S. N. COLLEGE OF PHARMACY

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PHARMA SPECTRUM

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S.N. COLLEGE OF PHARMACY

PHARMA SPECTRUM • Inaugural Issue • College Magazine

MESSAGE

Mr. Santosh Agrahari

Director (Administration)

It gives me immense pleasure to greet the students, faculty members and well-wishers of S. N. College of Pharmacy on the launch of our very own magazine, Pharma Spectrum. An institution is remembered not only for the degrees it awards, but for the voice it gives to the young minds it shapes. With this magazine, that voice now finds a permanent place in print.

The management of this institution has always believed that a pharmacy college must be more than classrooms and laboratories. It must be a place where curiosity is respected, where effort is recognised, and where every student is encouraged to think beyond the syllabus. Pharma Spectrum is a natural extension of that belief — a platform where our students can write, question, illustrate and share, and in doing so, discover abilities they did not know they possessed.

I extend my sincere appreciation to the Principal, the Directors, the editorial board and the faculty coordinators whose dedication has turned an idea into a publication. To our students, I would say this: fill these pages with honesty and imagination. Write about the science you love, the people who inspire you and the profession you are about to enter.

I wish Pharma Spectrum a long, distinguished and ever-widening journey, and assure the editorial team of the management's continued support in every issue to come.

With warm regards,

Mr. Santosh Agrahari

Director (Administration)

S. N. College of Pharmacy

S.N. COLLEGE OF PHARMACY

PHARMA SPECTRUM • Inaugural Issue • College Magazine

MESSAGE

Dr. Anoop Kumar Singh

DIRECTOR – RESEARCH

The launch of Pharma Spectrum marks a significant milestone in the academic life of S. N. College of Pharmacy. Research does not begin in a laboratory; it begins with a question, and it becomes meaningful only when it is communicated. A magazine such as this teaches our students the second half of that lesson — the discipline of expressing an idea clearly enough for someone else to understand it.

Pharmaceutical sciences today move at a remarkable pace. Novel drug delivery systems, computational drug design, biosimilars, pharmacovigilance, regulatory science and artificial intelligence in healthcare are reshaping what our graduates will do in their working lives. I hope Pharma Spectrum becomes the space where our students track these developments, review the literature that excites them, and present their own project findings, review articles and case studies with confidence.

To every contributor I offer one piece of advice: cite carefully, write honestly, and never be afraid of a simple sentence. Scientific writing is not about complicated language — it is about clarity, evidence and integrity. The habit you form while writing for this magazine is the same habit that will one day serve you in a peer-reviewed journal.

My congratulations to the editorial team on this fine initiative. May Pharma Spectrum kindle a lasting scientific temper in our students and grow, issue by issue, into a publication our institution is proud to be known by.

With warm regards,

Dr. Anoop Kumar Singh
Director – Research
S. N. College of Pharmacy

S.N. COLLEGE OF PHARMACY

PHARMA SPECTRUM • Inaugural Issue • College Magazine

MESSAGE

Dr. Raj Kumar Agrahari

DIRECTOR – ACADEMIC

I am delighted to congratulate the entire fraternity of S. N. College of Pharmacy on the inaugural issue of Pharma Spectrum. A college magazine is one of the truest mirrors of an institution's academic health, because it reflects not what is taught, but what has actually been absorbed, reflected upon and expressed by its students.

Our academic endeavour has always been to develop the complete pharmacy professional — sound in theory, skilled in practice and articulate in communication. Examinations assess the first two. It is initiatives like this magazine that nurture the third. Whether a student writes a technical article, a report on an industrial visit, a book review, a poem or simply designs a page, he or she is learning to organise thought and present it with care. These are the very skills that later distinguish a good professional from a merely qualified one.

I therefore encourage every student — from the first year to the final — to participate actively. Do not wait to become an expert before you write; you will become one partly by writing. I also record my gratitude to the faculty coordinators and student editors who have given their time so generously to bring this issue together.

May Pharma Spectrum continue to celebrate academic excellence, creativity and the collective spirit of our college for many years to come.

With warm regards,

Dr. Raj Kumar Agrahari

Director – Academic

S. N. College of Pharmacy

S.N. COLLEGE OF PHARMACY

PHARMA SPECTRUM • Inaugural Issue • College Magazine

MESSAGE

Dr. Swarup J. Chatterjee

PRINCIPAL

It is a moment of great pride for me to present the inaugural issue of Pharma Spectrum, the official magazine of S. N. College of Pharmacy. Every institution reaches a stage where it wishes to speak in its own words — about its work, its people and its aspirations. With this publication, our college has reached that stage.

The pharmacist stands at the very centre of modern healthcare: a custodian of drug safety, a bridge between the physician and the patient, and an innovator in the discovery and delivery of medicines. Preparing students for such a responsibility calls for more than academic instruction. It calls for a culture — of reading, questioning, collaborating and expressing. Pharma Spectrum has been conceived to strengthen exactly that culture, and I am confident it will become one of the most cherished traditions of this campus.

I place on record my sincere thanks to the management for its constant encouragement, to the Directors for their guidance, and to the faculty coordinators, editorial board and student contributors whose enthusiasm and long hours have made this issue possible. Its pages carry the work of many hands, and that is precisely its strength.

To our students I say: this magazine belongs to you. Read it, write for it, argue with it, and make it better with every issue. I wish Pharma Spectrum a bright and enduring future, and every reader a rewarding time with these pages.

With warm regards,

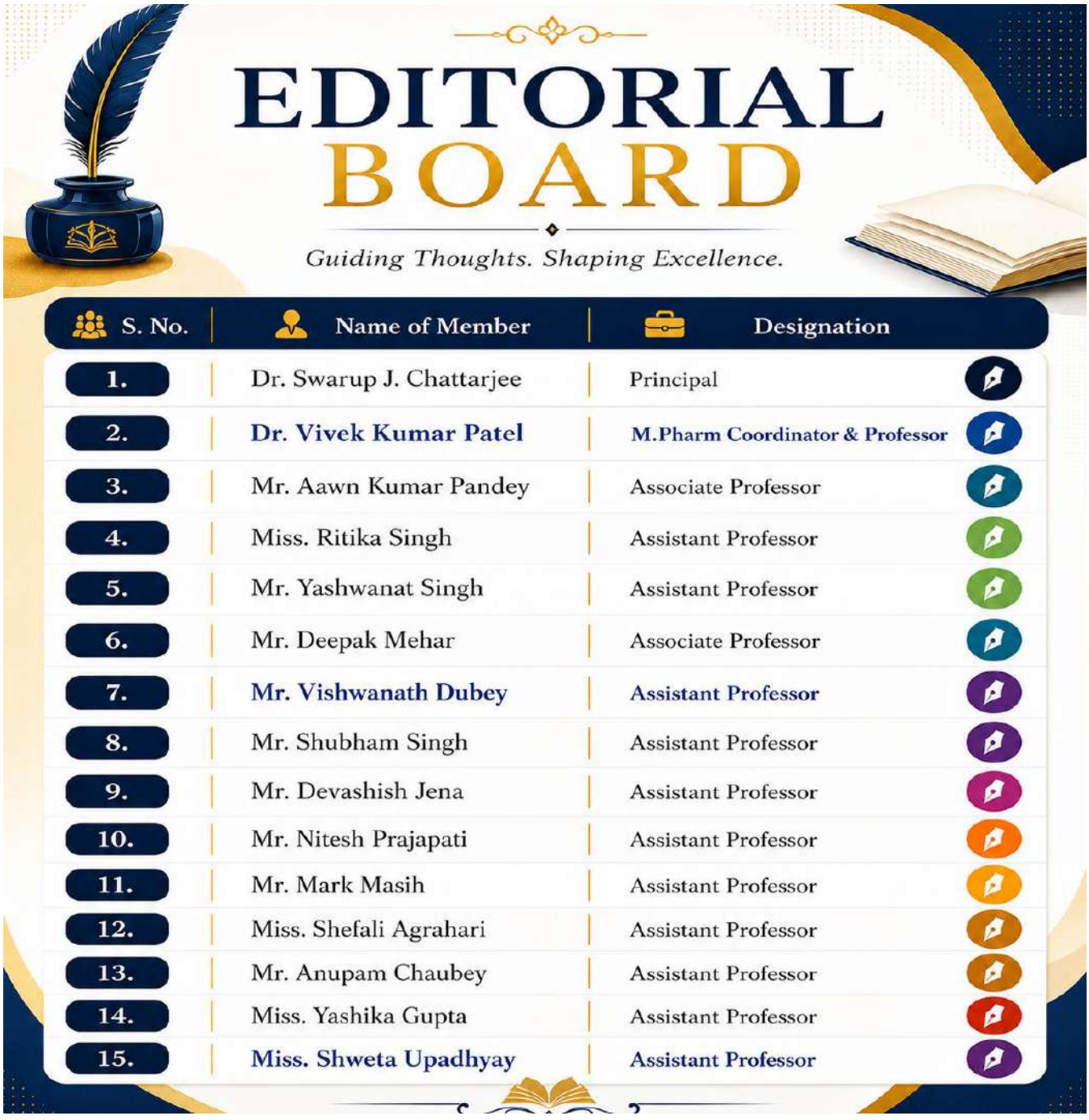
Dr. Swarup J. Chatterjee

Principal, S. N. College of Pharmacy

PHARMA SPECTRUM

A Biannual Magazine of Pharmaceutical Sciences

Volume 1 • Issue 1 • [August, 2026] • For Academic & Educational Circulation



S. No.	Name of Member	Designation
1.	Dr. Swarup J. Chattarjee	Principal
2.	Dr. Vivek Kumar Patel	M.Pharm Coordinator & Professor
3.	Mr. Aawn Kumar Pandey	Associate Professor
4.	Miss. Ritika Singh	Assistant Professor
5.	Mr. Yashwanat Singh	Assistant Professor
6.	Mr. Deepak Mehar	Associate Professor
7.	Mr. Vishwanath Dubey	Assistant Professor
8.	Mr. Shubham Singh	Assistant Professor
9.	Mr. Devashish Jena	Assistant Professor
10.	Mr. Nitesh Prajapati	Assistant Professor
11.	Mr. Mark Masih	Assistant Professor
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13.	Mr. Anupam Chaubey	Assistant Professor
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IN THIS ISSUE

For Academic & Educational Circulation

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ABOUT THIS MAGAZINE

Aims & Scope

What PHARMA SPECTRUM is for, and how this issue is arranged.

