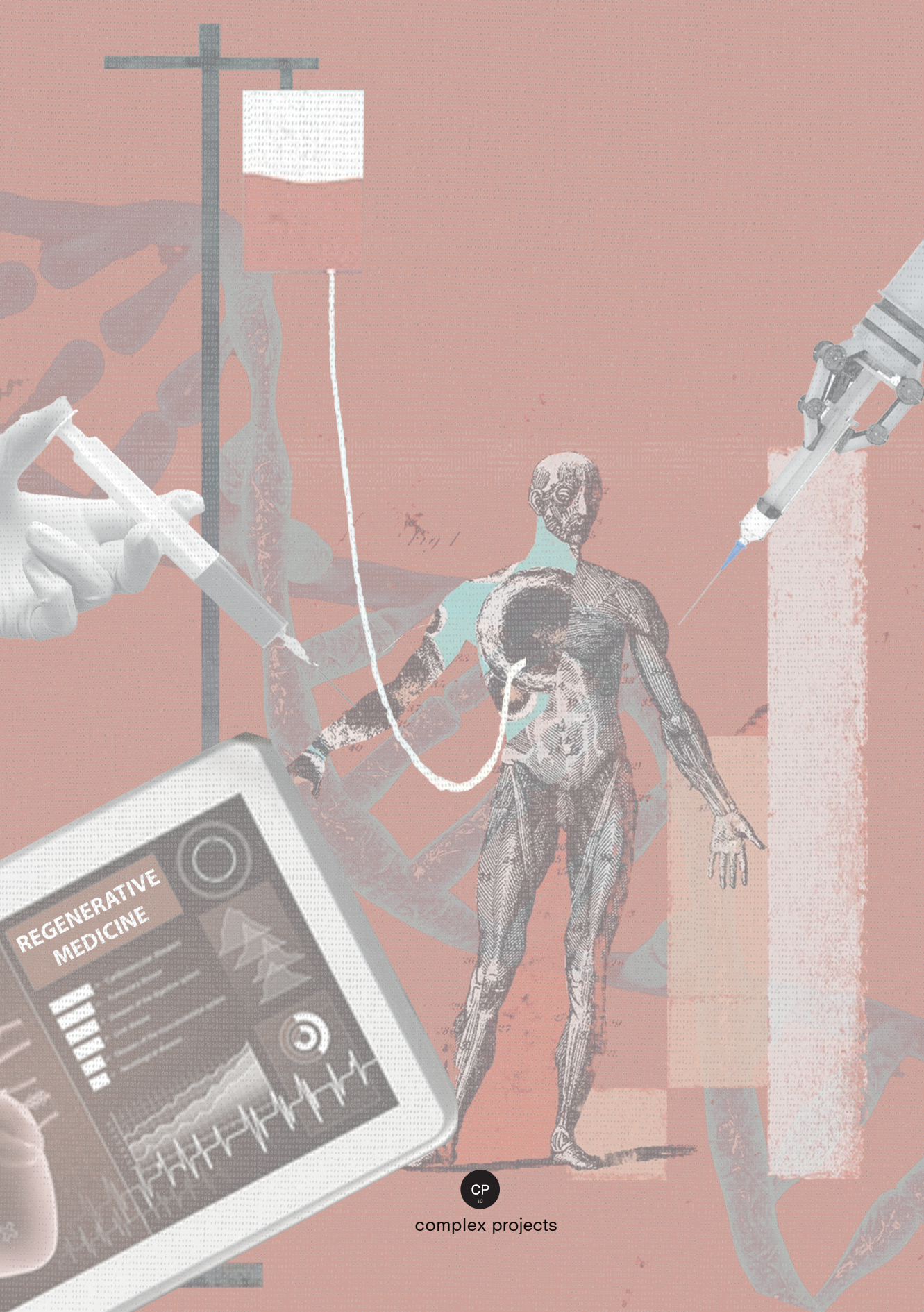
REGENERATIVE
MEDICINE

CENTER RE-GEN

An exploration into visualising the future hospital as a space of production and delivery of personalised regenerative medicine in Berlin.

2024, Spring studio

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Contents

Welcome to the future

By 2030, healthcare is expected to shift its focus toward harnessing the human body's regenerative abilities to cure and eradicate chronic and genetic diseases, while enabling total recovery from severe accidents. As science and the healthcare industry transition from a "treat and repair" model to a "regenerate and restore" paradigm, hospital architecture will evolve to support the advancements in regenerative medicine.

