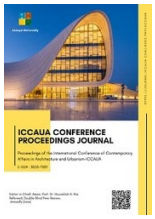

ICCAUA Proceedings Journal
Proceedings of the international conference of contemporary affairs in architecture and urbanism-ICCAUA

Volume 8 (December 2025), Pages 1565–1570
Journal homepage: https://journal.iccaua.com/

DOI: https://doi.org/10.38027/ICCAUAEN0206

Translational Medicine HUB at the University of Monterrey

* [1] Assistant Professor, **Sindy Melissa Godínez De León** [2], **Mariana Salazar Martínez** [3], **Nicole Manilla Huerta** and [4] **María Sofía Rosales Arizpe**
[1,2,3 & 4] *School of Architecture, University of Monterrey, Nuevo León, México*
E-mail [1]: sindy.godinez@udem.edu, E-mail [2]: mariana.salazarmartinez@udem.edu, E-mail [3]: nicole.manilla@udem.edu E-mail [4]: maria.rosalesa@udem.edu

Received: 14 February 2025
Revised: 9 June 2025
Accepted: 18 June 2025
Available online: 5 July 2025

This article has been selected and peer-reviewed for publication in this journal as part of the 8th International Conference of Contemporary Affairs in Architecture and Urbanism, held on 8–9 May 2025 in Alanya, Türkiye.

A b s t r a c t

The study aims to develop an architectural proposal for a research hub in translational medicine within the Medical School of Monterrey University's campus. The project addresses the need to integrate biomedical research with clinical practice, accelerating the transfer of scientific knowledge into therapeutic solutions and combining these efforts with educational activities. The article aims to illustrate the architectural design process. It begins by analyzing several case studies. The second phase describes the morphological conceptualization of the HUB, emphasizing the University's institutional vision, which combines interdisciplinary innovation within Mexico's legal and regulatory framework.

The architectural and functional design prioritizes modular and flexible spaces that encourage collaboration between scientists, doctors, engineers, and researchers, leveraging cutting-edge technology. Specialized areas are considered for preclinical research, clinical trials, biotechnology development, laboratories, co-working spaces, and interaction with educational networks. The result is a sustainable building that operates in conjunction with Christus Muguerza Hospital.

K e y w o r d s : Translational Medicine; Salutogenic Architecture, Public Health; Design Process, Public Health.

1. Introduction

The HUB project was born out of the need to implement translational medicine as a training component of the postgraduate academic program at the University of Monterrey's School of Medicine, located in the state of Nuevo León, Mexico. The primary objective of the research is to design a space dedicated to translational research focused on treatments, aiming to provide more practical and effective care for patients with cardiovascular diseases in the state of Nuevo León. Based on this concept, the project is designed for the University of Monterrey's Central Campus. The location leverages collaboration with the University's Vice-Rector's Office for Health Sciences. It leverages the synergy with the future Christus Muguerza Hospital, which is scheduled to open in 2026.

Currently, no health center in the state of Nuevo León offers this type of service, nor does it work with translational medicine. There are only two specialized centers in Mexico located in Guadalajara and Mexico City. It is essential to note that a translational medicine center should be situated adjacent to a specialty hospital, and it is also advisable to locate it near an educational center that conducts medical activities, allowing researchers to collaborate with students and faculty.

Over the past 15 years, the University of Monterrey has seen significant growth in student enrollment in the Health and Science School. The increase has been 1,196 students, a figure recorded over the past few years, from 2014 to 2024. (UDEM 2024 Traditional Population Table) Today, UDEM has 20,037 students enrolled in its three educational levels: graduate, master's, and doctoral programs. Of the total population, 20% are students in medical specialties and subspecialties. Now, the University offers 42 medical specialties in its academic curriculum.

Within the requirements of the postgraduate area of the School of Medicine, it was necessary to conduct in-depth research on the spaces dedicated to translational medicine. This work presents the main findings of the study and also highlights the team's decision regarding the relevance of the design guidelines used. Additionally, the team considers the current Mexican regulations regarding spaces dedicated to health, waste management, and the operation of various types of laboratories, as well as their security measures related to the management of hazardous agents.