‘PHARMA SPECTRUM’ is a biannual magazine of pharmaceutical sciences, written for students, researchers and educators alike. It sets out to capture the pace at which the discipline is being reinvented — from molecules designed on a screen before they are ever synthesised, to nanoparticles that ferry a drug across barriers once thought impassable.

The editorial policy of this issue has been to balance the technical with the human. Feature articles on drug delivery, artificial intelligence and antimicrobial resistance sit alongside short pieces on green manufacturing and drug safety, a corner of poetry, and a set of curious facts meant to remind us why we fell in love with this science in the first place.

Each article carries its own numbered references so that curious readers can trace ideas to their sources and dig deeper.

HOW THIS ISSUE IS ARRANGED

01 · Features — Six long reads on the technologies reshaping how medicines are designed, delivered and defended.

02 · In Focus — Closer studies of delivery, personalisation and pharmaceutical quality — where the engineering meets the patient.

03 · Short Takes — Seven brief dispatches, each readable in a few minutes.

04 · History Corner — Two backward glances at a molecule and at a profession.

05 · The Lighter Side — Curiosities, verse, two quizzes, a glossary and an index.

EDITORIAL CONVENTIONS

- **Square brackets mark placeholders for the editorial team to complete before the issue goes to press.**
- **Reference lists are representative starting points; authors should verify year, volume and DOI against the original sources.**
- **Tables are numbered continuously across the issue.**
- **Terms set in the Mini-Glossary are indexed on the closing pages.**

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FROM THE EDITOR'S DESK

Editorial

Pharmacy has always lived at the crossroads of chemistry, biology and human care.

Pharmacy has always lived at the crossroads of chemistry, biology, and human care. In an age where a molecule can be designed on a computer screen before it is ever synthesized in a flask, and where a nanoparticle can ferry a drug across barriers once thought impassable, the discipline is being reinvented at a remarkable pace. This inaugural issue of PHARMA SPECTRUME is our attempt to capture that momentum — to bring together the ideas, discoveries, and reflections that define contemporary pharmaceutical science.

Within these pages you will find feature articles on smart drug-delivery systems and the rising role of artificial intelligence, alongside a sober look at antimicrobial resistance, arguably the defining public-health challenge of our generation. We have deliberately balanced the technical with the human: short pieces on green manufacturing and drug safety sit beside a corner of poetry and a set of curious facts meant to remind us why we fell in love with this science in the first place.

This magazine is written for students, researchers, and educators alike. Each article carries its own numbered references so that curious readers can trace ideas to their sources and dig deeper. We warmly invite contributions — articles, reviews, artwork, and verse — for future issues.

—Dr.Swarup J. Chatterjee,

Editor-in-Chief, PHARMA SPECTRUM

WHAT YOU WILL FIND INSIDE

- **Twenty-one articles across five sections**
- **Four data tables and a mini-glossary**
- **Eighteen "Did You Know?" curiosities**
- **Five original poems in the Poetry Corner**
- **Two quizzes, with answers**
- **Numbered references for every article**

FEATURE

Nanostructured Lipid Carriers: The Next Frontier in Drug Delivery

A deliberately imperfect crystal, a drop of oil, and a route to the brain that goes around the body's tightest border.

By Dr.Swarup J. Chatterjee

For decades, formulation scientists have wrestled with a stubborn paradox: many of the most promising drug molecules are also the most difficult to deliver. They may be poorly soluble in water, chemically fragile, rapidly metabolized, or simply unable to reach the tissue where they are needed. Nanostructured lipid carriers, or NLCs, represent one of the most elegant solutions to emerge from the field of nanomedicine — a lipid-based delivery platform that combines the safety of natural fats with the precision of nanotechnology.

From solid lipids to smarter carriers

NLCs are the second generation of lipid nanoparticles, evolving directly from solid lipid nanoparticles (SLNs). An SLN is essentially a nanoscale droplet of solid fat that traps a drug within its crystalline matrix. While clever, SLNs suffered from a practical weakness: as the lipid crystallized into an orderly lattice during storage, it squeezed the drug out, causing leakage and limited loading capacity. NLCs solved this by deliberately blending a solid lipid with a small proportion of liquid lipid (oil). The resulting matrix is imperfect and disordered — and that imperfection is precisely the point. The irregular structure creates more room to accommodate drug molecules, boosting loading capacity and preventing the drug from being expelled over time.

The matrix is imperfect and disordered — and that imperfection is precisely the point.

Why formulators love them

The appeal of NLCs lies in a rare combination of advantages. They are typically made from physiologically tolerated lipids, which lowers toxicity concerns. They can be produced by scalable techniques such as high-pressure homogenization, making industrial manufacture feasible. They protect sensitive drugs from light, oxygen, and moisture, and they can be engineered to release their payload slowly and predictably. Perhaps most importantly, their nanoscale

size allows them to cross biological barriers and to be administered through routes as diverse as oral, topical, ocular, pulmonary, and intranasal.

A tool for the hard-to-reach brain

One of the most exciting applications is in delivering drugs to the central nervous system. The blood–brain barrier famously excludes the vast majority of therapeutic molecules. When NLCs are administered through the nose, however, they can exploit the olfactory and trigeminal pathways to reach the brain more directly, partly bypassing this barrier and reducing systemic exposure. This nose-to-brain strategy is being actively explored for antipsychotics, antidepressants, and drugs for neurodegenerative disease, offering hope of faster onset and fewer side effects.

Challenges that remain

NLCs are not a panacea. Physical stability during long-term storage, potential gelation, the risk of burst release, and the need for robust, reproducible manufacturing all demand careful attention. Regulatory frameworks for nanomedicines continue to mature, and thorough characterization — particle size, zeta potential, entrapment efficiency, and release kinetics — is essential before a formulation can advance. Yet the trajectory is unmistakable: as our ability to engineer matter at the nanoscale grows, lipid nanocarriers are moving steadily from the laboratory bench toward the clinic.

Table 1. SLNs versus NLCs at a glance

Attribute	Solid Lipid Nanoparticles (SLN)	Nanostructured Lipid Carriers (NLC)
Lipid phase	Solid lipid only	Solid lipid + liquid lipid (oil)
Matrix structure	Highly ordered, crystalline	Imperfect, disordered
Drug loading	Limited	Higher
Drug expulsion on storage	Common	Minimized
Generation	First	Second

A disordered lipid matrix gives NLCs their edge — more space for drug, less leakage over time.

References

1. Müller RH, Mäder K, Gohla S. Solid lipid nanoparticles (SLN) for controlled drug delivery — a review of the state of the art. European Journal of Pharmaceutics and Biopharmaceutics.

2. Beloqui A, Solinís MA, Rodríguez-Gascón A, et al. Nanostructured lipid carriers: promising drug delivery systems for future clinics. Nanomedicine: Nanotechnology, Biology and Medicine.

3. Khan S, Baboota S, Ali J, et al. Nanostructured lipid carriers: an emerging platform for improving oral bioavailability of lipophilic drugs. International Journal of Pharmaceutical Investigation.

4. Tapeinos C, Battaglini M, Ciofani G. Advances in the design of solid lipid nanoparticles and nanostructured lipid carriers for targeting brain diseases. Journal of Controlled Release.

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FEATURE

Artificial Intelligence in Drug Discovery

Machine learning has stopped being a promise and started being an instrument — but the chemistry still has to be true.

By Dr. **Vivek Kumar Patel, Professor**

Bringing a single new drug to market has long been an exercise in patience and expense — often more than a decade of work and enormous cost, with the great majority of candidates failing along the way. Against this backdrop, artificial intelligence has arrived not as a gimmick but as a genuine attempt to change the economics of discovery. By learning patterns from vast biological and chemical datasets, machine-learning models are beginning to compress timelines that were once measured in years.

Finding needles in chemical haystacks

The number of small, drug-like molecules that could theoretically exist is astronomically large — far more than could ever be synthesized and tested by hand. AI approaches allow researchers to search this space intelligently. Generative models can propose entirely new molecular structures with desired properties, while predictive models estimate how tightly a candidate will bind to its target, how soluble it will be, and how toxic it might prove. Instead of blindly screening millions of compounds in the laboratory, scientists can now prioritize the most promising few for real-world testing.

A molecule that looks perfect on a screen must still survive the unforgiving reality of biology.

Seeing proteins in three dimensions

A landmark moment came with the accurate computational prediction of protein structures from their amino-acid sequences. Because a protein's shape governs its function, and because many drugs work by fitting into a protein like a key

into a lock, reliable structure prediction has opened new doors for structure-based drug design. Targets that were once considered inaccessible are being revisited with fresh eyes.

Beyond the molecule

AI's influence extends across the entire pipeline. In clinical development, algorithms help identify suitable patient populations and predict trial outcomes. In manufacturing, machine vision and process analytics improve quality control. In pharmacovigilance, natural-language processing scans mountains of reports to detect early signals of adverse effects. Drug repurposing — finding new uses for existing, already-approved medicines — has proven a particularly fertile ground, since it sidesteps much of the safety testing required for entirely new compounds.

A partnership, not a replacement

For all the excitement, AI is a tool that amplifies human expertise rather than replacing it. Models are only as good as the data they learn from; biased or incomplete datasets produce misleading predictions. A molecule that looks perfect on a screen must still survive the unforgiving reality of biology. Questions of transparency, validation, and regulatory acceptance remain very much open. The most productive future is a collaborative one, in which chemists, biologists, and clinicians work alongside intelligent systems — each compensating for the other's blind spots.

References

1. Vamathevan J, Clark D, Czodrowski P, et al. Applications of machine learning in drug discovery and development. Nature Reviews Drug Discovery.