This project is a deep exploration into the intersection of regenerative medicine and hospital architecture. It envisions a highly specialized hospital designed to treat patients by eradicating genetic and chronic diseases. The overarching idea of regeneration plays a central role in shaping the hospital's program, site, and architectural design. This approach ensures that the hospital is tailored to meet the specific needs of human regeneration, aligning with cutting-edge scientific breakthroughs. The project integrates the four fundamental components of healthcare and regeneration under one roof: care, production, administration, and diagnosis/analysis, along with long-term storage facilities. This collaborative model creates a cohesive environment optimized for the process of regeneration. Simultaneously, the design prioritizes creating a sanctuary for patients and staff, while reimagining hospitals as vibrant, open public spaces that integrate seamlessly with the urban fabric and natural environment.

Ultimately, this project serves as a vision for how hospitals of the future can become not only centers of medical excellence but also community hubs that foster connection, healing, and innovation.

Image -1 Sectional model showing the main module and the patient room

Personal interest

My interest in hospitals and healthcare facilities stems from personal encounters over the past few years. The first instance was when I visited my grandfather undergoing open-heart surgery. The hospital, specializing in cardiology, housed around 150-170 rooms, marking a medium-sized facility. At the time, I wasn't well-versed in hospital architecture, but certain aspects left me questioning, "Does it really have to be this way?"

Upon arrival, high compound walls and a security presence greeted us, setting a tone of restriction rather than openness. Transitioning from the outside world to the hospital's interior invoked anxiety, marking the onset of a place where anything could happen. As we navigated to the cardiology department's lobby, the architecture and interiors mirrored the somberness and sorrow we felt. Dull colors dominated the space—monotonous grays and whites, small windows, and long corridors with numerous "Please Do Not Enter" signs. To reach the Cardiology department, we had to traverse through other departments, each corridor resembling the last—bereft of natural light, filled with the scent of medical equipment and cleaning solutions, and lined with doors bearing witness to various medical conditions. Witnessing other patients being wheeled through these corridors, pre and post-operation, only intensified the unsettling atmosphere.

Once my grandfather was settled in the patient ward, his room, devoid of external views, further contributed to the sense of isolation. With no colorful decorations or distractions, the room was a canvas of mild grays, accentuated by shiny white tiles and medical equipment. My grandfather, like many patients, spent his days with closed eyes, devoid of stimuli. Reflecting on my stay, it was undoubtedly one of the worst experiences. There was little for visitors to engage with, amplifying the feeling of desolation. Despite the hospital's accolades for its cardiology department, I couldn't help but question how patients enduring immense pain cope in such environments.

The onset of the pandemic exposed the hospital's vulnerabilities further. Overcrowded lobbies, a lack of treatment spaces, delayed diagnostics due to the rush—these issues underscored the need for hospital designs to adapt to evolving healthcare needs. It's not just medical procedures that require adaptation during epidemics, but also healthcare architecture. My experiences resonate with many others, both in India and the Netherlands, who have encountered similar challenges in healthcare facilities. Hospitals, as vital places in everyone's lives, warrant critical examination and improvement in their design and functionality.

Image 2 (above) - Monotonous development in healthcare sector in India | Image 3 (below) - Dark and corridor in a hospital in India

Current health scenario

With the onset of the pandemic, we all realized that the healthcare facilities we rely on, and the current state of our healthcare system, need to be re-evaluated. It has become evident that we must develop a solid plan to safeguard ourselves from any future pandemics. Additionally, the pandemic highlighted another critical issue—our population is gradually aging. The number of elderly people in our cities is increasing, and at the same time, the prevalence of chronic and genetic diseases is on the rise.

Today, 80% of people over the age of 65 have at least one chronic disease, and one in six people in the EU live with a mild to severe disability. Since 1950, global life expectancy has increased by 20 years, yet the primary causes of death remain unchanged. Figure 1 illustrates the leading causes of death in Germany, which reflect similar international trends. Most of these causes are chronic diseases that have no cure or require extremely lengthy and painful treatments.

Over time, human bodies are changing, and people are becoming more susceptible to illnesses, largely due to unhealthy lifestyles. This not only affects individuals but also has consequences for future generations. Furthermore, many available treatments for these diseases are generic and do not work equally well for every patient. During the pandemic, those already suffering from chronic illnesses were impacted the hardest.

Moreover, these chronic health conditions not only affect the body physically but also take a severe toll on mental health. A lifestyle dominated by unhealthy habits, long working hours, and little to no personal time has significantly contributed to both physical and mental health issues. These small, everyday stressors accumulate over time, leading to major conditions such as depression and anxiety, which have now become some of the most pressing healthcare concerns worldwide.