For this reason, the architectural proposal includes a block of consulting rooms where graduate students from the School of Medicine's Health Sciences can engage in experiential learning, sample collection, and data collection for ongoing analysis. This process enables them to maintain patients' medical records up to date and respond more effectively to

treatment. In the long term, this information will be used to provide suggestions in the field of preventive medicine. The program is divided into three main areas: the first dedicated to sample collection and laboratory facilities; the second to the administrative area, medical consultations, and day treatment; and the third to the educational area, which will include classrooms, an auditorium, and direct connections to the research offices. The primary objective of locating the building next to Christus Muguerza Hospital is to foster collaboration between the two institutions, enabling the HUB to complement the hospital's capabilities and facilitate the practical application of patient test results in clinical research. Another benefit of this project is that it will help position the University of Monterrey among the high-tech and medical research centers in northeastern Mexico. The promotion of clinical research will also serve as a gateway to other healthcare institutions and companies, providing professionals and researchers with the opportunity to become directly involved in cutting-edge and applicable medical research.

Observation and research in the field of hospital architecture are of utmost importance. For example, studies by Ulrich (1984) have demonstrated that rooms with a view of nature reduce postoperative recovery times, and natural light improves vitamin D levels and regulates circadian rhythms, thereby contributing to overall well-being (Zadeh et al., 2014). These observations, initially empirical, can be systematized within a translational framework to guide architectural decisions.

2. Overview of Translational Medicine structures in Mexico (Cases

2.1 Health situation in Mexico and Nuevo Leon

According to INEGI statistics, released in September 2024, the five most common causes of death in Mexico were: 1. Cardiovascular disease, 2. Malignant tumors, 3. Diabetes mellitus, 4. Accidents and 5. Influenza and pneumonia. The state of Nuevo Leon ranks 10th nationally in the number of deaths from cardiovascular disease. Nuevo León places the state among the top 15 nationally in terms of this type of disease, with 9,440 deaths recorded from this condition.

Just as Nuevo León tanked 11th in the nation for deaths from malignant tumors, with a total of 4,325 deaths INEGI (2023), This opens the way for an effort to improve the health of the people of Nuevo León. Currently, tests are sent to the United States for analysis because they have the necessary equipment, infrastructure, technology, and human capital, including scientists and researchers, as well as support and research funds that pharmaceutical companies provide to hospitals and subsequently distribute to research centers. Therefore, drug testing is quite common.

2.1 Translational Medicine, the new approach bench to bedside

There is a process for reducing medical costs and effort called translational research. According to Oyarzún (2017), Translational medicine is described as "Translating and applying findings obtained on the laboratory bench to the patient's bedside. This type of research involves translating laboratory findings into practical applications for patient treatment. According to Woolf (2008), translational medicine has been described as a "bench-to-bedside" approach, referring to its primary objective of effectively translating scientific discoveries made in the laboratory into direct clinical applications. Maia Barreto (2019) notes that the definition of translational research has evolved, implying that it has gradually shifted away from connecting with clinical research and is now being viewed from a perspective focused on the development of new technologies.

The term "translational architecture" has gained importance in recent decades, as clinical research has become a crucial pillar in the development of hospital spaces. The aim of the recently named translational spaces focuses on establishing a link between basic research and clinical application. This practice ensures that the most efficient processes are applied to the patient immediately. According to Martínez (2010), translational medicine offers new research and treatment procedures for patients, supported by the interaction between laboratory-developed research and healthcare. Clinical research aims to advance medical knowledge through the scientific study of individuals, either through direct interaction or the collection and analysis of blood, tissue, or other samples. This type of research is necessary within the building to achieve preventive medicine. This type of research is used in hospitals because it is directly related to patient outcomes; however, in this case, it would complement the research conducted in the laboratory. Therefore, translational research should be conducted close to a hospital. Thanks to this process, it is possible to gain access to capital from translational pharmaceutical companies.

Maia Barreto (2019) also mentions that translational research has several phases. The first phase involves processes that take ideas and discoveries from basic research at an early stage of disease and the different test and their application in humans. The second phase involves establishing efficacy in humans and developing clinical guidelines to integrate clinical knowledge into practice within healthcare operations and services. The third phase focuses mainly on implementation research and the dissemination of the application of the knowledge. The fourth phase focuses on the results and effectiveness of patients, as well as the expected effects of the technologies introduced into the health system, particularly in the population.

Oyarzún (2017) also mentions that translational medicine, for researchers in basic and preclinical sciences, involves translating knowledge about new mechanisms and techniques into novel diagnostic approaches and treatments for specific diseases, specifically related to cardiovascular diseases in this case. Currently, the University of Monterrey offers laboratories within its facilities, with a strong emphasis on the fact that these laboratories are approved and certified as teaching laboratories rather than research laboratories. The tests performed in them are for academic purposes, not clinical applications. The project's impact on campus will be greater, as it will serve not only educational purposes but also directly benefit the public through the research conducted at the facilities.