2. Jumper J, Evans R, Pritzel A, et al. Highly accurate protein structure prediction with deep learning. Nature.

3. Paul D, Sanap G, Shenoy S, et al. Artificial intelligence in drug discovery and development. Drug Discovery Today.

4. Mak KK, Pichika MR. Artificial intelligence in drug development: present status and future prospects. Drug Discovery Today.

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FEATURE

Antimicrobial Resistance: The Silent Pandemic

It arrives without headlines and leaves without obituaries. The quiet emergency that could unmake modern surgery.

By Dr. Vivek Kumar Patel

When Alexander Fleming accepted his Nobel Prize, he issued a quiet warning: misuse of penicillin could breed resistant bacteria. Decades later, that warning has become one of the gravest threats to modern medicine. Antimicrobial resistance — the ability of microorganisms to survive the very drugs designed to kill them — is often called a silent pandemic because it advances steadily, without the dramatic headlines of an acute outbreak, yet claims an enormous toll.

How resistance arises

Resistance is, at its heart, evolution in action. Whenever an antimicrobial is used, it exerts selective pressure: susceptible microbes die, but any that happen to carry a survival advantage persist and multiply. Bacteria are especially adept at this. They can inactivate a drug with enzymes, alter the target so the drug no longer binds, pump the drug out before it acts, or restrict its entry altogether. Worse still, they share resistance genes with one another through mobile genetic elements, spreading traits across species with alarming speed.

Antibiotics are a shared, finite resource, and preserving their power is a responsibility we all carry.

The drivers

The problem is fuelled by human behaviour as much as by biology. Overuse and misuse of antibiotics in human medicine — prescribing them for viral infections, or patients stopping a course early — accelerate resistance. So does heavy use in agriculture and livestock, where antimicrobials are sometimes given to promote growth. Poor sanitation and infection control allow resistant organisms to spread, while a thin pipeline of genuinely new antibiotics means we are running low on replacements.

Fighting back

There is no single solution, but a coordinated strategy offers real hope. Antimicrobial stewardship programmes ensure the right drug is used at the right dose for the right duration. Rapid diagnostics help clinicians

distinguish bacterial from viral infections and identify resistance early. Vaccines prevent infections from occurring in the first place, reducing the need for antibiotics. Researchers are pursuing novel classes of antimicrobials, bacteriophage therapy, and agents that disable resistance mechanisms directly. The One Health approach — recognizing that human, animal, and environmental health are interconnected — has become the guiding philosophy.

Pharmacists occupy a pivotal position in this fight. As the most accessible healthcare professionals, they counsel patients on correct use, discourage inappropriate demand for antibiotics, and support surveillance efforts. The message is simple but urgent: antibiotics are a shared, finite resource, and preserving their power is a responsibility we all carry.

Table 2. Common mechanisms of bacterial resistance

Mechanism	What the bacterium does	Example
Enzymatic inactivation	Destroys or modifies the drug	Beta-lactamases against penicillins
Target modification	Alters the drug's binding site	Altered PBPs in MRSA
Efflux pumps	Expels the drug from the cell	Tetracycline resistance
Reduced permeability	Blocks the drug from entering	Porin loss in Gram-negatives

Bacteria deploy several strategies at once, which is why combination approaches are often needed.

References

1. World Health Organization. Antimicrobial resistance: global report on surveillance. WHO, Geneva.

2. Murray CJL, Ikuta KS, Sharara F, et al. Global burden of bacterial antimicrobial resistance: a systematic analysis. The Lancet.

3. Ventola CL. The antibiotic resistance crisis: causes and threats. Pharmacy and Therapeutics.

4. Laxminarayan R, Duse A, Wattal C, et al. Antibiotic resistance — the need for global solutions. The Lancet Infectious Diseases.

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FEATURE

Biosimilars: The Coming of Age of Complex Medicines

When a medicine is grown rather than synthesised, "identical" stops being possible — and "highly similar" becomes a science.

By Awan Kumar Pandey

When a conventional small-molecule drug loses patent protection, chemists can reproduce it exactly, molecule for molecule, and sell it as a cheaper generic. Biological medicines — the large, intricate proteins grown inside living cells — are a different story entirely. A monoclonal antibody can be hundreds of times larger than aspirin and is folded into a precise three-dimensional shape by the cell that makes it. No two manufacturing processes will ever produce something perfectly identical. This is where the biosimilar enters: not an exact copy, but a highly similar version of an approved biological medicine, demonstrated to have no clinically meaningful differences in safety or effectiveness.

Why "similar" is the honest word

Because biologics are made in living systems, tiny variations — in sugar chains attached to a protein, for instance — are unavoidable even between batches of the original product. Biosimilar developers therefore aim not for chemical identity but for a rigorous match in structure, function, purity, and clinical behaviour. Approval demands an extensive comparability exercise: analytical studies comparing the molecule down to fine detail, followed by targeted clinical trials confirming the two behave the same in patients. The scientific bar is high precisely because the molecules are so complex.

Not an exact copy, but a highly similar version — with no clinically meaningful difference.

Why they matter

Biologics are among the most transformative — and most expensive — medicines ever developed, treating cancers, autoimmune conditions, and diabetes. Their cost can place them out of reach for health systems and patients alike.

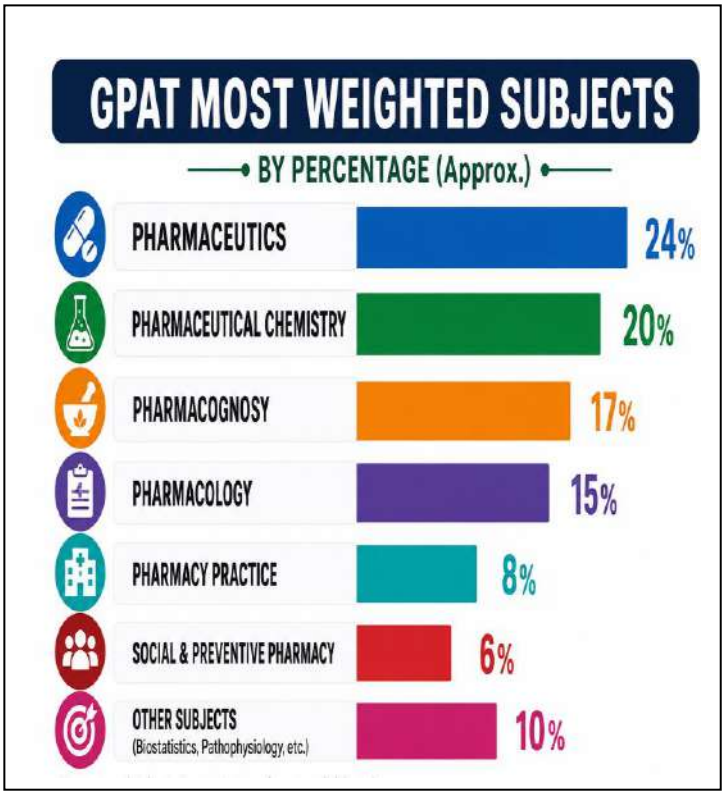
Biosimilars introduce competition once the original's exclusivity expires, expanding access and relieving pressure on healthcare budgets, often while preserving the manufacturer's incentive to keep innovating. Their steady adoption has been described as one of the quiet success stories of modern pharmacy.

The road ahead

Challenges remain around prescriber confidence, interchangeability rules that vary between countries, and public understanding of what "similar" truly means. Pharmacists play a central role in bridging these gaps — explaining to patients that a biosimilar has met a demanding standard of evidence, and supporting the smooth substitution that makes the savings real. As the first wave of biologics ages out of patent, biosimilars are set to become a familiar and vital part of the therapeutic landscape.

References

1. Kurki P, van Aerts L, Wolff-Holz E, et al. Interchangeability of biosimilars: a European perspective. BioDrugs.
2. Weise M, Bielsky MC, De Smet K, et al. Biosimilars: what clinicians should know. Blood.
3. World Health Organization. Guidelines on evaluation of similar biotherapeutic products (SBPs). WHO Technical Report Series.



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FEATURE

The Gut Microbiome: Pharmacology's New Frontier

Trillions of passengers turn out to be co-pilots, rewriting the drugs we swallow before our own enzymes get a look in.

By Miss. Ritika Singh

Inside every human being lives an invisible civilisation — trillions of bacteria, fungi, and viruses that populate the gut and outnumber our own cells. For most of medical history these microbes were treated as passive passengers, or worse, as germs to be eliminated. We now understand them as an active organ in their own right, shaping digestion, immunity, mood, and, remarkably, the way our bodies respond to medicines.

Microbes that metabolise drugs

The gut microbiome is a bustling chemical factory. Its resident bacteria carry an enormous repertoire of enzymes capable of transforming the drugs that pass through the intestine. In some cases they activate a medicine, switching on its therapeutic effect; in others they inactivate it, or convert it into a toxic by-product. Two patients given the same drug may respond quite differently simply because their microbial communities process it in different ways. This emerging field — sometimes called pharmacomicrobiomics — adds a whole new variable to the puzzle of why medicines work for some people and not others.

The recognition that the body is itself a shared ecosystem may prove one of the most profound shifts of the century.

The microbiome as a medicine

If microbes influence health, then altering them becomes a therapeutic strategy. The most dramatic example is faecal microbiota transplantation, which has proven strikingly effective against certain stubborn gut infections by restoring a healthy microbial balance. Beyond this, researchers are engineering probiotics — beneficial live bacteria — and prebiotics that feed them, and are even designing "live biotherapeutic products" as a new class of medicine subject to their own regulatory pathways. The dream is precise, targeted manipulation of the microbiome to treat conditions ranging from inflammatory disease to metabolic disorders.

A cautious optimism

The science is young, and the microbiome's complexity resists simple cause-and-effect stories. Correlation is abundant; proof of causation is harder to come by. Still, few areas of pharmaceutical research feel as genuinely new. For a discipline built on understanding how molecules meet the body, the recognition that the body is itself a shared ecosystem may prove one of the most profound shifts of the century.

