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Co-ordinator - SLS Newsletter
School of Life Sciences
B. S. Abdur Rahman Crescent Institute of Science and Technology
Chennai – 600048, Tamil Nadu, India

newsletter.sls@crescent.education
slsc.newsletter@gmail.com

Mobile : +91-9943535774
Phone : +91-044-2240380

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❖ Research Highlights

Benefits of Oral Administration of *Lacticaseibacillus paracasei* strain Shirota in Reducing Insulin Resistance

Noor Hammna Anwardeen

B. Tech Biotechnology, School of Life Sciences, B.S. Abdur Rahman Crescent Institute of Science and Technology, Chennai-600048, Tamil Nadu, India

Research Highlights:

This study aims to determine the effects of *Lacticaseibacillus paracasei* (previously known as *Lactobacillus casei*) strain Shirota (LcS) in alleviating insulin resistance. Insulin resistance is defined as the failure of target organs to respond normally to the action of insulin. This condition further leads to various metabolic abnormalities such as hypertension, less tolerance to glucose and elevated levels of lipids in the blood. One of the major determinants of insulin resistance is the presence of excess level of visceral fat, which causes chronic low-grade inflammation. This causes increased production of pro-inflammatory adipokine production. These adipokines interfere with the insulin signaling pathway, thus facilitating the development of insulin resistance. Obesity-associated inflammation causes increased Toll-like receptor 4 (TLR4) signaling. TLR4 recognizes lipopolysaccharide (LPS) and nonesterified fatty acids (NEFA) which are present in higher levels in obese individuals. Lipopolysaccharide-binding protein (LBP) is a central mediator in TLR4-mediated immune response. Plasma LBP level is an indicator of the intensity of TLR4 signaling, and can also represent level of obesity and insulin resistance. When there is an increase in level of plasma LBP, it represents increased insulin resistance.

Lactobacillus casei strain Shirota is a commercially available probiotic strain. Probiotics are live microorganisms which are beneficial to the host organism when administered in adequate amounts. *Lactobacillus casei* strain Shirota YIT 9029 (LcS) was obtained from the culture collection of the Yakult Central Institute for Microbiological Research (Tokyo, Japan). The bacterial cells were prepared for

administering to mice by preculturing in IL (ionic liquid) medium, then inoculating seventy millilitres of the preculture in 7 litres of IL medium (selective medium for isolation and enumeration of *Lactobacilli* which was described by Rogosa *et al*. 1951) in a fermenter and incubating for 24 hours. The cultured cells were collected and washed three times using distilled water by centrifugation at 9000 **g** for 30 minutes at 4^0C. Then, the cells were heat killed at 100^0C for 30 minutes, lyophilized and stored at -20^0C until use.

Four types of mice were used in this study. These include: Ten-week-old C57BL/6J DIO (Diet induced obese) mice which were fed commercial high fat (HF) diet from 4 weeks of age, ten-week-old ob/ob mice, ten-week-old db/db mice, ten-week-old KK-A^y/Ta mice. The first 3 types of mice were purchased from Charles River Japan, Yokohama, Japan. The 4^{th} type of mice was purchased from Clea Japan, Tokyo, Japan. All mice were housed individually in plastic cages under conventional conditions. The ob/ob mice (obese mice) are mutants which eat excessively due to mutation in the gene for leptin production and become obese. These ob/ob mice are commonly used as an animal model for type II diabetes. db/db mice are used as models for type II diabetes and obesity. KK-A^y/Ta mice are used as animal models for type II diabetes, and they develop hyperglycemia and obesity.

DIO mice received tap water and high fat diet for 14 days. Then, they were assigned randomly into two groups; one group was fed a high fat diet whereas the other group was fed a high fat diet supplemented with 0.05% (w/w) *Lactobacillus casei* strain Shirota (LcS) for 5 weeks. The high fat diet was referenced from D12492; Research Diets, Inc., New Brunswick, NJ, USA. The other types of mice (ob/ob, db/db, KK-A^y) received a normal mouse chow diet for one week. The body weight of mice was recorded once a week. Mice were subjected to insulin tolerance test (ITT) and oral glucose tolerance test (OGTT) to study insulin resistance and glucose intolerance respectively.

Insulin Tolerance Test (ITT) was done by injecting human insulin (Humulin R, Eli Lilly Japan) intraperitoneally into the mice and then collecting blood samples from the tail vein. Oral glucose tolerance test (OGTT) was done by oral administration of glucose using oral gavage, then collecting blood samples from the tail vein.

It was confirmed that the DIO mice which was fed commercial high fat diet from 4 weeks of age developed obesity, insulin resistance and glucose intolerance. The effect of LcS was studied by comparing results between control group (high fat diet alone) and LcS group. From the ITT. it was observed that plasma glucose levels were significantly lower in the LcS group at 30, 60, 90 and 120 minutes after insulin injection.

The insulin tolerance test results were as follows: the plasma glucose levels in control population were 140 mg dl^{-1}, 120 mg dl^{-1}, 150 mg dl^{-1}, 190 mg dl^{-1} at 30, 60, 90, and 120 minutes respectively after insulin loading. Whereas, in the LcS group, the plasma glucose levels were 120 mg dl^{-1}, 90 mg dl^{-1}, 100 mg dl^{-1} and 120 mg dl^{-1} at 30, 60, 90, and 120 minutes respectively after insulin loading. The most significant difference between control group and LcS group was observed at 120 minutes, where the LcS group has 70 mg dl^{-1} less plasma glucose level compared to control group. The OGTT results also showed that plasma glucose levels were significantly lower in the LcS group and followed a similar pattern as ITT results. The control group was also found to have higher level of plasma lipopolysaccharide-binding protein (LBP) of 5.2 µg ml^{-1} compared to 4.6 µg ml^{-1} in the LcS group. The administration of LcS in DIO mice caused less plasma LBP levels, which shows that LcS treatment may reduce obesity-associated inflammation by attenuating metabolic endotoxaemia. The above findings show the positive effect of LcS in reducing insulin resistance and improving glucose intolerance.