2.1. Methods and Mexican Normative

The research methodology is qualitative and projective in nature. In the first phase, a series of interviews was conducted with healthcare professionals, researchers, and the directors of the School of Medicine at the University of Monterrey.

In the second phase, case studies were analyzed, and in the third phase, all regulations related to the design and safety of hospital facilities were reviewed. One of the most essential interviews was with Dr. Silva (2024), in which he explicitly stated: "If this building existed, I would place UDEM as an international leader because it would be a center for translational medicine research. We are aware that there are not many in Latin America, and in Mexico, we have only two, located in Guadalajara and Mexico City. The problem that would be solved is that Mexican patients would have access to personalized medicine long before they had to wait for a group of laboratories willing to invest in it, specifically in Monterrey."

To prepare the proposal, the Mexican standard NOM-087-SEMARNAT-SSA1-2002 was applied, and the considerations for designing facilities with biological risk were studied. According to Rodriguez Dueñas (2007), the main aspects that must be considered in a building that works with biological agents include the definition and knowledge of the classification of the laboratories that will operate within the building. In this particular case, a BSL3 laboratory is an essential part of the project. BSL3 refers to Biological Safety Level 3; this status level is the standard for microbes that pose a high risk or are deadly diseases that can be transmitted through inhalation. This laboratory includes manipulation of COVID-19 samples. The goal is for the design to prevent the spread of disease within the laboratory. Circulation and the location of sample collection, changing rooms, and laboratories are planned according to work procedures that can generate contamination, ensuring that the space itself can protect staff and the surrounding environment.

3. Results

The research led to the design of a building divided into three blocks, directly connected to the Christus Muguerza Hospital and featuring an underground parking garage. The building blends seamlessly with the topography of the existing site. The architectural program (see Table 1) includes laboratories that comply with national safety regulations, specifically those of COFEPRIS and the U.S. Food and Drug Administration (FDA). The design proposes the inclusion of interdisciplinary interaction areas that foster collaboration and the exchange of ideas among researchers from diverse fields. This interaction aims to foster a collaborative environment and drive innovation by designing flexible spaces that prioritize open dialogue. The design of the built environment has a direct impact on public health. Well-designed spaces can reduce the incidence of disease, improve patient recovery, and enhance the environment and safety of healthcare providers.

This space features laboratories designed following international safety regulations, providing optimal conditions for medical and scientific work. Furthermore, it is essential to design interdisciplinary interaction areas that foster the exchange of ideas between researchers from different fields, strengthening innovation and collaboration. Interdisciplinary interaction areas would be spaces that promote collaboration, connection, and connectivity, enabling the integration of diverse areas of knowledge into the health hub. Finally, wellness spaces should be integrated for researchers, faculty, and students, where they can rest and exchange ideas, fostering a more balanced and creative work dynamic.

The building needed to be located within the campus and adjacent to the Christus Muguerza Hospital project. The location is strategic due to its direct connection to the hospital's diagnostic and consultation areas. Figure 1 illustrates that expansive gardens characterize the north façade, while the south façade is protected by an architectural skin that shields it from the critical solar radiation in Monterrey.

The project also took into account the design of the surrounding landscape, as Frumkin (2005) notes that translational medicine is not limited to disease treatment but also seeks to prevent and promote health. So, architecture and urban planning have a vast field of action. Designing cities that encourage active mobility, social interaction, and access to basic services directly translates into positive public health indicators.

Figure 1. Location oped by the Authors.

Recent projects have incorporated clinical innovation labs and experimental architecture, where new spatial arrangements, materials, or workflows are tested on pre-built prototypes before their implementation (Berry et al., 2012).

This methodology reflects architectural translation: the pre-validation of a spatial hypothesis before its generation. Most of them had the following architectural program (See Table 1)

Table 1. List of rooms in the architectural program. (Developed by the Authors).