References

1. Zimmermann M, Zimmermann-Kogadeeva M, Wegmann R, Goodman AL. Mapping human microbiome drug metabolism. Nature.
2. Lynch SV, Pedersen O. The human intestinal microbiome in health and disease. New England Journal of Medicine.
3. Cani PD. Human gut microbiome: hopes, threats and promises. Gut.

FEATURE

CRISPR and Gene Therapy: Editing the Code of Life

A defence system borrowed from bacteria has given medicine the power to edit the instructions themselves.

By Mr. Yashwanat Singh

For most of history, medicine could treat the symptoms of inherited disease but never touch its root cause — the faulty genetic instructions written into a patient's DNA. Gene therapy set out to change that, and in recent years it has moved from a hopeful idea to an approved, life-changing reality. At the heart of this revolution sits a molecular tool of astonishing precision, borrowed from the immune systems of bacteria.

A pair of molecular scissors

CRISPR is, in essence, a programmable way to find and edit a specific sequence within the three billion letters of the human genome. A guide molecule directs an enzyme to the exact spot in the DNA that needs attention, where it can cut, disable, or correct the code. What once required years of painstaking effort can now, in the laboratory, be attempted in days. The elegance and accessibility of the technique earned its pioneers a Nobel Prize and set off a wave of therapeutic development.

Gene therapy is not a casual tool but a profound one, and its stewardship will define much of medicine's coming decades.

From concept to cure

Gene therapies now exist that treat previously untouchable conditions — certain inherited blood disorders, a form of childhood blindness, and severe immune deficiencies among them. Some work by supplying a healthy copy of a missing gene, delivered into cells using a modified, harmless virus as a courier. Others edit the patient's own cells outside the body and return them, corrected, to do their work. A single treatment can, in the best cases, offer a durable cure where only lifelong management existed before.

Promise, price, and prudence

The obstacles are real and serious. Delivering an editing tool safely to the right cells, avoiding unintended changes elsewhere in the genome, and understanding long-term effects all demand caution. The staggering cost of these bespoke therapies raises

hard questions about equity and access. And the ability to edit the human germline — changes that would pass to future generations — carries ethical weight that the scientific community treats with great seriouS. N. ess. Gene therapy is not a casual tool but a profound one, and its stewardship will define much of medicine's coming decades.

References

1. Jinek M, Chylinski K, Fonfara I, et al. A programmable dual-RNA-guided DNA endonuclease in adaptive bacterial immunity. Science.
2. Doudna JA. The promise and challenge of therapeutic genome editing. Nature.
3. High KA, Roncarolo MG. Gene therapy. New England Journal of Medicine.

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RESEARCH SPOTLIGHT

Nose-to-Brain Drug Delivery: A Direct Route to the Mind

The roof of the nasal cavity opens almost directly onto the brain. Formulators have been learning to use the door.

By Mr. Deepak Mehar

The brain is medicine's best-guarded fortress. The blood–brain barrier, a tightly sealed layer of cells lining the brain's blood vessels, keeps out toxins — and, unfortunately, most drugs as well. For conditions such as schizophrenia, depression, epilepsy, and neurodegenerative disease, this barrier is a formidable obstacle. Intranasal delivery offers an ingenious way around it.

The roof of the nasal cavity is lined with olfactory tissue that connects almost directly to the brain. Drugs deposited here can travel along olfactory and trigeminal nerve pathways, reaching the central nervous system while partly bypassing the systemic circulation. The advantages are considerable: rapid onset, avoidance of first-pass metabolism in the liver, lower doses, and a non-invasive, needle-free experience that patients tolerate well.

The brain is medicine's best-guarded fortress.

The challenge is that the nose is designed to clear foreign material quickly. Mucociliary

clearance sweeps substances away within minutes, and only a limited volume can be administered. Formulation scientists address this with clever strategies: mucoadhesive gels that cling to the nasal lining, in-situ gelling systems that are liquid in the bottle but solidify on contact with the nasal mucosa, and nanocarriers such as nanostructured lipid carriers that protect the drug and enhance its uptake. Combining an in-situ gel with a lipid nanocarrier can prolong residence time while improving penetration — a pairing under active investigation for antipsychotic drugs.

Nose-to-brain delivery is still maturing, with questions around dose reproducibility and long-term safety of the nasal mucosa yet to be fully answered. But for a class of diseases where reaching the brain quickly and safely can transform a patient's life, it remains one of the most compelling frontiers in pharmaceutics.

References

1. Illum L. Nasal drug delivery — possibilities, problems and solutions. Journal of Controlled Release.

2. Kozlovskaya L, Abou-Kaoud M, Stepensky D. Quantitative analysis of drug delivery to the brain via nasal route. Journal of Controlled Release.

3. Agrawal M, Saraf S, Saraf S, et al. Nose-to-brain drug delivery: an update on clinical challenges and progress. Journal of Controlled Release.

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IN FOCUS

Pharmacogenomics: Medicine Tailored to Your Genes

Why one dose cures, does nothing, and harms — in three different people. Part of the answer was written before birth.

By Miss Shweta Upadhyay

Why does the same dose of the same drug cure one patient, do nothing for another, and cause a dangerous reaction in a third? Part of the answer is written in our DNA. Pharmacogenomics is the study of how a person's genetic makeup influences their response to medicines — and it is quietly steering medicine away from the one-size-fits-all model toward something far more personal.

Much of the variation comes down to how our bodies process drugs. Enzymes in the liver, particularly the cytochrome P450 family, break down a large share of common medications. Small genetic differences can make a person a rapid, normal, or poor metabolizer. A poor metabolizer may accumulate a drug to toxic levels at a standard dose, while a rapid metabolizer may clear it so fast that it never works. Genetic testing can flag these differences in advance, allowing clinicians to adjust the drug or dose before treatment even begins.

The prescription of the future may routinely account for the unique biology of the person holding it.

The clinical payoffs are already real. Genetic testing guides the safe use of certain blood thinners, chemotherapy agents, HIV medications, and drugs for mental health, helping to avoid severe adverse reactions and wasted time on ineffective therapy. In oncology especially, matching a drug to the molecular profile of a tumour has become standard practice for several cancers.

Barriers remain — cost, limited access to testing, gaps in clinician training, and the need for larger studies across diverse populations. Yet the direction of travel is clear. As genetic testing becomes cheaper and faster, the prescription of the future may routinely account for the unique biology of the person holding it — the essence of what is often called precision medicine.

References

1. Roden DM, McLeod HL, Relling MV, et al. Pharmacogenomics. The Lancet.

2. Relling MV, Evans WE. Pharmacogenomics in the clinic. Nature.

3. Pirmohamed M. Pharmacogenomics: current status and future perspectives. Nature Reviews Genetics.

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IN FOCUS

mRNA Vaccines: A Revolution in a Vial

Not the protein, but the recipe for it. How a fragile molecule in a fatty bubble became the fastest vaccine platform ever built.

By Mr Shubham Singh

Few technologies have moved from scientific curiosity to household name as swiftly as the messenger-RNA vaccine. For decades it was a promising but troublesome idea, quietly pursued in laboratories. Then, in the span of a single global crisis, it became one of the most consequential medical tools of the century. Understanding how it works reveals a beautifully simple principle at the heart of a great deal of clever engineering.

Traditional vaccines typically introduce a weakened or inactivated germ, or a piece of it, to teach the immune system what to fight. An mRNA vaccine does something more elegant: rather than delivering the target protein itself, it delivers the instructions to make it. Messenger RNA is the body's own natural courier, carrying genetic recipes from DNA to the cellular machinery that builds proteins. A vaccine borrows this system, supplying a short-lived strand of mRNA that instructs cells to manufacture a harmless fragment of a pathogen — which the immune system then learns to recognise and defend against.

Rather than delivering the protein, it delivers the instructions to make it.

The engineering challenges were formidable. Naked mRNA is fragile and is rapidly destroyed by the body, and it can provoke unwanted inflammation. Two breakthroughs proved decisive. First, chemists learned to subtly modify the RNA building blocks so the molecule slipped past the body's alarm systems while still working. Second, the delicate strand was wrapped inside a lipid nanoparticle — a tiny fatty bubble that protects the cargo and ushers it safely into cells. Here, pharmaceutics and nanotechnology meet vaccinology in a single formulation.

The advantages are striking. Because the platform only requires the genetic sequence of a target, mRNA vaccines can be designed with remarkable speed and updated quickly as pathogens evolve. Manufacturing is largely synthetic and does not depend on growing live viruses, which simplifies scale-up. Researchers are now exploring the same technology far beyond infectious disease — for cancer, where personalised vaccines could train the immune system against a patient's own tumour, and for a range of other conditions. Challenges remain around cold-chain storage and equitable access, but the door that has been opened is unlikely to close.

References

1. Pardi N, Hogan MJ, Porter FW, Weissman D. mRNA vaccines — a new era in vaccinology. Nature Reviews Drug Discovery.

2. Karió K, Muramatsu H, Welsh FA, et al. Incorporation of pseudouridine into mRNA yields superior nonimmunogenic vector. Molecular Therapy.