For Further Reading: Naito, E., Yoshida, Y., Makino, K., Kounoshi, Y., Kunihiro, S., Takahashi, R., Matsuzaki, T., Miyazaki, K., & Ishikawa, F. (2011, February 1). Beneficial effect of oral administration of *Lactobacillus casei* strain Shirota on insulin resistance in diet-induced obesity mice. *Journal of Applied Microbiology*, *110*(3), 650–657. https://doi.org/10.1111/j.1365-2672.2010.04922.x

***Author Correspondence: Ms. Noor Hammna Anwardeen**, B. Tech Biotechnology, School of Life Sciences, B.S. Abdur Rahman Crescent Institute of Science and Technology, Chennai-600048, Tamil Nadu, India. E-Mail: noorhammna@gmail.com

❖ Mini Review

BIOINFORMATICS IN VIROLOGY

Rasitha Arafa R

B.Tech. Biotechnology, School of Life Sciences, B.S.Abdur Rahman Crescent Institute of Science and Technology, Chennai-600048, Tamil Nadu, India

Introduction

According to David Robertson, *"Currently, all of the data points strongly in one direction, and that's toward Viruses."* Viral diseases are caused by a variety of social, environmental and ecological factors, including economic burden, genetic information transfer and storage, and the capability to regulate entire ecosystems. To address numerous unanswered questions in virology, new genome sequencing technologies have been developed to handle big data and analyze individual virus families.

Virus Bioinformatics

Technically, the small size of viral genomes makes it possible to sequence large figures of isolates, generally in clinical surrounds, an advantage that's generally unapproachable for any other living system. To make this process easier, bioinformatic manners have been integrated to predict viral evolution in cases grounded on individual virus population characteristics. This could help clinicians and virologists to discover and characterize the underpinning contagion populations that are causing complaint, and numerous attempts have been made to achieve this thing and some of the sources mentioned in this review

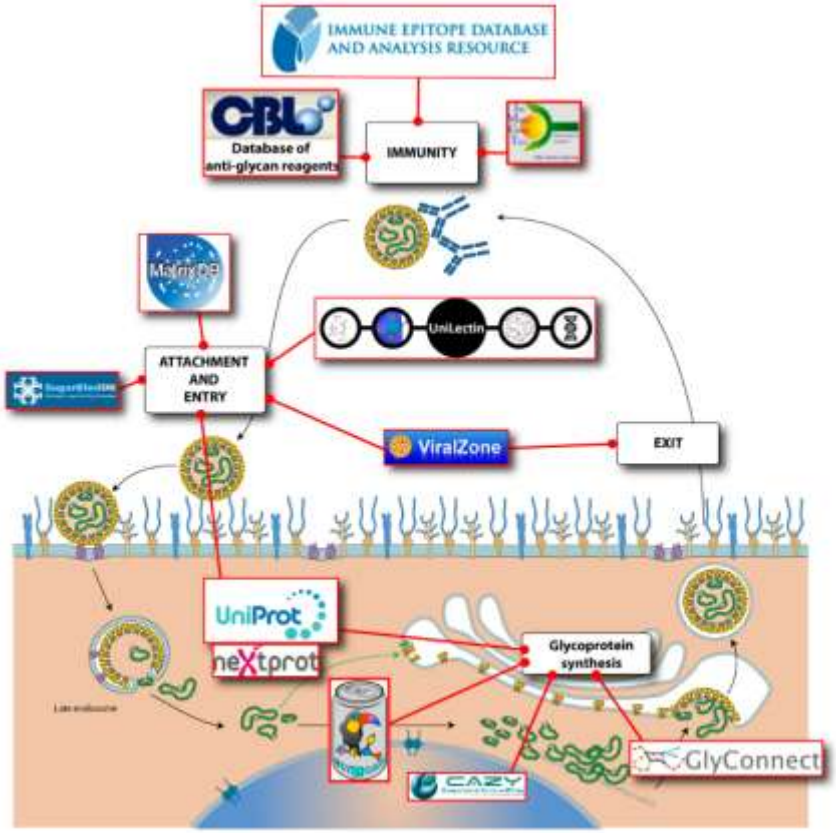


Figure 1. A sample image depicting the use of Bioinformatics in virus research

Few selective software tools and resources for virus bioinformatics

1. Virus specific Databases

Virus Pathogen Database and Analysis Resource (ViPR)	Integrates genomes for multiple virus families (Belonging to *Arenaviridae, Bunyaviridae, Caliciviridae, Coronaviridae, Flaviviridae, Filoviridae*, etc.,)
EpiFlu	Complete collection of genetic sequence data of influenza viruses and related clinical and epidemiological data.
HIV database	Includes genetic sequences and immunological epitope data while HCV is a complete database of the Hepatitis C Virus.
ViralZone	Provides general molecular and epidemiological information, along with virion and genome figures. Each page gives an easy access to UniProtKB/Swiss-Prot.
The virus variation resource (VVR)	Selection of web interfaces, analysis and visualization tools for virus sequence data.

2. Viral Phylogeny

Phylogenetic trees are conventional graphical representation for viral phylogenies. This faces serious challenges including variation in evolutionary rate, no "fossil records" of viruses, difficulty to find evolutionary relationships between viruses and their hosts. Several methods and software tools exist such as AdaPatch, AntiPatch and AntigenicTree.

RaxML, PhyML	Inference of large phylogenetic trees.
BEAST	A software package for phylogenetic analysis with an emphasis on time-scaled trees.

3. Virus Evolution

Genetic reassortment and recombination can enable viruses to dramatically change their epidemiology and host range. Studying genome evolution is thus integral to understanding viruses and their potential to emerge in novel host species. Virus evolution and host ecology are inseparable. The extremely high mutation rates of some viruses pose particular challenges to sequencing technologies and bioinformatics.