Research and	Area	Square meters
Labs area	Light microscopy laboratory	20.16 m2
	Molecular and Cellular Biology laboratory	20.16 m2
	Tissue and organ bank	20.16 m2
	BSL3 Laboratory	25 m2
	Vivarium	20 m2
	Sterilization center	20 m2
	Sampling	12 m2
	Staff changing room and restrooms	40m2
	Filter	4m2
	Lobby	15m2
	Storage of reagents and chemicals	40m2
Educational area	Collaborative work areas	50m2
	Private meeting rooms (3)	30m2
	Postgraduate classrooms (6)	210m2
	Multipurpose Room	200m2
	Auditorium	300m2
	Research, Bioethics and Biosafety Committee	20 m2
	Dining area/ cafeteria	100m2
	Restrooms	40m2
	Warehouse and supply storage	20m2
	Lobby	30m2
Clinical diagnosis	Clinical psychology	18m2
	Nurse station	20m2
	Nutrition Diagnosis	18m2
	Family and specialized Medicine	18m2
	Clinical analysis laboratory	20m2
	Molecular diagnostic laboratory	20m2
	Lobby / Waiting room and reception	30m2
Administrative	Director of the HUB	20m2
	Director of research	20m2
	Finance Office	20m2
	RRHH	20m2
	Multipurpose offices (7)	70m2
	Lobby/ Waiting room and reception	30m2
	Meeting room	25m2
	Individual work rooms (10)	100m2
Services	Warehouse and supply storage	20m2
	Maintenance and technical services area	80m2
	Restrooms	40m2
	Circulation/stairs and elevators	35m2

The architectural program corresponds to a doctor-laboratory-patient dynamic that enables efficient use of patient information. As Hamilton & Watkins (2009) noted, translational medicine is not a unidirectional process. Its cycle involves not only bringing discoveries from the laboratory to the clinic but also providing feedback on the research from experiences. This bidirectionality implies constant interdisciplinary collaboration and adaptability to the context. In architecture, an analogous approach is evidence-based design (EBD), which promotes the creation of spaces based on empirical data on how these influence health and behavior.

As Kleinman (1988) notes, collaboration with healthcare professionals is crucial in architectural design, as it enables the creation of spaces more effectively adapted to the physical and emotional needs of users. A clear example is how the design of community clinics can benefit from ethnographic knowledge to integrate local customs, cultural perceptions of illness, and traditional forms of healing, all of which are consistent with the principles of context-sensitive translational medicine. In this particular case, the health hub aims to treat the most prevalent diseases within the Monterrey metropolitan area.

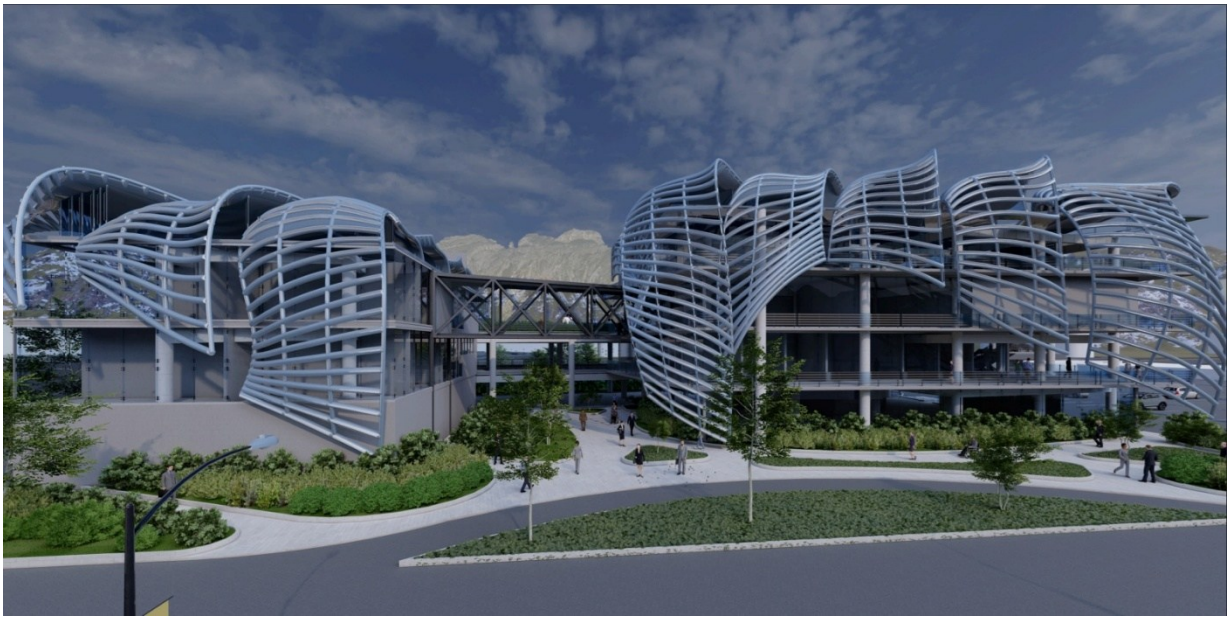

Figure 2. Proposal of Health HUB. Developed by the Authors.

