partnerships with academic and healthcare institutions.

DEPARTMENT ACTIVITIES

FACULTY



Standing:

Mrs. Nimmi M., Mrs. Necthu Dasan, Mrs. Princy C., Mrs. Ayisha Nitha P., Mrs. Shalima N. K., Mrs. Shitha G., Mrs. Jyothisree G., Mrs. Ayswarya K.

Sitting:

Mr. Jibin Joy, Mr. Byju K., Dr. G. Babu, Dr. Biju C. R., Mr. Arunlal V. B.

ONGOING RESEARCH PROJECTS

Following are the research projects from Department of Pharmaceutical Chemistry for Post Graduate students in the academic year 2022-2023:

Students Name	Project Title	Guided by
Shahma mariyam	Structure based approach to determine potential targets for indole derivatives; its synthesis and invitro evaluation.	Dr. Biju C. R.
Muhsina K.	Analytical evaluation and validation of newly formulated combined dosage form of atorvastatin with capsaicin and its pharmacokinetics evaluation.	Dr. Biju C. R.
Adhiti Sibi	<i>Insilico</i> approach to design and synthesis of pyrazole appended quinoline analogous for the evaluation of anticancer and immunomodulatory activities.	Mr. Arunlal V. B.
Ashitha Sivadas K	<i>Insilico</i> design and synthetic strategy of benzimidazole-oxadiazole scaffolds as potent antidiabetic agents.	Mr. Byju K.
Shilpa Sathish K.	<i>Insilico</i> binding studies and synthesis of biologically significant enzyme inhibitor of thiaziazole linked indole dione derivatives as anti diabetic agents	Mrs. Shalima N. K.
Ajmal Ali	Analytical evaluation and validation of newly formulated dosage form containing isolated components of Ficus religiosa root bark.	Mrs. Jyothisree G.
Rinjuna Recnas	<i>Insilico</i> modeling, synthesis and anticancer activity of Quinoxaline azol analogs.	Mr. Jibin Joy

CONFERENCES / WORKSHOPS ATTENDED



Mrs. Jyothisree G., Dr. Anilasree B. P. and Dr. Siraj Sundaran have accompanied 5th year Phram. D. students for hospital visit at Indraprastha Apollo Hospital, New Delhi on 07/06/22.



Dr. Biju C. R. has invited as a speaker in Continuing Education Programme conducted by Kerala Private Pharmacist Association, Vadakara. He has given a seminar on the topic "Adverse Drug Reactions" at Lakshmi auditorium, Vadakara on 21/07/22.



Mr. Ajmal Ali, 3rd Semester M. Pharm. (Pharmaceutical Analysis) has participated in two days national conference on 'Automation, IT And Advancements in Pharmaceutical Sciences' in ICAAPS-2022 organised by PSG College of Pharmacy, Coimbatore from 22/07/22 to 23/07/22.

3rd Semester M. Pharm. (Pharmaceutical Chemistry and Pharmaceutics) students have undergone industrial training at Dr. Reddy's Laboratories, Vishakhapattanam from 18/07/22 to 28/07/22.



3rd Semester M. Pharm. (Pharmaceutical Chemistry) students have attended two days hands on workshop on 'Biologics & Vaccine Design' organized by Department of Biotechnology, Manipal Institute of Technology, Manipal from 27/07/22 to 28/07/22.

RESEARCH PUBLICATIONS

1. Babu G. et al, *Insilico* molecular docking and pharmacokinetic prediction studies of novel pyrazole linked furan and thiophene derivatives for antifungal activity, World Journal of Pharmaceutical and Life Sciences, 7(6), 2021, 90-98.
2. Babu G. et al, *Insilico* design and pharmacokinetic prediction studies of novel benzothiazole clubbed oxadiazole derivatives for antidiabetic activity, European Journal of Pharmaceutical and Medical Research, 8(6), 2021, 315-322.
3. Arunlal V. B. et al, *Insilico* designing and docking studies of 1, 3, 4, - oxadiazole linked quinoxaline derivatives as antimicrobial agents, World Journal of Pharmacy and Pharmaceutical Sciences, 10(12), 2021, 1516-1530.
4. Ayswarya K., DNA sequencing using graphene nanopores. 'Happenings': A Publication from KUHS on Recent Advances, 2021, 1(4), 2021, 90-93.
5. Shalima N. K. et al, *Insilico* studies and molecular docking of 1, 3, 4 - thiaziazole derivatives as antimicrobial agents, International Journal of Pharmaceutical Research and Applications, 6(6), 2021, 05-15.

ACHIEVEMENTS

Mrs. Ayswarya K. has completed 'Certificate Program in Quality Assurance Systems' in MOOC Platform (MOOC-CQAS) conducted by the 'Centre for Interdisciplinary, Allied Health Sciences and Technology Studies', KUHS, from 07/05/21 to 17/11/21.



B. Pharm. (2017 batch) students have secured 100% results in their elective subject 'Advanced Instrumental Techniques' in KUHS 8th semester B. Pharm. Degree Regular Examinations held in May 2022.

M. Pharm. (Pharmaceutical Chemistry and Pharmaceutical Analysis) students (2020 batch) have secured 100% results in KUHS 2nd semester M. Pharm. Degree Regular Examinations held in May 2022.



SOCIAL ACTIVITIES

Dr. G. Babu, Mr. Arunlal V. B., Mr. Byju K., Mr. Jibin Joy and Mrs. Nimmi M. along with other staff members have participated in 'Free Asthma Camp' organized by DAMCOP in association with PVS Hospital at Mofussil bus stand, Kozhikode on 09/05/22.



Dr. G. Babu, Mr. Byju K. and Mrs. Nimmi M. along with other staff members and 5th semester B. Pharm. & 5th year Pharm. D. students have participated in 'Medical Camp and First Aid Training' organized by DAMCOP at 'Institute of Tribal Studies and Research', Wayanad on 23/07/22.



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