3. Hou X, Zaks T, Langer R, Dong Y. Lipid nanoparticles for mRNA delivery. Nature Reviews Materials.

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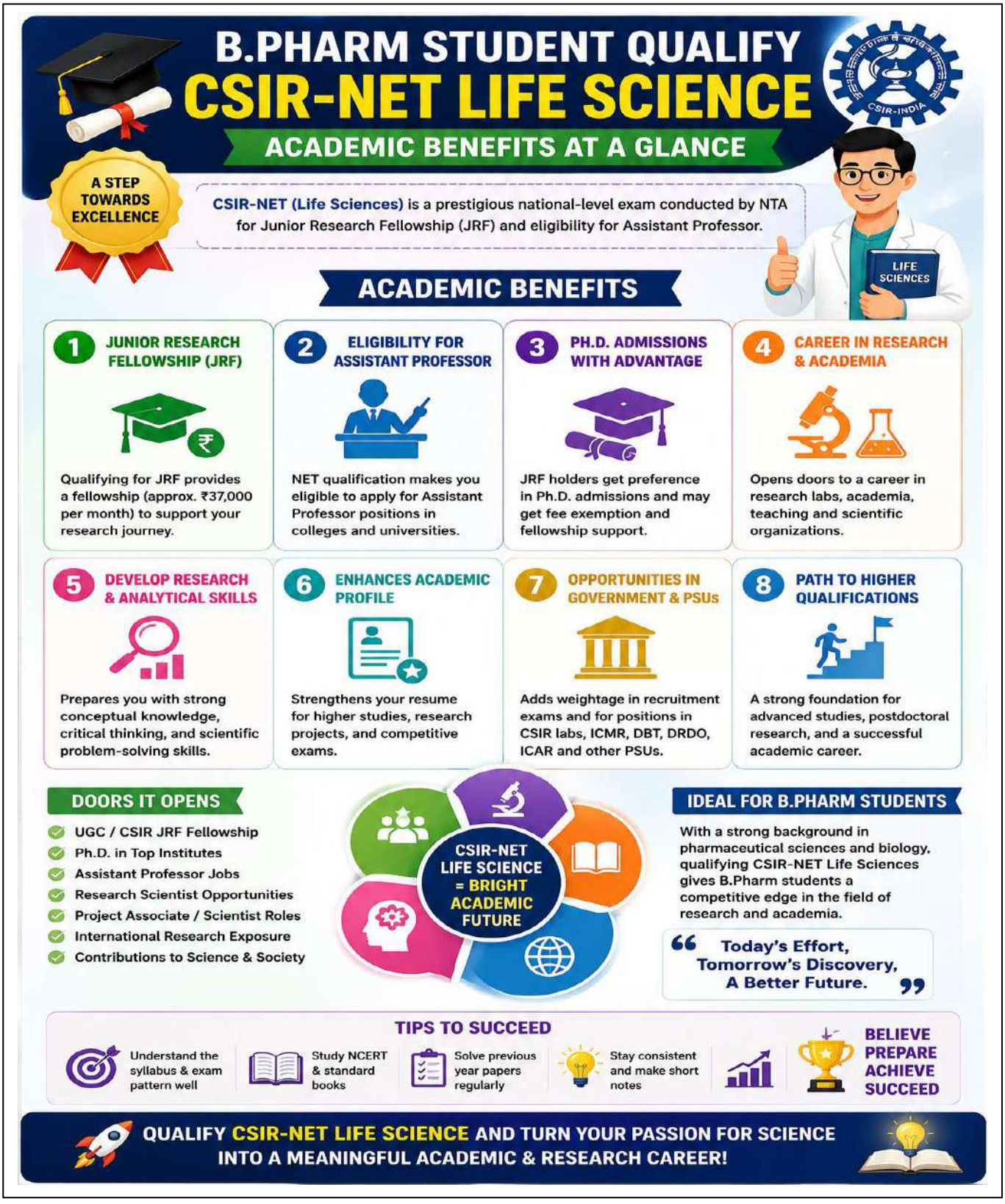

IN FOCUS

Transdermal Delivery: Medicine Through the Skin

The skin evolved to keep the world out. Patches, enhancers and microneedles are the argument for letting a little in.

By Mr. Devashish Jena

The skin is the body's largest organ and its most determined gatekeeper. Its outermost layer, a thin sheet of dead cells packed with lipids, evolved specifically to keep the outside world out. That makes it a formidable barrier — and an intriguing opportunity. If a drug can be coaxed across it steadily, the skin becomes a route for delivering medicine without a single needle or swallowed pill.

The familiar adhesive patch is the most visible success of this approach, delivering drugs for pain, heart conditions, hormone therapy, motion sickness, and smoking cessation. The advantages are considerable: a patch can release its drug at a slow, constant rate for hours or days, avoiding the peaks and troughs of tablets, bypassing the digestive system and the liver's first-pass metabolism, and offering a simple, non-invasive experience that improves adherence. It can also be removed instantly if a problem arises.

The skin is the body's largest organ and its most determined gatekeeper.

The central challenge is the barrier itself. Only small, moderately fat-loving molecules cross the skin easily, which rules out many drugs in their natural form. Formulation scientists deploy an array of strategies to widen the gateway — chemical penetration enhancers that loosen the skin's lipid packing, and physical methods such as microneedles: arrays of tiny, painless projections that create microscopic channels through the outer layer. Microneedle patches, in particular, are expanding the transdermal route to include larger molecules and even vaccines, hinting at a future of self-administered, pain-free immunisation.

References

1. PrauS. N. itz MR, Langer R. Transdermal drug delivery. Nature Biotechnology.

2. Alkilani AZ, McCrudden MTC, Donnelly RF. Transdermal drug delivery: innovative pharmaceutical developments. Pharmaceutics.

3. PrauS. N. itz MR. Engineering microneedle patches for vaccination and drug delivery to skin. Annual Review of Chemical and Biomolecular Engineering.

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IN FOCUS

Quality by Design: Building Quality In, Not Testing It In

Stop testing quality in at the end. Understand the process well enough that a good product is the only thing it can make.

By Mr. Nitesh Prajapati

For much of the twentieth century, pharmaceutical quality rested on a simple but limited idea: make the product, then test a sample at the end to see if it passed. If it failed, an entire batch might be discarded. Quality by Design, or QbD, turns this philosophy on its head. Rather than inspecting quality into a product after the fact, it builds quality in from the very beginning, through deep understanding of the process itself.

QbD begins by defining what the finished product must achieve — its quality target product profile — and works backwards to identify the critical quality attributes that matter to the patient, such as dissolution or purity. Scientists then determine which material properties and process parameters actually influence those attributes, often using structured experiments and statistical modelling. From this emerges a "design space": a well-mapped region of operating conditions within which the process is known to yield a good product. Operating inside that space is not a gamble but a controlled certainty.

The benefits ripple outward. Manufacturers gain flexibility to adjust within the design space without triggering fresh regulatory approval, waste and batch failures fall, and — most importantly — patients receive more consistent, reliable medicines. Regulators worldwide have embraced the approach, embedding it in international guidelines. For today's formulation scientist, QbD is less a technique than a mindset: quality is not a hurdle cleared at the finish line, but a property designed into every step of the journey.

Table 3. Key building blocks of Quality by Design

Term	Meaning in plain language
QTPP	The goals the final product must meet for the patient
CQA	Attributes (e.g. purity, dissolution) that must stay in range
CPP	Process settings that influence the critical attributes
Design space	The safe zone of conditions that reliably yields quality
Control strategy	The plan that keeps the process inside that zone

QbD replaces "test at the end" with "understand from the start".

References

1. International Council for Harmonisation. ICH Q8(R2): Pharmaceutical Development. ICH Harmonised Tripartite Guideline.
2. Yu LX, Amidon G, Khan MA, et al. Understanding pharmaceutical quality by design. The AAPS Journal.
3. Rathore AS, Winkle H. Quality by design for biopharmaceuticals. Nature Biotechnology.

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IN FOCUS

The Cold Chain: Keeping Medicine Alive on the Journey

An unglamorous relay of refrigerators, loggers and cool boxes — and the difference between a vaccine and a vial of water.

By Mr. Mark Masih

A vaccine that has lost its potency is worse than useless — it offers false protection. Many of the most important modern medicines, from vaccines to insulin to certain biologics, are delicate biological products that degrade if they grow too warm or, sometimes, too cold. Ensuring they remain within a narrow temperature range from the moment of manufacture until the moment they reach a patient is the task of the pharmaceutical cold chain, an unglamorous but life-or-death piece of logistics.

The cold chain is a continuous relay. It begins in temperature-controlled manufacturing and storage, moves through refrigerated transport and distribution hubs, and ends in the clinic's refrigerator and finally the point of administration. A single weak link — a power failure, a delayed shipment, an unmonitored cool box on a rural road — can silently ruin an entire consignment. The challenge is greatest in regions with unreliable electricity and long distances, where the last few kilometres are often the hardest.

A vaccine that has lost its potency is worse than useless — it offers false protection.

Technology is steadily strengthening the chain. Data loggers and temperature indicators record whether a product has ever strayed outside its safe range. Vaccine vial monitors change colour to warn if heat exposure has been excessive. Solar-powered refrigerators, insulated carriers, and even drone delivery are extending reliable cold storage into remote areas. Pharmacists and supply-chain professionals sit at the heart of this effort, and their vigilance is what turns a manufactured vaccine into an effective one at the patient's arm.

References

1. World Health Organization. Immunization supply chain and logistics: a neglected but essential system. WHO.
2. Ashok A, Brison M, LeTallec Y. Improving cold chain systems: challenges and solutions. Vaccine.
3. Kartoglu U, Milstien J. Tools and approaches to ensure quality of vaccines throughout the cold chain. Expert Review of Vaccines.

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PHARMA SPECTRUM, VOLUME 1 ISSUE 1

SHORT TAKE

Green Chemistry: Cleaner Ways to Make Medicine

The cleanest waste is the waste never made.

By Miss. Shefali Agrahari

Every kilogram of a finished drug can generate many times its weight in waste — solvents, by-products, and spent reagents. Green chemistry asks a deceptively simple question: can we design the process so the waste is never created in the first place? Built on twelve guiding principles, it favours safer solvents, catalytic rather than wasteful reactions, renewable feedstocks, and processes that are energy-efficient by design.

The pharmaceutical industry has embraced these ideas with real enthusiasm, partly because they align environmental responsibility with cost savings. Biocatalysis — using enzymes to perform chemistry under mild, water-based conditions — has replaced harsh reagents in many syntheses. Continuous-flow manufacturing, in which chemistry happens in a steady stream through small reactors rather than in large batches, improves safety and reduces waste. Metrics such as the E-factor and atom economy give chemists concrete tools to measure and improve the greenness of a route.

For a new generation of pharmacists and chemists, sustainability is no longer an afterthought bolted on at the end. It is becoming a design principle woven into the earliest stages of process development — proof that good science and good stewardship can go hand in hand.