Another crucial factor affecting health is environmental degradation. The rapid expansion of cities and industries, along with increased vehicular emissions and pollution, has severely impacted air quality. This has led to a rise in respiratory diseases, as seen in Figure 1, where two of the leading health issues are related to respiratory conditions.

Additionally, while technological and industrial advancements have brought convenience, they have also contributed to an increasing number of accidents. Road accidents, workplace hazards, and other mishaps not only result in rising mortality rates but also leave many people with life-altering injuries or permanent disabilities.

Humans continue to misuse scientific advancements in various ways, often prioritizing short-term convenience and entertainment while ignoring the long-term damage. The consequences of these actions are slowly becoming evident, affecting both our health and the well-being of future generation

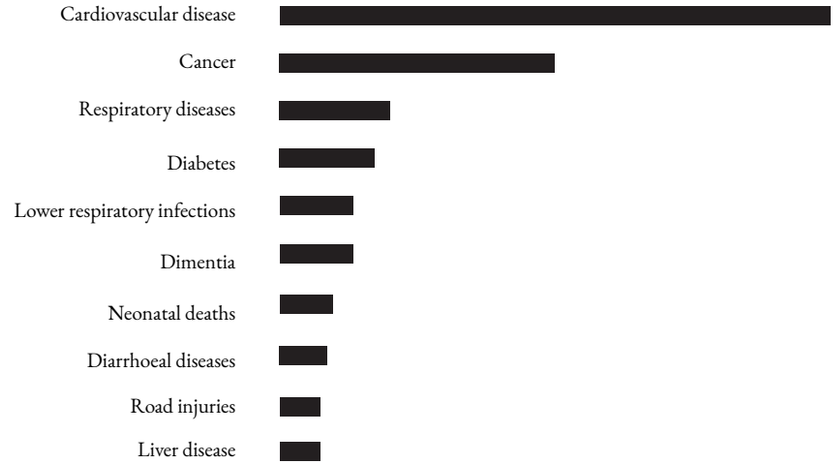


Figure 1 (above) - Leading reasons of death in Germany | Image 4 (below) - Collage showing the aging population

Image 5 (above) - Collage showing unhealthy lifestyle | Image 6 (below) - Collage showing how our boides are changing

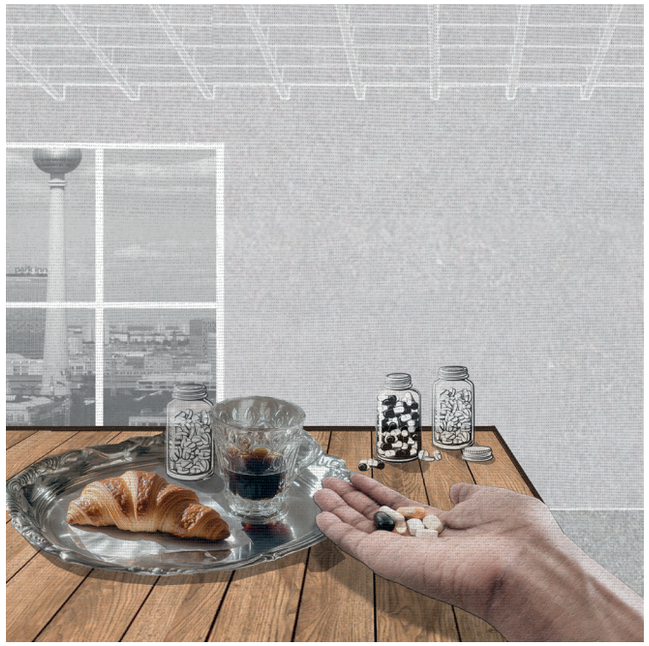


Image 7 (above) - Collage showing changing scenario of dinner plates with meds | Image 8 (below) - Collage showing increasing intake of meds for diseases

All the health issues mentioned above prevent people from enjoying and engaging in the activities they love. As shown in Image 9, a child with a physical disability, possibly caused by one of the issues mentioned earlier, attempts to engage in sports. Similarly, in Image 10, a person who desires to explore the world is confined to a wheelchair and dependent on assisted movements due to their health condition.

This project envisions a future where these health issues can be permanently solved, offering humanity the opportunity to extend its lifespan. The solution, as proposed by leading scientists and doctors, lies in the smallest elements of our bodies: stem cells, which define our identity. This approach could lead to a future where humans not only receive treatment but can be cured of chronic or cellular diseases for which we currently have no solution. Imagine the possibility of fully recovering after a major accident as if nothing had happened, or overcoming the health issues associated with aging.

