

Contributions regarding the architectural planning of environments for higher education in biological sciences

Summary

This essay presents the Comprehensive Participatory Redevelopment Plan (PGRP) of the Institute of Biological Sciences at the Federal University of Minas Gerais (ICB/UFGM), analyzing it as a case study of architectural planning for higher education in Brazil. The text highlights how the modernist brutalist conception of the original building, based on the principle of the “free plan,” provided the necessary environmental flexibility for the modernization of laboratories and infrastructure after forty years of uninterrupted use. The text discusses the logistical strategies adopted to enable the renovations without interrupting academic activities, such as the use of temporary laboratories (buffers), and emphasizes the importance of participatory management with faculty and departments. Finally, it reflects on the fundamental role of public investment and institutional technical resilience in maintaining centers of scientific excellence, especially in the face of budgetary challenges and global crises, such as the 2020 pandemic.

Keywords: architectural planning, higher education, participatory management, environmental rehabilitation

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Introduction

This text aims to present brief contributions regarding architectural planning for teaching and research spaces at the higher education level. It is a study that considers multiple disciplines, involving: history, architectural planning and design, issues concerning scientific research, and popular participation in decisions about the use of these spaces. By blending essayistic and case study characteristics, this work can be seen as an invitation to critical reflection on academic infrastructure. Because it deals with a specific case in Brazil, it serves as a relative reference for other regions and researchers. For those interested, it should be noted that other studies and texts on this case have already been published.

These reflections stem from intensive design work developed since 2010 at a Brazilian university, UFGM – Federal University of Minas Gerais. The architectural plan for renovations and expansions was named PGRP – Comprehensive Participatory Redevelopment Plan, carried out at ICB – Institute of Biological Sciences. It is worth noting that the largest and most important universities in Brazil are public and appear in rankings of the best and most highly rated institutions in Latin America.¹ This provides value and pride to the architects involved in the environmental improvement plan.

The PGRP (Comprehensive Participatory Redevelopment Plan) was implemented to redevelop the spaces of an architectural complex spanning over 45,000 m², inaugurated in the 1970s and intensively used ever since.² Since research in biological sciences requires continuous transformations, the evolution of equipment and work methodologies constantly demands new environments; therefore, it is to be expected that, after more than 40 years of uninterrupted use, such spaces have suffered wear and tear. Between the 1980s and 2000s, Brazil went through a period of neoliberal policies that hindered the maintenance and continuous requalification of areas, which made the implementation of the PGRP (Comprehensive Participatory Redevelopment Plan) an indispensable measure for overall improvement. In architectural terms, the ICB (Institute of

Biological Sciences) was designed according to modernist principles, which facilitated the requalification plans initiated in 2010.

The development and approval of the PGRP (Comprehensive Participatory Redevelopment Plan) involved the participation of the local community. This collaboration was fundamental in ensuring that specific needs were fully met. This is a crucial factor for a country like Brazil, which needs to optimize scarce financial resources. The implementation of the plan was only possible because the federal government prevailing policy at the time prioritized the growth and improvement of university infrastructure, which represented a policy shift compared to previous decades.

Based on the above, it is worth mentioning that the 2020 pandemic crisis highlighted the importance of public investment in advancing science and fully serving society, filling gaps that the private sector cannot fully address. We bring this point to the forefront because the ICB and its faculty played an important role for the state of Minas Gerais in advancing research, implementing preventative measures, and addressing that specific crisis.

It should be noted that this author is an architect at UFGM and participates in the planning discussed here, so his professional experience constitutes one of the sources of information. Other sources include oral accounts from senior professors at ICB, analysis of archived technical projects, specific bibliography, and research data published in the press.

Thinking about the new space for academic teaching and research

The ICB was designed based on the Brutalist modernist style, very common in Brazil during the 1960s and 1970s. This style emphasized the independence between the building's supporting structure and the internal enclosure elements that constitute the spaces (the concept of “open plan,” which we will discuss later). This design allows for so-called environmental flexibility; that is, spaces can be easily

rearranged to accommodate different functions, according to the specific needs of the users.

In the case of a teaching and research institute, this characteristic is fundamental because, given technological advancements and methodological changes in the research developed by faculty, the spaces demand continuous transformations. The positive aspect is that the original structure allowed such adaptations to occur over time, meeting the demands accumulated in more than 40 years of use. The negative point, however, is that the transformations carried out in a piecemeal fashion, without a global order, caused wear and tear and deterioration of the whole. Although this degradation did not impede the research already underway, it could impact the advancement of new studies and the possibilities that were emerging in the 21st century.

Next, we have an image of the ICB at the time of its construction in the 1970s (Figure 1).



Figure 1 General image of the ICB in the 1970s, source: UFMG, 2026.

The ICB is one of the most important science centers in the country. It is located at UFMG, in the city of Belo Horizonte, capital of the state of Minas Gerais. In the image below, we represent the set of 17 blocks that make up the complete architecture of the institute from an aerial view (Figure 2).