References

1. Anastas PT, Warner JC. Green Chemistry: Theory and Practice. Oxford University Press.
2. Sheldon RA. Metrics of green chemistry and sustainability: past, present, and future. ACS Sustainable Chemistry & Engineering.
3. Dunn PJ. The importance of green chemistry in process research and development. Chemical Society Reviews.

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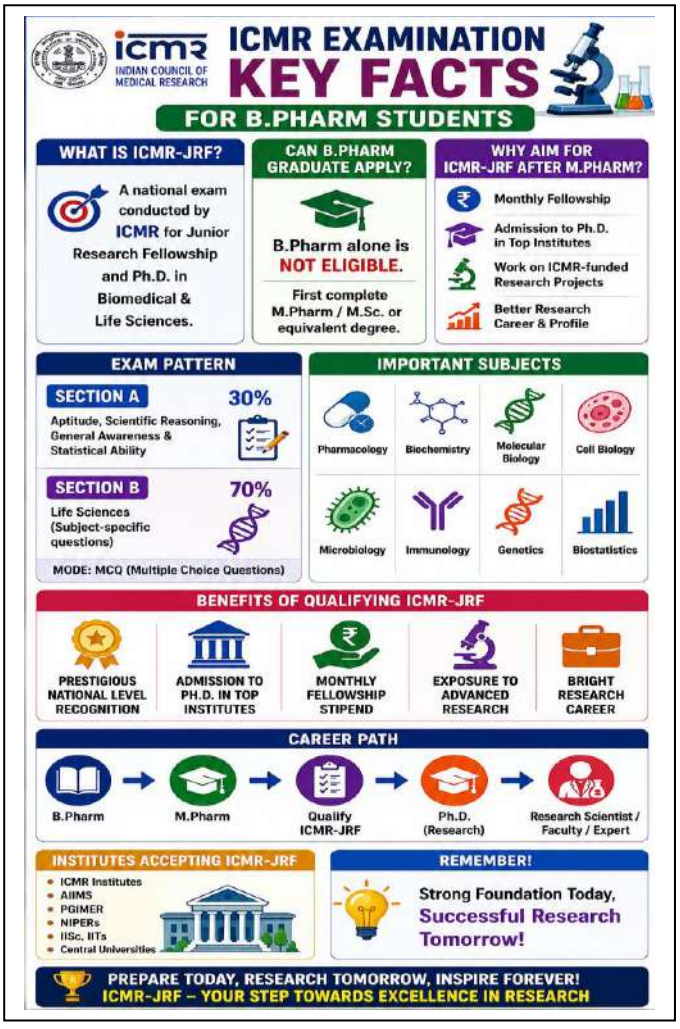

SHORT TAKE

Pharmacovigilance: The Watchful Guardian of Drug Safety

Approval is the beginning of the evidence, not the end of it.

By Anupam Chaubey

A drug's journey does not end when it is approved — in many ways it is only beginning. Clinical trials, however rigorous, involve a limited number of carefully selected patients over a limited time. Rare side effects, long-term risks, and interactions in real-world, diverse populations may only surface once millions of people begin taking a medicine. Pharmacovigilance is the science of monitoring, detecting, and preventing these adverse effects after a drug reaches the market.

At its core lies a simple but powerful act: reporting. When a patient experiences an unexpected reaction, healthcare professionals and increasingly patients themselves can submit a report to a national safety database. Analysts sift through this flood of information, hunting for patterns — a signal that a particular drug may be linked to a particular harm. When a credible signal emerges, regulators can respond by updating warnings, restricting use, or, in serious cases, withdrawing the drug entirely.

Pharmacists are frontline sentinels in this system. Trusted and accessible, they are often the first to hear about a troubling reaction and are ideally placed to report it. A culture that encourages honest, timely reporting is what keeps the whole safety net strong — turning individual observations into collective protection.

References

1. World Health Organization. The Importance of Pharmacovigilance: Safety Monitoring of Medicinal Products. WHO, Geneva.

2. Edwards IR, Aronson JK. Adverse drug reactions: definitions, diagnosis, and management. The Lancet.

3. Beninger P. Pharmacovigilance: an overview. Clinical Therapeutics.

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PHARMA SPECTRUM, VOLUME 1 ISSUE 1

SHORT TAKE

Nutraceuticals and the Herbal Renaissance

Ancient plant wisdom meets the modern demand for proof.

By Miss. Yashika Gupta

The boundary between food and medicine has always been porous. Long before modern pharmacology, healers reached for plants, spices, and foods to treat and prevent illness. Today that ancient wisdom is being re-examined with scientific rigour under the banner of nutraceuticals — food-derived products that claim health benefits beyond basic nutrition.

The category is broad, spanning dietary supplements, functional foods fortified with beneficial ingredients, and isolated bioactive compounds. Familiar examples include omega-3 fatty acids for heart health, probiotics for gut balance, and plant polyphenols valued for their antioxidant properties. Interest in traditional botanical medicines, including those from long-standing systems such as Ayurveda, has surged as researchers work to validate historical claims and identify the active molecules responsible.

Enthusiasm, however, must be tempered with caution. Because many nutraceuticals are regulated more loosely than conventional drugs, product quality and consistency can vary widely, and evidence of efficacy is sometimes thin. Herb–drug interactions are a genuine and underappreciated risk. The task for pharmaceutical science is to bring the same standards of standardization, safety testing, and evidence to this field that we demand of any medicine — honouring tradition while insisting on proof.

References

1. DeFelice SL. The nutraceutical revolution: its impact on food industry R&D. Trends in Food Science & Technology.
2. Nasri H, Baradaran A, Shirzad H, et al. New concepts in nutraceuticals as an alternative for pharmaceuticals. International Journal of Preventive Medicine.
3. Ekor M. The growing use of herbal medicines: issues relating to adverse reactions and challenges in monitoring safety. Frontiers in Pharmacology.

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SHORT TAKE

Printing Pills: The Rise of 3D-Printed Medicines

A tablet built layer by layer can be dosed for exactly one patient.

By Mr. Vishwanath Dubey

The tablet has looked much the same for a century — a compressed, uniform disc churned out by the million. Three-dimensional printing challenges that uniformity. By building a dosage form layer by layer under digital control, printing allows medicines to be shaped, structured, and dosed in ways that mass production simply cannot match.

The appeal lies in personalisation. A printer can produce a tablet with a dose calibrated precisely to an individual patient's weight, age, or genetic profile — a genuine step toward personalised medicine. It can combine several drugs into a single "polypill", easing the burden on patients who take many medicines a day. It can craft complex internal structures that release different drugs at different rates, and it can create porous tablets that dissolve on the tongue in seconds, a boon for children and those who struggle to swallow. The approval of a 3D-printed tablet by a major regulator marked a turning point, proving the technology could meet pharmaceutical standards.

Obstacles endure: regulatory frameworks must adapt, quality control at small scale is demanding, and the range of suitable materials is still growing. Yet the vision is compelling — a future in which a hospital pharmacy, or even a community one, prints a patient's medicine on demand, tailored exactly to their needs.

References

1. Goyanes A, Buanz ABM, Basit AW, Gaisford S. Fused-filament 3D printing of drug products: microstructure analysis and drug release. International Journal of Pharmaceutics.

2. Trenfield SJ, Awad A, Goyanes A, et al. 3D printing pharmaceuticals: drug development to frontline care. Trends in Pharmacological Sciences.

3. Jamróz W, Szafraniec J, Kurek M, Jachowicz R. 3D printing in pharmaceutical and medical applications. Pharmaceutical Research.

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SHORT TAKE

Orphan Drugs: Medicine for the Few

A cruel arithmetic — and the legislation written to overturn it.

By Dr. Swarup. J.Chattarjee

A disease that affects only a handful of people in a million presents a cruel economic paradox. The cost of developing a treatment is much the same whether millions or a few thousand patients will use it — but with so small a market, companies once had little incentive to try. These conditions, and the treatments they lacked, came to be called "orphans": real, serious, and neglected.

The turning point came with legislation designed to change the mathematics. By offering incentives — extended market exclusivity, tax relief, fee waivers, and regulatory support — governments made rare-disease research commercially viable. The effect has been remarkable: hundreds of orphan drugs have since reached patients who previously had no options at all, and rare diseases have become an active frontier of pharmaceutical innovation, particularly for gene and cell therapies.

Difficult questions endure. Orphan drugs are often extraordinarily expensive, straining health systems and forcing hard choices. Running clinical trials with very few patients is scientifically challenging. Yet the underlying principle — that a person should not be denied hope simply because their illness is rare — has reshaped how society thinks about the reach of medicine, and about whom the pharmaceutical enterprise is ultimately meant to serve.

References

1. Braun MM, Farag-El-Massah S, Xu K, Coté TR. Emergence of orphan drugs in the United States. Nature Reviews Drug Discovery.

2. Kesselheim AS, Myers JA, Avorn J. Characteristics of clinical trials to support approval of orphan vs non-orphan drugs. JAMA.

3. Hall AK, Carlson MR. The current status of orphan drug development in Europe and the US. Intractable & Rare Diseases Research.