4. Discussions

The design allows for the proper handling and transportation of chemicals within the building. Considerations for the laboratory area included:

- Confining processes to prevent the reléase of aerosols in laboratory work areas. In this case, a ventilation system is proposed to capture toxic gas emissions.
- Implementation of materials resistant to chemical spills within the laboratories. Cleanliness and hygiene are considered priorities within the complete building.
- The area has various filters that allow for adequate protection methods for operations working or implementing cleaning protocols within the restricted area.
- There is a designated space for managing biological and infectious waste under Mexican regulation NOM-087-SEMARNAT-SSA1-2002.

5. Conclusions

The importance of promoting this type of healthcare infrastructure is proven to be effective collaboration within the established healthcare network. A building can be integrated that complements existing healthcare services and actively participates in research, thereby promoting prevention, cure, and patient well-being. Translational architecture has significant development potential in developing countries. It can become a branch of contemporary design where each space complies with regulations and responds to the need for studying and analyzing clinical patterns for their subsequent improvement and dissemination. The relationship between translational medicine and architecture enables a reevaluation of physical spaces used for diagnosis and treatment, as well as for disease prevention and enhanced patient health.

Acknowledgments

Special thanks to the University of Monterrey Research Unit for their support in disseminating this documentation research. As a research team, we would like to thank Professor Salvador Amaro Rosas for his time and assistance in developing the parametric section of the study. Thanks also to Professor Catalina Mayela Lozano Cantú for her comments and suggestions throughout the process and to Professor Sergio Bacco Garza for his guidance on the project's structural aspects.

Conflict of Interests

The Author(s) declare(s) that there is no conflict of interest.

References

Amen, M. A. (2024). AI-driven sustainable habitat design: Key policy frameworks and ethical safeguards. *Smart Design Policies*, *1*(1), 23–32. https://doi.org/10.38027/SMART-V1N1-4

Berry, L. L., Parker, D., Coile, R. C., Hamilton, D. K., O'Neill, D. D., & Sadler, B. L. (2012). The business case for better buildings: A look at the value of hospital design. *Frontiers of Health Services Management*.

Frumkin, H. (2005). Healthy places: Built environments and public health. *American Journal of Public Health*.

Giles-Corti, B., Vernez-Moudon, A., Reis, R., Turrell, G., Dannenberg, A. L., Badland, H., ... & Owen, N. (2016). City planning and population health: A global challenge. *The Lancet*, *388*(10062), 2912–2924.

Hamilton, D. K., & Watkins, D. H. (2009). *Evidence-based design for multiple building types*. Wiley.

Kleinman, A. (1988). *The illness narratives: Suffering, healing, and the human condition*. Basic Books.

Maia Barreto, J. O., Nunes, E., Gurgel-Gonçalves, R., Rodriguez Fleury, S., Soares, M. S., & Pacheco, L. M. (2019). Translational research in public health: Challenges of an evolving field. *Saúde em Debate*, *43*(Especial 2), 4–9. https://doi.org/10.1590/0103-11042019S200

Martínez-Monedero, M. (2010). Arquitectura para un centro traslacional y clínico [Architecture for a translational and clinical centre]. In *Investigación traslacional y clínica, hacia un modelo* (pp. 66–82). Universidad de Granada. http://hdl.handle.net/10481/27591

Oyarzún, M. (2017). Medicina traslacional: Un puente de plata entre las ciencias básicas y la medicina clínica [Translational medicine: A silver bridge between basic sciences and clinical medicine]. *SciELO*. https://www.scielo.cl/scielo.php?script=sci_arttext&pid=S0717-73482017000200081

Rodriguez Dueñas, J. (2007). *Bioseguridad en el diseño de instalaciones con riesgo biológico* [Biosafety in the design of facilities with biological risk] (Vol. 1). Centro Nacional de Seguridad Biológica.

Ulrich, R. S. (1984). View through a window may influence recovery from surgery. *Science*, *224*(4647), 420–421.

Woolf, S. H. (2008). The meaning of translational research and why it matters. *JAMA*, *299*(2), 211–213.

Zadeh, R. S., Shepley, M. M., Waggener, L. T., & Kennedy, L. (2014). Impact of windows and daylight on acute-care nurses' physiological, psychological, and behavioural health. *Health Environments Research & Design Journal*, *7*(4), 35–61.

Interviews

Silva, L. (2024, 30 November). Interview.