Cir-seq	Links replicated reads of an original molecule through circularization and then rolling circle amplification) can lessen the impact of sequencing error.
BAsESeq	Transpose template-specific barcodes onto virus genomes and reduces error by allotting reads containing identical barcodes to the same read family.

4. Gene Prediction Tools

ORF Finder	Searches for open reading frames in the provided sequence
Prodigal	A protein-coding gene prediction software tool
VIGOR	Annotation program for small viral genomes

5. Read processing tools

Few tools for quality checking of the reads are:

FastQC, PRINSEQ, mulitQC	Checks read sequencing quality
Poretools, nanoOK	Quality checks for nanopore long reads

Tools for raw reads pre-processing are:

Cutadapt, Trimmomatic, BBduk	Quality trimming, artefacts removal on short reads
Nanocorrect, PoreSeq	Non-hybrid error correction for nanopore long reads
Nanocorr, NaS	Hybrid error correction for nanopore long reads

6. Virus Genotyping

Genome annotation is important for locating genes, predicting their functions, and the coding and non-coding regions of a genome. Currently some virus-related tools have been developed for annotation. For example,

GLUE	Open toolkit used for storage and interpretation of sequence data and used to organize viral sequence data, even multiple sequence alignments. It is a resource for data as well analysis and storage platform.
ATHLATES	Finds Human Leukocyte Antigens (HLAs) from Illumina exome sequencing data which enables to determine pathogens like viruses.
PRiSM	Set of algorithms to create primers for the amplification and sequencing of short viral genomes, maintaining the sample population diversity.
Tanoti	Reference based short read aligner guided by BLAST.
RotaC2.0	An automated genotyping tool for Group A rotaviruses.

7. Genome assembly tools

Tools to perform genome assembly of single genomes:

VICUNA	Produces population consensus genome assembly
IVA	Assembler designed for RNA viruses
SPAdes	Generic genome assembler
Canu, Miniasm	Non-hybrid assemblers for nanopore long reads
Unicycler	Hybrid assembly pipeline for nanopore long reads with the use of short reads

Tools to perform genome assembly of metagenomes:

MEGAHIT, metaSPAdes, Ray-meta, IBDA-UD	Assemblers optimized for metagenomics data
crAss	Cross-assembly analysis of multiple metagenomes

8. Read mapping

BWA, Bowtie, BBmap	Align short read sequences to a reference
STAR	Splice-aware aligner for RNA-seq data
GraphMap, LAST	Align long read sequences to a reference

9. Similarity searches

BLAST	A suite of tools to find regions of similarity between DNA and protein sequences
HHpred	Sensitive protein homology detection, function, and structure prediction
HMMER	Homology based search

10. Multiple Sequence Alignment

MAFFT, ClustalW	Multiple sequence alignment for DNA and protein sequences
MUSCLE	Multiple sequence alignment for protein sequences

11. Sequence taxonomic annotation

CAT, Kraken, Centrifuge, Kaiju	Assign taxonomic labels to reads or assembled contigs

12. Taxonomy and classification

GRAViTy	Classification of eukaryotic viruses
vConTACT	Classification of double stranded DNA viruses of bacteria and archaea
VICTOR	Genome based phylogeny and classification of prokaryotic viruses
DEmARC	Classification of viruses based on genetic divergence

13. Transcriptomics

DESeq2, Sleuth	Statistical analysis of RNA-seq data

14. RNA secondary structures

mfold/UNAFold	RNA secondary structure prediction
ViennaRNA package	Suite of tools to perform RNA structures prediction and comparison
LocARNA	Structure-guided multiple sequence alignment of RNA sequences

Conclusion

The future of virus bioinformatics depends on rapid specific bioinformatic software development, establishment of useful virus-specific databases and tools. Bioinformatics opens up a vast range of possibilities for new analyses and interpretations of viruses. While computational predictions always need to be validated by relevant in wet lab experiments. These can be used to estimate the accuracy of diverse bioinformatics tools, providing an important focus for wet laboratory experiments and saving valuable time and resources. Thus, bioinformatics has already become an integral and transformative component of virus research.

References:

1. Ibrahim B, McMahon DP, Hufsky F, Beer M, Deng L, Mercier PL, Palmarini M, Thiel V, Marz M. A new era of virus bioinformatics. Virus Res. 2018 Jun 2;251:86-90. doi: 10.1016/j.virusres.2018.05.009. Epub 2018 May 8. PMID: 29751021.

2. Pappas N, Roux S, Hölzer M, Lamkiewicz K, Mock F, Marz M, Dutilh BE. Virus Bioinformatics. Encyclopedia of Virology. 2021:124–32. doi: 10.1016/B978-0-12-814515-9.00034-5. Epub 2021 Mar 1. PMCID: PMC7567488.

3. Figure 1 source: https://www.mdpi.com/viruses/viruses-11-00374/article_deploy/html/images/viruses-11-00374-g001.png

***Author correspondence: Ms. Rasitha Arafa R, B.Tech., Biotechnology,** School of Life Sciences, B.S.Abdur Rahman Crescent Institute of Science and Technology, Chennai-600048, Tamil Nadu, India. E.Mail: 210151601045@crescent.education