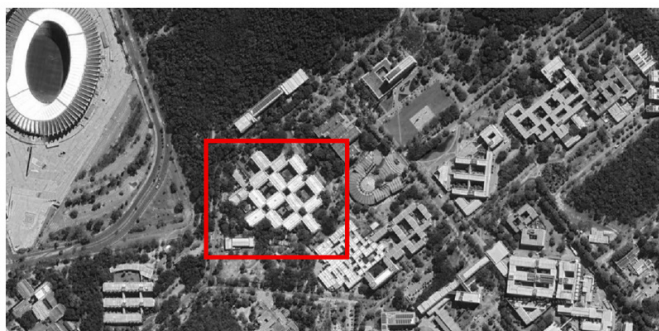


Figure 2 Context of the ICB and its immediate surroundings, source: edited from Google Maps, 2026.

In the image below, we represent the ICB (marked in red) in its location relative to the UFMG campus, and the campus in relation to the urban fabric of its immediate surroundings (Figure 3).

The PGRP, as mentioned, took advantage of the modernist design of the original building, the so-called “free plan.” Widely disseminated in architectural literature and introduced by Le Corbusier.³ This concept is based on the strict separation between the supporting structure and the internal partitions. By using a grid of reinforced concrete pillars and slabs to support the building, the system eliminates the need for load-

bearing walls, allowing the partitions to be configured with complete autonomy. In the case of the ICB (Institute of Biological Sciences), this characteristic enables environmental flexibility: the architecture ceases to be a rigid obstacle and becomes an adaptable infrastructure, capable of being reconfigured and modernized over the decades to accommodate new technologies and scientific methodologies without compromising the structural integrity of the original work.



Figure 3 Context of UFMG and ICB in relation to the city of Belo Horizonte, source: edited from Google Maps, 2026.

In this way, the entire interior of the building can be considered potentially renewable, allowing the facilities to be redone and modernized. In this sense, spaces that were previously deteriorated by time or underutilized due to a lack of comprehensive planning (since interventions occurred individually) could be rationalized, with the addition of new elements to the floor plan for the benefit of the community.

To enable the complete transformation of the building without interrupting essential activities, the following operational strategies were adopted: transferring the theoretical classrooms to a dedicated building, which freed up space within the main building; and creating temporary research environments, called “Temporary Laboratories,” which function as buffers, housing researchers while their original spaces are being renovated. To enhance this strategy, two new blocks were also conceived: one for practical classes and another for animal facilities. However, these blocks have not yet been built due to a shortage of financial resources. There was a withdrawal of resources from universities during the years 2016 and 2023.⁴ The idea is that new buffers can be created and that all spaces will be completely renovated in the coming years.

Below, we present a set of images that contrast the deteriorated state of certain locations with areas already renovated as part of the PGRP (Comprehensive Participatory Redevelopment Plan). On the left, there is a set of four images of highly degraded spaces belonging to retired professors, highlighting the need for renovation. On the right, we see a typical image of the laboratories after renovation, characterized by uncluttered spaces, increased natural lighting, new furniture and research benches, as well as new sink and electrical infrastructure. These areas are suitable both for welcoming new faculty members and for researchers who need to expand their workstations (Figure 4).

To achieve the quality seen in the image on the right, the participation of professors and departments was fundamental. In this sense, regular technical meetings and public hearings were constantly guaranteed; it was these meetings and the exchange of ideas that enabled the advancement of the architectural renovation project and the satisfaction at the end of the work. All demands and considerations were received by the team of architects and reflected in the final project.



Figure 4 Qualitative comparison of environments, sources: images left: author / photo right: Foca Lisboa, UFMG, 2026.

Although the complete work has not yet been finished and not all ICB buildings have been renovated, given that the execution of public works in Brazil presents complex challenges, and there was a depletion of resources in universities between 2016 and 2022, the technical commitment remains resilient, prioritizing the high standard of quality necessary for the full development of research in biological sciences. Future expectations are for the resumption of construction.⁵

Conclusion

The implementation of the Comprehensive Participatory Redevelopment Plan (PGRP) at ICB/UFMG demonstrates that the longevity of complex laboratory buildings is intrinsically linked to their spatial versatility. By taking advantage of the brutalist modernist design and the “free plan” system, the project reaffirms the premise that structures designed with independence between support and enclosure are best suited to absorb the accelerated pace of technological and methodological changes inherent in the biological sciences.

Beyond the technical aspects, the success of the interventions demonstrates the effectiveness of participatory management and strategic planning. The adoption of innovative operational strategies, such as buffer laboratories, combined with constant dialogue with faculty and departments, allowed the requalification to transcend mere aesthetic reform, resulting in a functional rationalization that optimizes public resources and meets the demands of teaching and research in a personalized way.

Ultimately, the experience of the case study highlights the importance of technical resilience and continuous state investment for national scientific sovereignty. Even in the face of budgetary obstacles and historical challenges in the management of public works,

the maintenance of high-quality academic infrastructures proved indispensable (as demonstrated in addressing the 2020 health crisis), consolidating architecture as a strategic element for the advancement of science and the full service to society.

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Conflicts of interest

The authors declare no competing interests.

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