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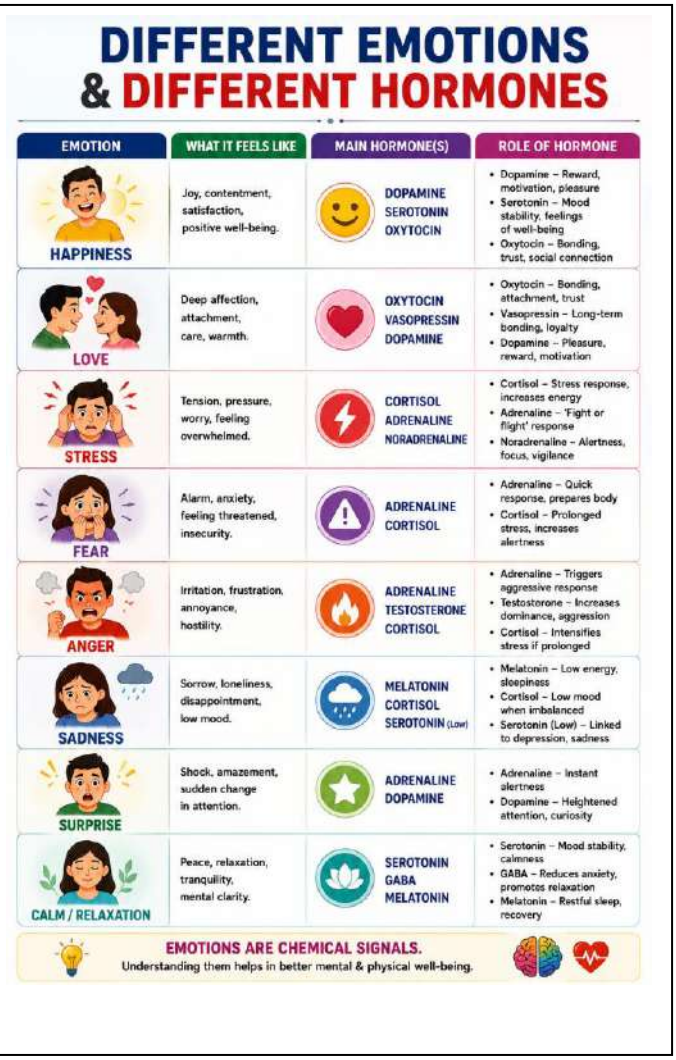

SHORT TAKE

The Biopharmaceutics Classification System, Explained

Two questions — can it dissolve, can it cross — and four answers that have shaped drug development for decades.

By Dr. Swarup. J.Chattarjee

Whether a swallowed drug actually reaches the bloodstream depends on two simple-sounding properties: can it dissolve, and can it cross the intestinal wall? The Biopharmaceutics Classification System, or BCS, distils these into an elegant framework that has quietly shaped drug development for decades. It sorts drugs into four classes based on their solubility and their permeability.

The scheme is intuitive once seen. A drug that both dissolves readily and crosses the gut lining easily poses few delivery problems. One that dissolves poorly but permeates well can often be helped with clever formulation to improve its solubility. The reverse case — dissolves well but crosses poorly — calls for strategies to enhance absorption. The hardest cases dissolve poorly and permeate poorly, demanding the most ingenuity from formulators. Knowing a drug's class early tells scientists where the trouble is likely to lie.

Table 4. The four BCS classes

Class	Solubility	Permeability	Formulation outlook
I	High	High	Generally straightforward
II	Low	High	Improve solubility / dissolution
III	High	Low	Enhance permeation / absorption
IV	Low	Low	Most challenging

A map of where a drug's delivery challenges are likely to lie.

References

1. Amidon GL, Lennernäs H, Shah VP, Crison JR. A theoretical basis for a biopharmaceutic drug classification. Pharmaceutical Research.

2. Wu CY, Benet LZ. Predicting drug disposition via application of BCS. Pharmaceutical Research.

3. World Health Organization. Proposal to waive in vivo bioequivalence requirements for WHO Model List medicines. WHO Technical Report Series.

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SHORT TAKE

Chronopharmacology: Timing Is Medicine

The right drug, the right dose — and, it turns out, the right hour.

By Dr.Vivek Kumar Patel

We are not the same creature at midnight as at noon. Blood pressure, hormone levels, body temperature, and the activity of countless enzymes all rise and fall on a roughly twenty-four-hour rhythm governed by our internal biological clock. Chronopharmacology asks a natural but often overlooked question: if the body changes through the day, might the timing of a medicine change how well it works?

The evidence says it often does. Some conditions have their own daily patterns — asthma attacks and heart problems, for instance, cluster in the early morning hours — so a drug timed to be most active then may work better and more safely. The body also processes and eliminates drugs at different rates depending on the hour, which can affect both effectiveness and side effects. In areas from blood-pressure control to cancer chemotherapy, aligning treatment with the body's rhythms has shown genuine promise.

Turning this insight into practice has inspired ingenious formulations — delayed-release tablets taken at bedtime that unleash their drug just before dawn, when it is needed most. The field is a fine illustration of a deeper truth in pharmacy: a medicine's success depends not only on the right drug at the right dose, but sometimes on the right moment as well.

References

1. Smolensky MH, Peppas NA. Chronobiology, drug delivery, and chronotherapeutics. Advanced Drug Delivery Reviews.

2. Dallmann R, Okyar A, Lévi F. Dosing-time makes the poison: circadian regulation and pharmacotherapy. Trends in Molecular Medicine.

3. Hermida RC, Ayala DE, Fernández JR, et al. Chronotherapy of hypertension. Chronobiology International.

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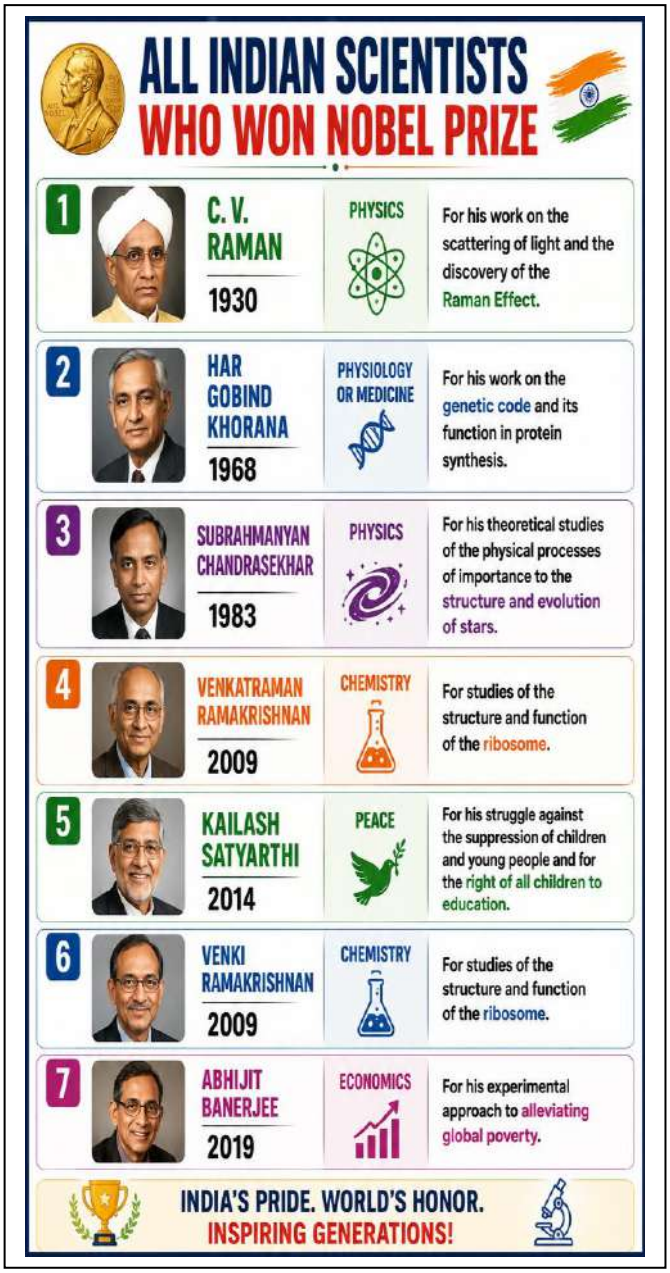

HISTORY CORNER

The Story of Insulin: A Century of a Life-Saving Molecule

A patent sold for a token sum, and a century of a molecule that keeps being reinvented.

By Vivek Kumar Patel

Before the 1920s, a diagnosis of what we now call type 1 diabetes was effectively a death sentence. Children wasted away on desperate starvation diets that bought only a little time. Then, in one of the most celebrated episodes in medical history, a small team in Toronto isolated a substance from the pancreas that could rescue these patients almost overnight. The first young patient to receive purified insulin recovered so dramatically that the discovery was hailed as a miracle. The Nobel Prize followed within a year.

What happened next set an example that still resonates. The discoverers, believing so vital a medicine should belong to humanity, sold the patent to their university for a token sum. Insulin became one of the first great triumphs of pharmaceutical manufacturing at scale, initially extracted from animal pancreases and later, through the arrival of recombinant DNA technology in the late twentieth century, produced as human insulin by engineered microorganisms — a landmark for biotechnology itself.

Discovering a medicine and ensuring everyone who needs it can obtain it are two very different achievements.

The molecule has kept evolving. Modern insulin analogues are engineered to act faster or last longer, smoothing the daily balancing act that people with diabetes must perform. Delivery has advanced too, from glass syringes to discreet pens and sophisticated pumps. Yet the story carries a sober modern coda: access and affordability remain pressing concerns in many parts of the world, a reminder that discovering a medicine and ensuring everyone who needs it can obtain it are two very different achievements.

References

1. Bliss M. The Discovery of Insulin. University of Chicago Press.

2. Vecchio I, Tornali C, Bragazzi NL, Martini M. The discovery of insulin: an important milestone in the history of medicine. Frontiers in Endocrinology.

3. Hirsch IB, Juneja R, Beals JM, et al. The evolution of insulin and how it informs therapy in type 1 diabetes. Endocrine Reviews.

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HISTORY CORNER

From Apothecary to Clinical Scientist: A Brief History of Pharmacy

From clay tablets and Baghdad's first shops to genomics: one unbroken thread of trusted stewardship.

By Dr.Vivek Kumar Patel

The impulse to heal with plants and preparations is as old as humanity itself. The earliest records of pharmacy reach back thousands of years to Mesopotamia and ancient Egypt, where clay tablets and papyri catalogued remedies, dosages, and methods of preparation. In these early societies the roles of physician, priest, and pharmacist were often blended into one, and healing carried a whiff of both craft and ceremony.

A crucial turning point came in the medieval Islamic world, where scholars established some of the first dedicated pharmacy shops and wrote sophisticated treatises on drug preparation, standardisation, and the separation of pharmacy from medicine as a distinct profession. This knowledge, blended with earlier Greek and Roman learning, flowed into Europe, where the apothecary became a fixture of every town — grinding, mixing, and compounding by hand from a wall of labelled jars.

A thread runs unbroken from the ancient apothecary to the clinical scientist of today.