❖ Mini Review

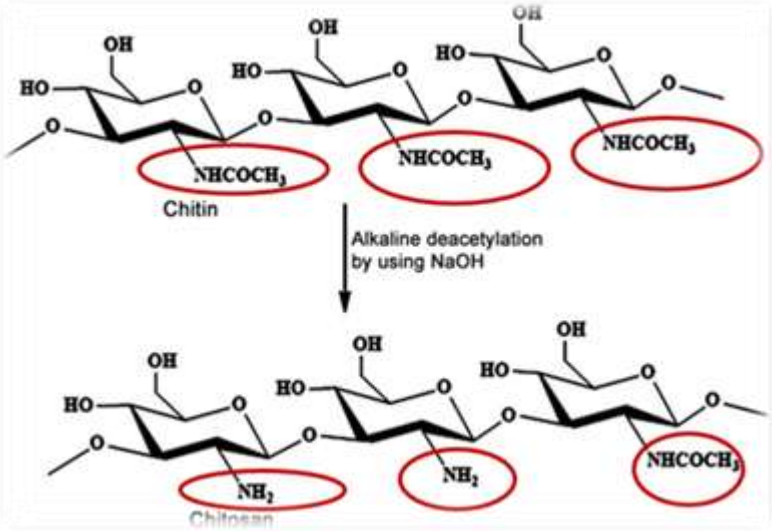
Chitosan as drug delivery molecules

Ayaan Ebrahim Naivasal

B.Tech., Biotechnology, School of Life Sciences, B.S.Abdur Rahman Crescent Institute of Science and Technology, Chennai-600048, Tamil Nadu, India

Abstract

Chitosan is an aminopolysaccharide that is derived from chitin (usually obtained from the exoskeleton of shellfish such as crab, lobster, etc.) by partial deacetylation in an alkaline solution. It consists of 2 monomeric units; N-acetyl-D-glucosamine and β--linked D-glucosamine. Chitosan is a biocompatible and biodegradable molecule and can bind to the outer surface of internal organs thus making it an option for drug delivery systems. Since the start of the millennium, chitosan has been employed in the development of effective drug delivery systems. An example of such a delivery system is *β*-cyclodextrin grafted N-maleoyl chitosan (CD-*g*-NMCS for short). When the drug Ketoprofen, which is less soluble in water, was loaded onto CD-*g*-NMCS, it was found to have a more delayed and consistent secretion than unloaded Ketoprofen (1).



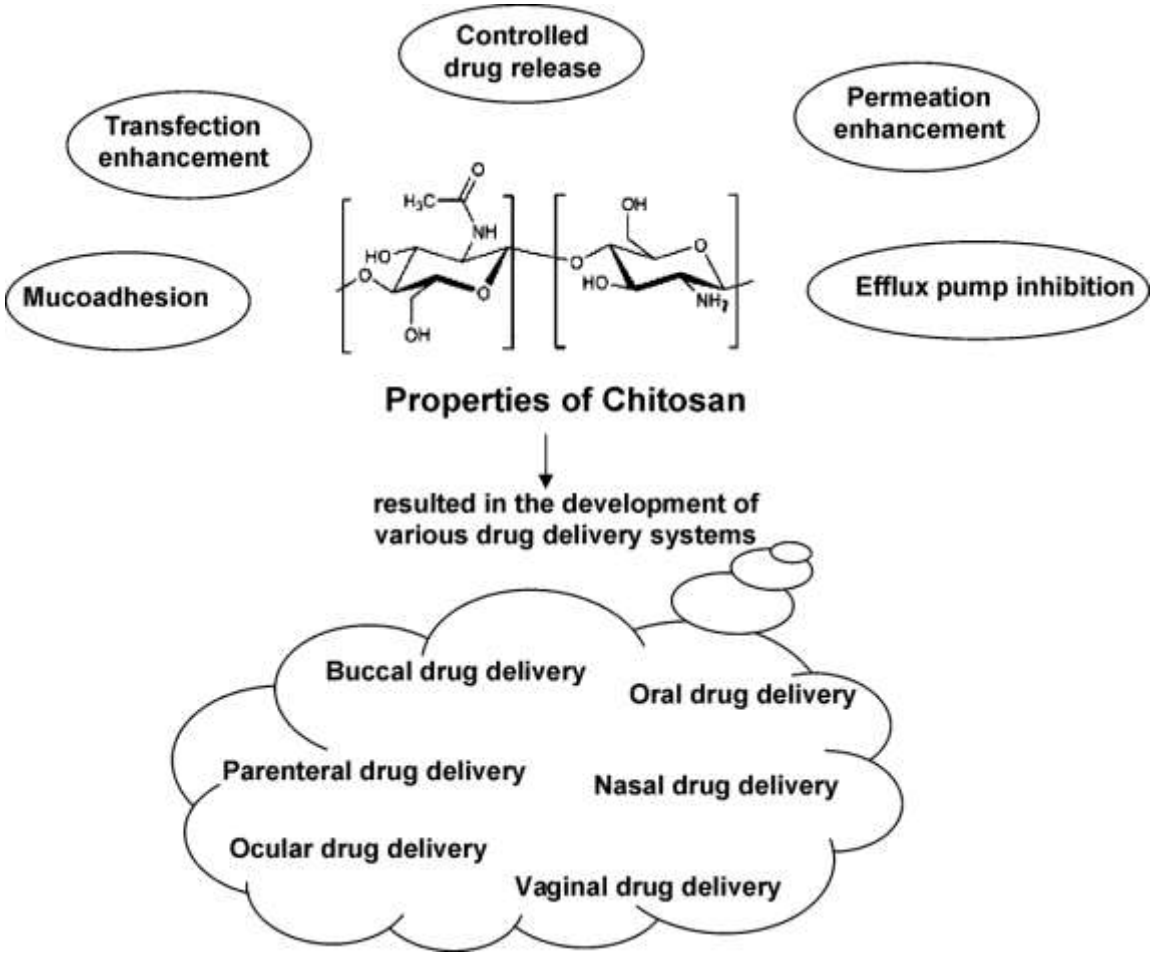
Another drug delivery system was designed for the release of ranitidine hydrochloride. Some of the components needed to create the chitosan superporous gel were N,N'-Methylene-bis-acrylamide, Ammonium Persulfate, Hydroxypropylmethyl cellulose, etc. Ranitidine hydrochloride was loaded onto the gel. The delivery system essentially consisted of two core parts i.e. conveyor system made up of superporous hydrogel composite (SPHC) and a core consisting of a mixture of the drug and the polymer (2). Ranitidine hydrochloride was observed to be continuously released for about 18 hours after initial delivery. Interestingly, the success of this delivery system was greatly dependent upon parameters such as density, concentration, mechanical strength, etc. As the density increased, it was found that the porosity of SPHC with chitosan decreased as chitosan accumulated at the pores. Increasing the chitosan concentration greatly reduced the water absorption capacity of the SPHC but still greater than those of nonporous hydrogels. In the end, the delivery system was found to be effective, stable, with little to no side-effects and a great future potential (3).