The future will be a world where humans regenerate, overcoming deadly health issues and preparing for any forthcoming epidemics.

Image 9 (above) - Monotonous development in healthcare sector in India | Image 10 (below) - Dark and corridor in a hospital in India

The regenerative medicine - definition

Regenerative medicine is a rising field of healthcare industry that deals with the smallest elements of our bodies - the cells to improve the persons health and has the ability to errradicate majority of the gentic and age related issues. As quatoed in a research paper from National library of Medicine, 'Regenerative medicine has the potential to heal or replace tissues and organs damaged by age, disease, or trauma, as well as to normalize congenital defects.'[1]

It works by extracting the cells, engineering and modifying them and replacing the defected cells by your own engineered cells. The three main ways this can be delivered is via personalised medicines, gene therapies or complete tissue or organ transplant.

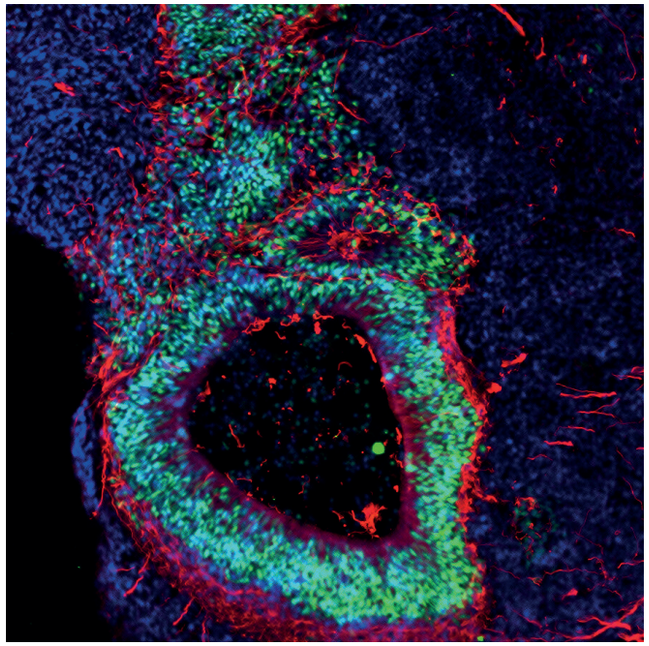
Tissues and organ production

Gene based therapies

Precision medicine

Figure 2 - Major parts of regenerative treatments

1. *Mao, A. S., & Mooney, D. J. (2015). Regenerative medicine: Current therapies and future directions. Proceedings of the National Academy of Sciences of the United States of America, 112(47), 14452–14459. https://doi.org/10.1073/pnas.1508520112*



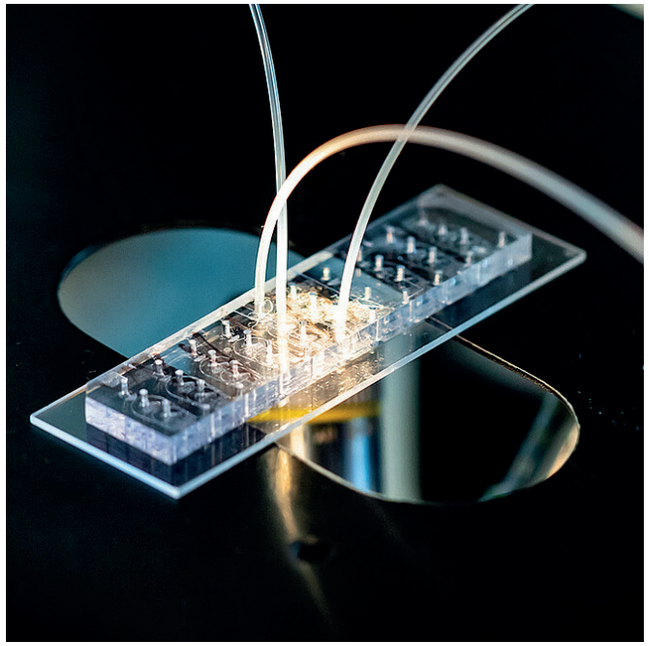
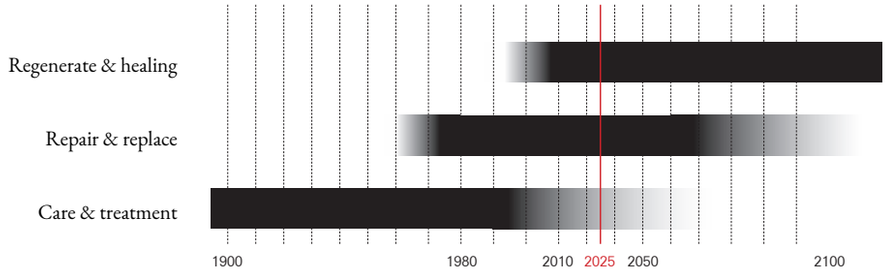
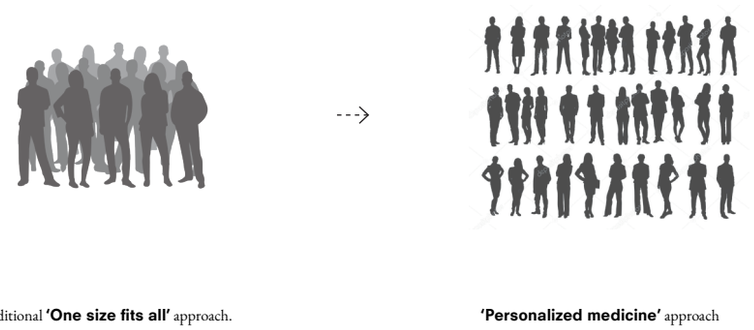