The great transformation arrived with modern chemistry. In the nineteenth century, scientists began isolating pure active compounds from plants — morphine from opium among the first — replacing crude mixtures with precise, measurable drugs. The rise of the pharmaceutical industry in the twentieth century shifted manufacturing from the apothecary's bench to the factory, and the pharmacist's role evolved accordingly.

Today the profession stands transformed once again. The modern pharmacist is far more than a dispenser of tablets: they are clinical advisers, medication-safety experts, researchers, and educators, working within a science that spans nanotechnology and genomics. Yet a thread runs unbroken from the ancient apothecary to the clinical scientist of today — the careful, trusted stewardship of the substances that heal.

References

1. Sonnedecker G, Kremers E, Urdang G. Kremers and Urdang's History of Pharmacy. American Institute of the History of Pharmacy.
2. Anderson S. Making Medicines: A Brief History of Pharmacy and Pharmaceuticals. Pharmaceutical Press.
3. Hadzovic S. Pharmacy and the great contribution of Arab-Islamic science to its development. MedicinskiArhiv.

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CURIOSITIES

Did You Know?

Curious and delightful facts from the world of pharmacy.

♦ **Accidental** antibiotic. Penicillin was discovered by accident in 1928 when a stray mould contaminated a forgotten culture plate — a reminder that some of medicine's greatest gifts arrive uninvited.

♦ **The** word "drug" has humble roots. It is thought to derive from an old Dutch word for dry — a nod to the dried plants and herbs that once filled the apothecary's shelves.

♦ **Bitter** by design. Many medicines taste bitter because a huge number of bitter compounds happen to be biologically active. Our tongues evolved to detect bitterness partly as a warning system against toxins.

♦ **The** placebo is real. A sugar pill with no active ingredient can produce measurable improvements in some conditions — the placebo effect — which is why rigorous trials compare new drugs against placebos.

♦ **Aspirin** comes from willow. The active principle behind aspirin traces back to willow bark, used for pain and fever for thousands of years before chemists refined it into a modern medicine.

♦ **AS.** N. ake on the symbol. The bowl of Hygieia — a cup entwined by a serpent — is a widely recognised symbol of pharmacy, drawn from Greek mythology and the goddess of health.

♦ **Tiny** but mighty. A single nanometre is about one hundred-thousandth the width of a human hair — the scale at which many modern drug carriers operate.

♦ **Chirality** matters. Some molecules exist as mirror-image twins. One twin can heal while the other does nothing — or worse — which is why the "handedness" of a drug can be a matter of life and death.

♦ **The** first pharmacy stood in Baghdad. The world's earliest documented apothecary shops opened in Baghdad in the eighth century, long before the profession spread through Europe — a reminder of pharmacy's deep and global roots.

♦ **Poison** and cure are cousins. The physician Paracelsus captured a founding truth of pharmacology five centuries ago: it is the dose that separates a remedy from a poison. Almost any substance, even water, becomes harmful in a large enough amount.

♦ **Colour** is a clue. The colour and shape of many tablets are chosen deliberately — not for decoration, but to help patients tell their medicines apart and to reduce dangerous mix-ups.

Have a curiosity of your own? Send it to the editors for the next issue.

POETRY CORNER

Poetry Corner

Where science meets the soul.

Ode to a Molecule

Small architect of fate you are,
a lattice spun from carbon's art,
you slip through gates no eye can see
to mend the quiet, aching heart.

A milligram, a whispered dose,
yet worlds of healing you contain —
the chemist's hope, the patient's prayer,
the gentle end of needless pain.

— Author

Dr. Swarup J. Chatterjee

The Pharmacist

Behind the counter, calm and sure,
she reads the script, she reads the fear,
and turns a name into a cure
with careful hands and words made clear.

No fanfare marks the lives she saves,
no headline sings her steady art —
yet every measured dose she gives
is science practised with a heart.

— Author

Dr.Vivek Kumar Patel

At the Nanoscale

Too small to see, too vast to name,
a carrier of light and cure,
it crosses walls the years called sealed
and makes the doubtful future sure.

So here's to those who dream in scale
no ruler yet has learned to hold —
the quiet architects of hope,
in lipid, gene, and grains of gold.

— Mr. Vishwanath Dubey

The Apothecary's Jars

A hundred jars in tidy rows,
each labelled in a careful hand,
they hold the patience of the years,
the quiet lore of leaf and land.

And though the factory hums today
where once a mortar softly rang,
the same intent still lights the work —
to ease the ache, to still the pang.

— Author

Mr. Yashwanat Singh

Half-Life

a fading echo in the blood,
now full, now less, now less again,
a tide that slips its gentle flood.

Sodose the hours with steady care,
and trust the maths the body keeps —
the science of the vanishing,
the rhythm even healing keeps.

— Author

Mr. Shubham Singh

TEST YOURSELF

Test Your Knowledge

A quick quiz for the curious mind. Answers below — no peeking.

1. **Which liquid component distinguishes an NLC from a solid lipid nanoparticle?**
2. **What barrier does nose-to-brain delivery help drugs bypass?**
3. **Which enzyme family in the liver is central to pharmacogenomics?**
4. **What is the term for finding new uses for existing approved drugs?**
5. **Name one of the twelve founding ideas of green chemistry (any principle).**
6. **What do we call the post-marketing monitoring of drug safety?**

ANSWERS

1. **A liquid lipid (oil).**
2. **The blood–brain barrier.**
3. **The cytochrome P450 family.**
4. **Drug repurposing (or repositioning).**
5. **e.g. prevent waste / use safer solvents / design for energy efficiency.**
6. **Pharmacovigilance.**

HOW DID YOU DO?

Six correct — you have read this issue twice. Four or five — a fine effort.
Three or fewer — turn back to page one; it is all in there.

CURIOSITIES

Did You Know? — Round Two

More curiosities from the world of pharmacy.

♦ **Botox began as a poison. The same toxin responsible for a deadly form of food poisoning, purified and used in minute doses, became a treatment for muscle disorders and, later, wrinkles — a striking case of poison turned remedy.**

♦ **Digitalis came from a hunch. The heart medicine digitalis traces to an eighteenth-century physician who noticed a folk healer's herbal brew for dropsy contained foxglove — careful observation turning folklore into pharmacology.**

♦ **Vaccines owe a debt to milkmaids. The word "vaccine" comes from the Latin for cow, honouring the observation that milkmaids exposed to cowpox seemed protected from deadly smallpox.**

♦ **Half-life is not half the effect. A drug's half-life is the time for its concentration to fall by half — a key idea for dosing schedules, though it does not always match how long the effect lasts.**

♦ **Grapefruit is a troublemaker. Grapefruit can block an enzyme that breaks down certain drugs, causing them to build up to unexpectedly high levels — which is why some medicine labels warn against it.**

♦ **The pill count is enormous. Billions of doses of medicine are manufactured every single day worldwide, in one of the largest and most tightly regulated production efforts on the planet.**

♦ **Tablets can be gluten-free — or not. The inactive ingredients in a tablet, called excipients, can matter enormously to sensitive patients, which is why formulation is never just about the active drug.**

Have a curiosity of your own? Send it to the editors for the next issue.

TEST YOURSELF

Test Your Knowledge — Round Two

Six more for the curious. Answers below.

1. **A highly similar version of an approved biologic is called a what?**
2. **Which gene-editing tool is described as "molecular scissors"?**
3. **Which BCS class has low solubility AND low permeability?**
4. **What is the outer skin layer that resists transdermal drugs?**
5. **In QbD, what name is given to the safe zone of operating conditions?**
6. **The word "vaccine" comes from the Latin word for which animal?**

ANSWERS

1. **A biosimilar.**
2. **CRISPR.**
3. **Class IV.**
4. **The stratum corneum (outermost layer).**
5. **The design space.**
6. **The cow (Latin "vacca").**

HOW DID YOU DO?

Six correct — you have read this issue twice. Four or five — a fine effort.
Three or fewer — turn back to page one; it is all in there.

REFERENCE

Mini-Glossary

Key terms from this issue, in one place.

Term	Quick definition
Biosimilar	A highly similar version of an approved biological medicine
CRISPR	A programmable tool for editing specific DNA sequences
Microbiome	The community of microbes living in and on the body
NLC	Nanostructured lipid carrier; a lipid-based drug nanocarrier
Pharmacovigilance	Post-marketing monitoring of drug safety
Pharmacogenomics	How genes influence individual drug response
Bioavailability	The fraction of a dose that reaches the bloodstream
Half-life	Time for a drug's concentration to fall by half
Excipient	An inactive ingredient in a formulation
Design space	The validated range of conditions yielding quality (QbD)

A fuller glossary will accompany future issues. Suggestions for terms to include are welcome.

REFERENCE

Index of Key Terms

Where to find the ideas of this issue.

LOOKING AHEAD

Coming in the Next Issue

Submissions are open to students, faculty and researchers.

› Antibody–drug conjugates

Guided missiles of oncology: a cytotoxic payload, an antibody address label, and the linker chemistry that holds the two apart until precisely the right moment.

› Regulatory science in India

How a dossier travels from bench to approval, and what the CDSCO pathway asks of a formulation scientist.

› Ocular drug delivery

The eye clears almost everything within minutes. Inserts, implants and mucoadhesives argue otherwise.

› Clinical pharmacy at the bedside

Medication reconciliation, therapeutic drug monitoring, and the pharmacist as a member of the ward round.

› Artificial intelligence, part two

From molecule generation to trial design — what happened when the models met the regulators.

SUBMISSION GUIDELINES

- **Feature articles: 800–1,200 words, with 4–6 numbered references.**
- **Short takes: 300–500 words, with 3 references.**
- **Reviews and case studies are welcome; please indicate the category on submission.**
- **Poetry, artwork and photography: send with a one-line caption.**
- **Tables and figures: supply as separate editable files where possible.**
- **All submissions are reviewed by the editorial board. Authors should verify every citation — year, volume and DOI — before submitting.**

Submit to: [vivekptl428@gmail.com] • Deadline: [20, NOVEMBER 2026]

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