Using nanoparticles based on chitosan is another effective method of drug delivery. These nanoparticles are less toxic, more stable, possess site specific drug targeting, etc. Chitosan nanoparticles can load both water-insoluble and water-soluble drugs (4). The shapes of these nanoparticles can occur in the form of nanospheres, nanofibers and nanocapsules. Many methods of synthesizing chitosan nanoparticles are currently available (5). Some of these include cross-linking where covalent bonds are formed between chitosan and a crosslinker (6) such as PEG (7), self-assembly by which chitosan molecules associate with each other or with other molecules through Van der Waals forces, hydrogen bonds, etc. (8), emulsion by which chitosan solution is emulsified in an oil phase by the water in oil emulsion technique (9), precipitation by which chitosan solution is sprayed over an alkali solution using a compressed air nozzle to form coarvecate droplets (6,10), among others. Chitosan nanoparticles can be administered through a variety of routes. Some of these routes include

- Oral delivery- Chitosan nanoparticles prevent the degradation of drugs by enzymes in the gastrointestinal tract, increase the surface contact time between drug and internal surface, increase membrane permeability, etc. (11)
- Nasal delivery- Drugs administered can directly pass through the blood-brain barrier (7). Chitosan particles have a better mucoadhesion than uncoated particles

and a higher penetrating potential (6). Dopamine that needs to be delivered to the brain for the treatment of Parkinson's disease (PD) is encapsulated with chitosan in order to cross the blood-brain barrier.

- Transdermal delivery- Drugs administered can avoid first pass metabolism. Chitosan particles can fluidize the epidermal lipid when they interact with the skin in order to promote drug diffusion. Transdermal delivery systems were often accompanied by the application of microwave radiation (12).
- Vaginal delivery- Drugs administered this way do not experience the acidic environment of the stomach, first pass metabolism, etc. Vaginal delivery drugs mainly focus on the prevention of STDs such as HIV, HPV, etc. Chitosan nanoparticles loaded with a peptide drug were first freeze dried before being administered to the vagina. After coming into contact with the vaginal medium, the outer shell was quickly dissolved allowing the contents to be released (13).



The eye is an isolated organ that is protected by many barriers. Diseases such as age related macular degeneration, diabetic retinopathy, etc. affect the eye causing irreversible damage (18). Due to the presence of natural barriers like blood ocular barrier, conventional routes of administration are not able to deliver appropriate concentrations of drugs to both the anterior as well as the posterior segments (14). Thus, invasive intravitreal injections (IVT) were the main route of administration for the treatment of diseases such as AMD and DR (15). However, these injections can cause some side effects such as cataracts, vitreous hemorrhage, etc. (16), as well as increased costs along with an increase in potential life threatening systemic effects (17). Thus, topical drug delivery systems for the posterior segment of the eye were heavily researched (19). Among them, chitosan had been found to have the most potential as an effective topical drug delivery system for the posterior eye segment (20).

Chitosan has a good mucoadhesion ability (21) as well as enhancing permeation (22). Mucoadhesion is a type of bioadhesion wherein two surfaces attach to each other via attractive forces where one surface is mucosal (23). Polymers such as chitosan play an important role in determining the strength of the mucoadhesive joint pertaining to the mucosal surface (24). Chitosan being structurally similar to glycosaminoglycans is highly biodegradable essential for ocular drug delivery systems. Their dual function in prolonging drug contact time at the surface as well as enhancing permeation to create pathways to be followed by drugs makes them a lucrative option in ophthalmic drug delivery. Emulsions consisting of two or more immiscible liquids have several benefits such as controlled drug release, protecting labile drugs, presence of surfactants, etc. which makes them suitable for ophthalmic drug delivery (25). Chitosan coated emulsions loaded with the drug Coumarin-6 was supplied for the retinal drug delivery in mice in order to research for possible posterior eye segment administration via the use of eye drops. Surface modifications of liquid chitosan emulsions had a profound effect on the electrostatic interaction between the system and the eye thereby promoting drug delivery to the posterior segment (26).

Liposomes are biological systems that contain an aqueous core that's surrounded by a phospholipid bilayer with a particle size of 10nm-1µm (27). In addition to being biocompatible and biodegradable, liposomes enable the incorporation of hydrophilic drugs (dissolved in aqueous core) as well as lipophilic drugs (solubilized in

phospholipid bilayer) (28). Chitosan coated liposomes were developed for the topical delivery of TA (Triamcinolone Acetonide) into the posterior eye segment. These liposomes were first prepared via thin hydration method before being coated with 0.1-0.3% chitosan solution so that the surface of the liposome becomes positively charged which is then able to interact with the negatively charged mucin surface thereby imparting mucoadhesiveness (29). This resulted in an increase in particle size as well as a shift in zeta potential from negative to positive. The CCLs had higher encapsulation efficiency values as well as higher colloidal stability when compared to uncoated liposomes (30).

Micelles are colloidal carriers with a size between 10-200nm by self-aggregation of amphiphilic molecules. A micelle consists of a hydrophobic tail and a hydrophilic head (31). Chitosan oligosaccharide with a molecular weight less than 10000 Da was known to increase drug retention period at the surface due to interactions between the positively charged chitosan and the negatively charged sialic acid present in mucins. Nanomicelles were developed for the topical administration of the drug Dexamethasone to the posterior segment (32). Chitosan oligosaccharide-valylvaline-steric acid (CVS) nanomicelles were produced to deliver the drug for the treatment of macula edema. The DEX loaded CVS nanomicelle permeated through the posterior segment primarily through the conjunctival route due to its large surface allowing the nanomicelles to diffuse efficiently. In vitro studies showed that DEX was found on the tears of the subject for up to 6 hours (33).