Image 11 (above) - Microscopic image of stem cells | Image 12 (below) - Preparation of Regenerative medicine

Image - 13 Collage abstractly displaying regenerative treatment

Image - 14 Collage abstractly displaying human regeneration





Traditional **'One size fits all'** approach.
All patients with the same diagnosis recive same treatment

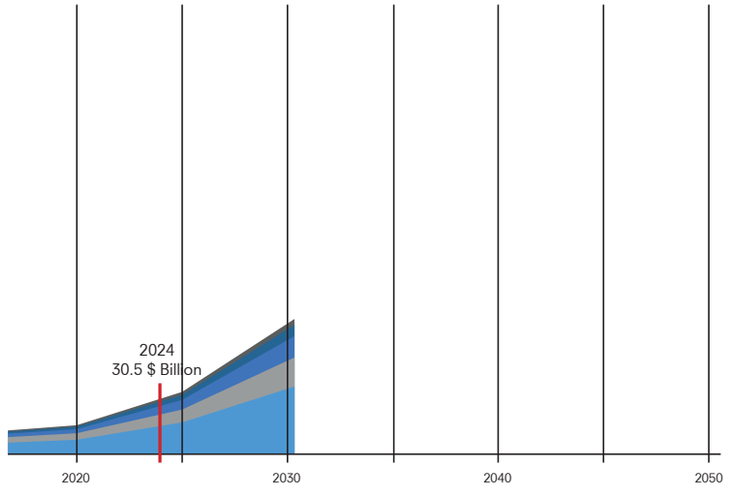
'Personalized medicine' approach
Treatment strategy based on patients unique profile

Growth & Paradigm shift

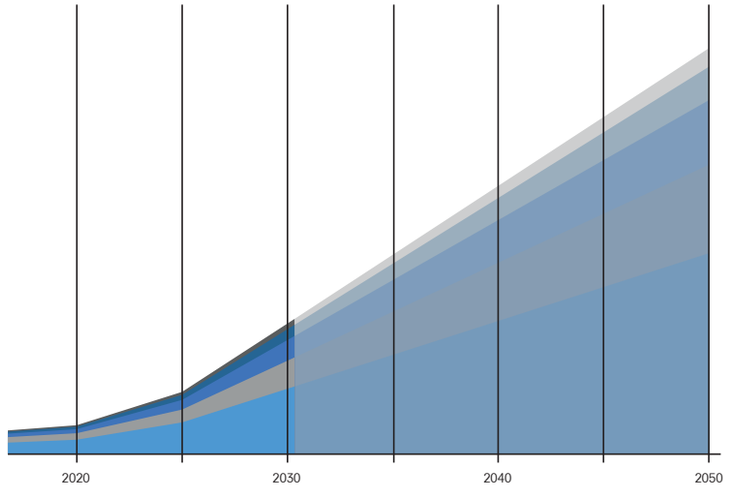
With the introduction of regenerative health and medicine, there is a paradigm shift in how healthcare models function. Traditionally, treatments followed a standardized approach, where all patients with the same disease received identical treatments through uniform procedures. However, as depicted in Figure - xx, regenerative medicine revolutionizes this by making treatments entirely personalized. Since therapies are derived from a patient's own stem cells, the focus shifts from the conventional "repair and replace" model to a "regenerate and heal" approach.

