


# Chapter 3

## Supramolecules as Efficient Tools for Modern Targeted Drug Delivery Approaches

**Nikita Patel**

 <https://orcid.org/0009-0005-1883-5158>

*Krishna School of Science, KPGU, India*

**Miral Vora**

*Krishna School of Science, KPGU, India*

**Asha Joshi**

*Krishna School of Science, KPGU, India*

**Bhupesh Bhatt**

*Sardar Patel University, India*

### **ABSTRACT**

*The field of supramolecular chemistry includes dynamic covalent chemistry as well as the investigation of all forms of intermolecular non-covalent bond formation in engineered molecular systems. Reversible non-covalent interactions, a key component of supramolecular chemistry, include hydrogen-bonding,  $\pi$ - $\pi$  stacking, hydrophobic, van der Waals, and electrostatic interactions. Advances in supramolecular chemistry in recent times have largely aided biomedical applications. For an understanding of how pharmaceuticals interact with binding sites in biological systems, supramolecular chemistry is crucial. Therapeutic compounds should be momentarily contained within the carrier vehicles and released at a predetermined location or time in order*

DOI: 10.4018/979-8-3693-2774-6.ch003

*to create effective drug delivery systems (DDS). This chapter summarizes the current trends and notable developments in supramolecular systems with specific functions, along with their many biomedical uses in drug delivery, gene transfection, protein delivery, molecular recognition, and biomimetic chemistry.*

## **INTRODUCTION**

Supramolecular chemistry has garnered a lot of interest lately for its potential applications in material design such as polymer chemistry and general chemistry. When a large number of constituents spontaneously self-assemble in a particular phase, a polymolecular assembly known as a supramolecular polymer is created. Depending on the phase's nature, these assemblies can take the form of a film, layer, membrane, vesicle, mesomorphic phase, crystal, etc., and have highly specific microscopic organization and macroscopic properties.(Krieg et al., 2016) The building blocks for a relatively novel method of creating intelligent drug carriers and other functional medicinal materials are these molecular characteristics. Although systemic therapy benefits from the use of drug carriers, regulated release of pharmaceuticals from localized depots has been a significant area of research in drug delivery, (Wang et al., 2018).

Once more, the fact that this early drug delivery system was clinically successful suggests that employing an engineering approach to enhance treatment outcomes is a promising approach. In the realm of medication administration, approaches that can achieve any or all of the following are required: enhanced therapeutic efficacy, decreased off-site drug exposure or toxicity, decreased dosage or frequency of administration, enhanced therapeutic adherence, and enhanced patient-specific therapeutic function.(Chen et al., 2018) The best way to address issue of a medicine being safely transported through body to its intended location is through drug delivery. Targeted drug delivery will address a number of issues, including preventing medication deterioration and unintended interactions with biological molecules, enhancing drug absorption by tumor cells in a targeted manner, tracking pharmacokinetics, and boosting drug bioavailability inside tumor cells.

Therapeutic compounds should be momentarily contained within carrier vehicles and released at a predetermined location or time in order to create effective drug delivery systems (DDS).(Mura, Nicolas, & Couvreur, 2013) Numerous supramolecular systems, including polymersomes, micelles, vesicles, and physical gels, are presently being studied for their potential as drug delivery methods.(Yoon & Jang, 2010) These materials may be a good fit for the demands of nanomedicine because of their complex chemical design.(Xing & Zhao, 2016) Nanotechnology is an interdisciplinary field of study that has the potential to significantly transform scientific

34 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage: [www.igi-global.com/chapter/supramolecules-as-efficient-tools-for-modern-targeted-drug-delivery-approaches/389989](http://www.igi-global.com/chapter/supramolecules-as-efficient-tools-for-modern-targeted-drug-delivery-approaches/389989)

## Related Content

---

### Nanomedicines and Its Applications Beyond

Popat Mohite, Roshan Dave, Shubham Munde, Anil Raosaheb Pawar, Sudarshan Singh, Bhupendra Prajapati and Aarati Budhar (2026). *Demystifying the Complexities of Supramolecular Systems: Real World Applications* (pp. 209-240).

[www.irma-international.org/chapter/nanomedicines-and-its-applications-beyond/389993](http://www.irma-international.org/chapter/nanomedicines-and-its-applications-beyond/389993)

### Ten Years of the MIA-QSAR Strategy: Historical Development and Applications

Stephen Jones Barigye and Matheus Puggina de Freitas (2016). *International Journal of Quantitative Structure-Property Relationships* (pp. 64-77).

[www.irma-international.org/article/ten-years-of-the-mia-qsar-strategy/144690](http://www.irma-international.org/article/ten-years-of-the-mia-qsar-strategy/144690)

### First Report on the Validated Classification-Based Chemometric Modeling of Human Rhinovirus 3C Protease (HRV 3Cpro) Inhibitors

Sk. Abdul Amin, Nilanjan Adhikari, Shovanlal Gayen and Tarun Jha (2018). *International Journal of Quantitative Structure-Property Relationships* (pp. 1-20).

[www.irma-international.org/article/first-report-on-the-validated-classification-based-chemometric-modeling-of-human-rhinovirus-3c-protease-hrv-3cpro-inhibitors/204889](http://www.irma-international.org/article/first-report-on-the-validated-classification-based-chemometric-modeling-of-human-rhinovirus-3c-protease-hrv-3cpro-inhibitors/204889)

### Indazoles Chemistry and Biological Activities: Synthesis, Properties, and Biological Activities of Indazole

Navnath Tulshiram Hatvate, Khushbu Bagul, Nandini Anil Singh Gour and Kalyani S. Sonawane (2025). *Five Membered Bioactive N and O-Heterocycles: Models and Medical Applications* (pp. 203-254).

[www.irma-international.org/chapter/indazoles-chemistry-and-biological-activities/370716](http://www.irma-international.org/chapter/indazoles-chemistry-and-biological-activities/370716)

### QSAR/QSPR in Polymers: Recent Developments in Property Modeling

Bakhtiyor Rasulev and Gerardo Casanola-Martin (2020). *International Journal of Quantitative Structure-Property Relationships* (pp. 80-88).

[www.irma-international.org/article/qsarqspr-in-polymers/239624](http://www.irma-international.org/article/qsarqspr-in-polymers/239624)