Lipid nanoparticles are a type of drug delivery system which are divided into three categories; Nanostructured lipid carriers (NLCs), solid lipid nanoparticles (SLNPs) and hybrid lipid nanoparticles (34). One method for drug delivery to the posterior eye segment included coating chitosan on SLNPs to be delivered in order to signify the role of mucoadhesion. The SLNPs were loaded with indomethacin which were then coated with chitosan of molecular weight less than 200 KDa. The surface coating was confirmed due to a shift in zeta potential. The efficiency of chitosan coated SLNPs was then evaluated in studies using Male New Zealand White Albino Rabbits. Results indicated the presence of high levels of indomethacin in the deep eye tissues such as RPE choroid. The effect of chitosan in increasing indomethacin levels was correlated to the extensive mucoadhesive properties of chitosan by the authors. The high delivery

potential was also attributed to the fact that chitosan tends to create a sharp reduction in the trans epithelial electrical resistance (TEER) and it's promotion of model macromolecules permeability (35).

References

1. Xinyu Hou, Wenjuan Zhang, Muye He, Yiben Lu, Kaiyan Lou, and Feng Gao Preparation and characterization of β-cyclodextrin grafted N-maleoyl chitosan nanoparticles for drug delivery. Asian J Pharm Sci. 2017 Nov; 12(6): 558–568. [PubMed]
2. Dorkoosh FA, Verhoef JC, Borchard G, Rafiee-Tehrani M, Verheijden JH, Junginger HE. Intestinal absorption of human insulin in pigs using delivery systems based on superporous hydrogel polymers. *Int J Pharm.* 2002;247:47–55. [PubMed] [Google Scholar]
3. Hitesh Chavda and Chhaganbhai Patel Chitosan superporous hydrogel composite-based floating drug delivery system: A newer formulation approach. J Pharm Bioallied Sci. 2010 Apr-Jun; 2(2): 124–131. [PubMed]
4. Ali A., Ahmed S. A review on chitosan and its nanocomposites in drug delivery. *Int. J. Biol. Macromol.* 2018;109:273–286. [PubMed]
5. Shoueir K.R., El-Desouky N., Rashad M.M., Ahmed M.K., Janowska I., El-Kemary M. Chitosan based-nanoparticles and nanocapsules: Overview, physicochemical features, applications of a nanofibrous scaffold, and bioprinting. *Int. J. Biol. Macromol.* 2021;167:1176–1197.[PubMed]
6. Garg U., Chauhan S., Nagaich U., Jain N. Current advances in chitosan nanoparticles based drug delivery and targeting. *Adv. Pharm. Bull.* 2019;9:195–204.[PubMed]
7. Li J., Cai C., Li J., Li J., Li J., Sun T., Wang L., Wu H., Yu G. Chitosan-Based nanomaterials for drug delivery. *Molecules.* 2018;23:2661.[PubMed]
8. Quinones J.P., Peniche H., Peniche C. Chitosan based self-assembled nanoparticles in drug delivery. *Polymers.* 2018:235.[PubMed]
9. Luesakul U., Puthong S., Sansanaphongpricha K., Muangsin N. Quaternizedchitosan-Coated nanoemulsions: A novel platform for improving the stability, anti-inflammatory, anti-cancer and transdermal properties of Plai extract. *Carbohydr. Polym.* 2020;230:115625.[PubMed]

10. Hassani A., Hussain S.A., Abdullah N., Kmaruddin S. Review on micro-encapsulation with Chitosan for pharmaceutical applications. *MOJ Curr. Res. Rev.* 2018;1:77–84.[CrossRef] [Google Scholar]
11. Lang X., Wang T., Sun M., Chen X., Liu Y. Advances and applications of chitosan-based nanomaterials as oral delivery carriers. *Int. J. Biol. Macromol.* 2020;154:433–445.[PubMed]
12. Nawaz A., Wong T.W. Microwave as skin permeation enhancer for transdermal drug delivery of chitosan-5-fluorouracil nanoparticles. *Carbohydr. Polym.* 2017;157:906–919.[PubMed]
13. Marciello M., Rossi S., Caramella C., Remunán-López C. Freeze-Dried cylinders carrying chitosan nanoparticles for vaginal peptide delivery. *Carbohydr. Polym.* 2017;170:43–51.[PubMed]
14. Urtti A. Challenges and obstacles of ocular pharmacokinetics and drug delivery. *Adv. Drug Deliv. Rev.* 2006;58:1131–1135.[PubMed]
15. Varela-Fernández R., Díaz-Tomé V., Luaces-Rodríguez A., Conde-Penedo A., García-Otero X., Luzardo-Álvarez A., Fernández-Ferreiro A., Otero-Espinar F.J. Drug Delivery to the Posterior Segment of the Eye: Biopharmaceutic and Pharmacokinetic Considerations. *Pharmaceutics.* 2020;12:269.[PubMed]
16. Kaji H., Nagai N., Nishizawa M., Abe T. Drug delivery devices for retinal diseases. *Adv. Drug Deliv. Rev.* 2018;128:148–157.[PubMed]
17. Costagliola C., Agnifili L., Arcidiacono B., Duse S., Fasanella V., Mastropasqua R., Verolino M., Semeraro F. Systemic thromboembolic adverse events in patients treated with intravitreal anti-VEGF drugs for neovascular age-related macular degeneration. *Expert Opin. Biol. Ther.* 2012;12:1299–1313.[PubMed]
18. Burton M.J., Ramke J., Marques A.P., Bourne R.R.A., Congdon N., Jones I., Ah Tong B.A.M., Arunga S., Bachani D., Bascaran C., et al. The Lancet Global Health Commission on Global Eye Health: Vision beyond 2020. *Lancet Glob. Health.* 2021;9:e489–e551.[PubMed]
19. Thareja A., Hughes H., Alvarez-Lorenzo C., Hakkarainen J.J., Ahmed Z. Penetration Enhancers for Topical Drug Delivery to the Ocular Posterior Segment—A Systematic Review. *Pharmaceutics.* 2021;13:276.[PubMed]
20. Kumar A., Vimal A., Kumar A. Why Chitosan? From properties to perspective of mucosal drug delivery. *Int. J. Biol. Macromol.* 2016;91:615–622.[PubMed]

21. M Ways T.M., Lau W.M., Khutoryanskiy V.V. Chitosan and Its Derivatives for Application in Mucoadhesive Drug Delivery Systems. *Polymers.* 2018;10:267. [PubMed]
22. Bernkop-Schnürch A., Dünnhaupt S. Chitosan-based drug delivery systems. *Eur. J. Pharm. Biopharm.* 2012;81:463–469.[PubMed]
23. Smart J.D. The basics and underlying mechanisms of mucoadhesion. *Adv. Drug Deliv. Rev.* 2005;57:1556–1568.[PubMed]
24. Benediktsdóttir B.E., Baldursson Ó., Másson M. Challenges in evaluation of chitosan and trimethylated chitosan (TMC) as mucosal permeation enhancers: From synthesis to in vitro application. *J. Control. Release.* 2014;173:18–31.[PubMed]
25. Peng C.C., Bengani L.C., Jung H.J., Leclerc J., Gupta C., Chauhan A. Emulsions and microemulsions for ocular drug delivery. *J. Drug Deliv. Sci. Technol.* 2011;21:111–121.[CrossRef] [Google Scholar]
26. Ying L., Tahara K., Takeuchi H. Drug delivery to the ocular posterior segment using lipid emulsion via eye drop administration: Effect of emulsion formulations and surface modification. *Int. J. Pharm.* 2013;453:329–335.[PubMed]
27. Agarwal R., Iezhitsa I., Agarwal P., Abdul Nasir N.A., Razali N., Alyautdin R., Ismail N.M. Liposomes in topical ophthalmic drug delivery: An update. *Drug Deliv.* 2016;23:1075–1091.[PubMed]
28. Daraee H., Etemadi A., Kouhi M., Alimirzalu S., Akbarzadeh A. Application of liposomes in medicine and drug delivery. *Artif. Cells Nanomed. Biotechnol.* 2016;44:381–391.[PubMed]
29. Khalil M., Hashmi U., Riaz R., Rukh Abbas S. Chitosan coated liposomes (CCL) containing triamcinolone acetonide for sustained delivery: A potential topical treatment for posterior segment diseases. *Int. J. Biol. Macromol.* 2020;143:483–491.[PubMed]
30. Li J., Cheng T., Tian Q., Cheng Y., Zhao L., Zhang X., Qu Y. A more efficient ocular delivery system of triamcinolone acetonide as eye drop to the posterior segment of the eye. *Drug Deliv.* 2019;26:188–198.[PubMed]
31. Owen S.C., Chan D.P., Shoichet M.S. Polymeric micelle stability. *Nano Today.* 2012;7:53–65.[CrossRef] [Google Scholar]

32. Xu X., Sun L., Zhou L., Cheng Y., Cao F. Functional chitosan oligosaccharide nanomicelles for topical ocular drug delivery of dexamethasone. *Carbohydr. Polym.* 2020;227:115356.[PubMed]
33. Gukasyan H.J., Hailu S., Karami T.K., Graham R. Ocular biopharmaceutics: Impact of modeling and simulation on topical ophthalmic formulation development. *Drug Discov. Today.* 2019;24:1587–1597.[PubMed]
34. Wang Y., Xu X., Gu Y., Cheng Y., Cao F. Recent advance of nanoparticle-based topical drug delivery to the posterior segment of the eye. *Expert Opin. Drug Deliv.* 2018;15.[PubMed]
35. Balguri S.P., Adelli G.R., Majumdar S. Topical ophthalmic lipid nanoparticle formulations (SLN, NLC) of indomethacin for delivery to the posterior segment ocular tissues. *Eur. J. Pharm. Biopharm.* 2016;109:224–235.[PubMed]

***Author correspondence: Mr. Ayaan Ebrahim Naivasal, B.Tech., Biotechnology,** School of Life Sciences, B.S.Abdur Rahman Crescent Institute of Science and Technology, Chennai-600048, Tamil Nadu, India. E.Mail: ayaanebrahim.biotech_2019@crescent.education

❖ Scientific Tips

Nobel Laureates in Science and Technology 2022

Moharam Sabira A

B.Tech. Biotechnology, School of Life Sciences, B.S.Abdur Rahman Crescent Institute of Science and Technology, Chennai-600048, Tamil Nadu, India

In brief, this scientific tips helps to know the biography and contributions of Nobel laureates in science and Technology obtained in the year 2022

Alain Aspect

The Nobel Prize in Physics 2022
Born: 15 June 1947, Agen, France
Affiliation at the time of the award: Institut d'Optique Graduate School – Université
Paris-Saclay, Paris, France; École Polytechnique, Palaiseau, France

Prize motivation: "for experiments with entangled photons, establishing the violation of Bell inequalities and pioneering quantum information science"

One of the most remarkable traits of quantum mechanics is that it allows two or more particles to exist in what is called an entangled state. What happens to one of the particles in an entangled pair determines what happens to the other particle, even if they are far apart. In 1981–1982, Alain Aspect conducted groundbreaking experiments using entangled light particles, photons. These and other experiments confirm that quantum mechanics is correct and pave the way for quantum computers, quantum networks and quantum encrypted communication.

John Clauser

The Nobel Prize in Physics 2022
Born: 1 December 1942, Pasadena, CA, USA
Affiliation at the time of the award: J.F. Clauser & Assoc., Walnut Creek, CA, USA
Prize motivation: “for experiments with entangled photons, establishing the violation of Bell inequalities and pioneering quantum information science”
One of the most remarkable traits of quantum mechanics is that it allows two or more particles to exist in what is called an entangled state. What happens to one of the particles in an entangled pair determines what happens to the other particle, even if they are far apart. In 1972, John Clauser conducted groundbreaking experiments using entangled light particles, photons. This and other experiments confirm that quantum mechanics is correct and pave the way for quantum computers, quantum networks and quantum encrypted communication.

Anton Zeilinger

The Nobel Prize in Physics 2022
Born: 20 May 1945, Ried im Innkreis, Austria
Affiliation at the time of the award: University of Vienna, Vienna, Austria; Institute for Quantum Optics and Quantum Information, Austrian Academy of
Sciences, Vienna, Austria
Prize motivation: “for experiments with entangled photons, establishing the violation of Bell inequalities and pioneering quantum information science”
One of the most remarkable traits of quantum mechanics is that it allows two or more particles to exist in what is called an entangled state. What happens to one of the particles in an entangled pair determines what happens to the other particle, even if they are far apart. In 1997– 1998, Anton Zeilinger conducted groundbreaking experiments using entangled light particles, photons. These and other experiments confirm that quantum mechanics is correct and pave the way for quantum computers, quantum networks and quantum encrypted communication.

Carolyn R. Bertozzi

The Nobel Prize in Chemistry 2022
Born: 10 October 1966, Boston, MA, USA
Affiliation at the time of the award: Stanford University, Stanford, CA, USA; Howard Hughes Medical Institute, USA
Prize motivation: "for the development of click chemistry and bio-orthogonal chemistry"

Chemists strive to build increasingly complicated molecules. For a long time, this has been very time consuming and expensive. Click chemistry means that molecular building blocks snap together quickly and efficiently. Around 2000, Carolyn Bertozzi started utilising click chemistry in living organisms. She developed bioorthogonal reactions which take place inside living organisms without disrupting the normal chemistry of the cell. These reactions are now used to explore cells, track biological processes, and improve the targeting of cancer pharmaceuticals.

Morten Meldal

The Nobel Prize in Chemistry 2022
Born: 1954,
Copenhagen, Denmark
Affiliation at the time of the award: University of Copenhagen, Copenhagen, Denmark
Prize motivation: "for the development of click chemistry and bioorthogonal chemistry"

Chemists strive to build increasingly complicated molecules. For a long time, this has been very time consuming and expensive. Click chemistry means that molecular building blocks snap together quickly and efficiently. In 2002, Morten Meldal and Barry Sharpless, independently of each other, developed an elegant and efficient chemical reaction: the copper catalysed azide-alkyne cycloaddition. This is now in widespread use and is utilised in the development of pharmaceuticals, for mapping DNA and creating new materials.

K. Barry Sharpless

The Nobel Prize in Chemistry 2022

Born: 28 April 1941,

Philadelphia, PA, USA

Affiliation at the time of the award: Scripps Research, La Jolla, CA, USA

Prize motivation: "for the development of click chemistry and bioorthogonal chemistry"

Chemists strive to build increasingly complicated molecules. For a long time, this has been very time consuming and expensive. Barry Sharpless coined the concept of click chemistry, where molecular building blocks snap together quickly and efficiently. In 2002, Sharpless and Morten Meldal, independently of each other, developed an elegant and efficient chemical reaction: the copper catalysed azide-alkyne cycloaddition. This is now in widespread use and is utilised in the development of pharmaceuticals, for mapping DNA and creating new materials.

Svante Pääbo

The Nobel Prize in Physiology or Medicine 2022

Born: 20 April 1955, Stockholm, Sweden

Affiliation at the time of the award: Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany; Okinawa Institute of Science and Technology, Okinawa, Japan

Prize motivation: "for his discoveries concerning the genomes of extinct hominins and human evolution"

Where do we humans come from, and how are we related to extinct hominins? In 2010, Svante Pääbo succeeded in sequencing the genome of the Neanderthal. He also discovered a previously unknown hominin, Denisova. He also found that gene transfer had occurred from these now extinct hominins to Homo sapiens following the migration out of Africa around 70,000 years ago. This ancient flow of genes to present-day humans has physiological relevance today, for example affecting how our immune system reacts to infections.

***Author correspondence: Ms. A. Moharam Sabira, B.Tech. Biotechnology**, School of Life Sciences, B.S.Abdur Rahman Crescent Institute of Science and Technology, Chennai-600048, Tamil Nadu, India. E.Mail: 210151601038@crescent.education

❖ INSTRUCTIONS TO AUTHORS:

SLS newsletter, a biannual publication by the School of life science intends to enlighten the readers with research articles, reviews, reports, research highlights, news and facts, concerned to the advancing field of biotechnology.

In order to acknowledge recent advancements and potential knowledge, bringing it to the notice of the science community through the newsletter, SLS welcomes original research, review and reports and details of the forthcoming events (conferences, seminars, symposia, trainings and workshops.)

❖ GUIDELINES FOR SUBMISSION:

✓ The article submitted must be an own write up on the selected article.

✓ References: The research paper referred must be assessed from renowned publishers (science, nature etc.,) and the references must be mentioned in the article.

✓ No Plagiarism will be entertained.

✓ The article should be typed in double space in word format limited to > 1000 words with font “Cambria” and font size 12 with 1.5 line spacing.

✓ Illustration and tables: Illustrations must be reduced to one – third of the page. Typed tables should be provided with tittles. Authors are specially requested to reduce the number of tables, illustrations and diagrams to a minimum (maximum 2).

✓ The SLS newsletter assumes no responsibility for statements and opinions advanced by the contributors to the journal.

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