This transformation marks the beginning of a new era in healthcare. The regenerative medicine market is projected to grow at an annual rate of over 25%, signaling its rapid advancement and widespread adoption in the coming years.

Figure 3 (above) Showing the paradigm shift in healthcare technique | Figure - 4 (below) showing shift from traditional healthcare to personalised healthcare



Compound annual growth rate of more than 18%



Compound annual growth rate of more than 25%

Figure - 5 The graph depicts the growth of regenerative medicine market world wide

Existing healthcare infrastructure

Today's healthcare infrastructure is largely traditional and struggles to keep pace with the rapid rise in medical innovations. It is often said that by the time a hospital is designed and built, the technology is already outdated. As shown in Figure 6, there is a clear contrast between the fast-paced evolution of medical innovations and the long lifespan of hospital infrastructure, which is becoming increasingly rigid, inflexible, and outdated. As a result, hospitals today are quickly becoming obsolete (Image 15).

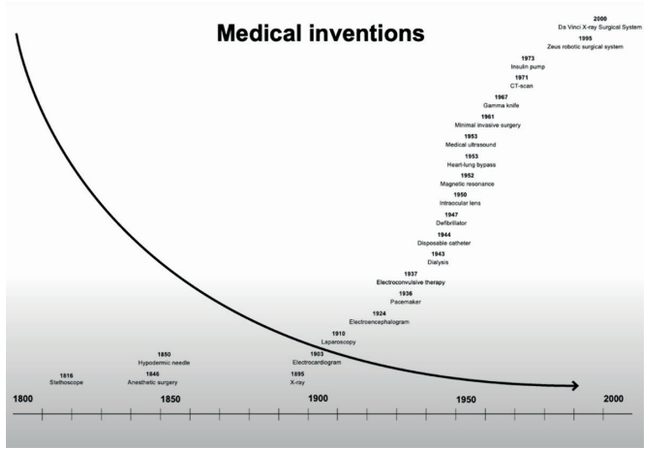
Collaboration and Translation of Research to Clinical Practice-
Currently, there is a significant gap between the research conducted in labs both by private and public entities with its practical application in patient care. Much of the research never reaches the clinical stage, and vice versa. Additionally, what happens in the surgical space often doesn't make it to researchers to delve deeper into these issues. Beyond the gap between clinical and surgical fields, there are also disconnects between these disciplines and other areas, such as education, production, innovation, and biobanking. The same is depited in figure 7. Although university hospitals sometimes bridge the gap between surgical care, education, and research, their scale and ties to universities often make it challenging to integrate these areas fully. The key question is: can we create a holistic care environment that reduces the time it takes to transfer information between disciplines?

Adaptability and Flexibility-
Existing healthcare architecture in cities with impressive medical innovations are also not equipped to adapt to these changing needs. This was especially evident during the pandemic, where healthcare facilities struggled to meet the rising demands. Similar experiences have been shared on the personal interest page. Hospitals are becoming obsolete as healthcare trends evolve and new health issues emerge.

Delivery of Care-
The traditional healthcare process is highly functional and departmental. Patients must navigate through various spaces to reach their final treatment step.[2] This flow is inefficient and not optimized for the patient's experience. With a stronger focus on technical aspects, the spatial arrangements and architecture of hospitals fail to promote patient-centric care. (Image - 16 and image 17) What if the hospital's spaces were designed to prioritize patient healing, making the environment more effective for their recovery?

Hospital and Its Relation to the City-
The relationship between the hospital and the city plays a critical role in how the hospital functions as a shared space where everyone feels welcome. Yet, hospitals today are often surrounded by high walls, and even when located within the city, they are isolated by fences and built far from the hustle and bustle. The idea is that these hospitals are meant to be quiet sanctuaries, disconnected from the city's noise, offering patients access to green spaces. However, this separation becomes restrictive if hospitals are not well connected to the city through public transportation or other mobility options.

2. *Amato, C., McCanne, L., Yang, C., Ostler, D., Ratib, O., Wilhelm, D., & Bernhard, L. (2021, December 15). The Hospital of the Future: Rethinking architectural design to enable new patient-centered treatment concepts - International Journal of Computer Assisted Radiology and surgery. SpringerLink. https://link.springer.com/article/10.1007/s11548-021-02540-9#citeas*



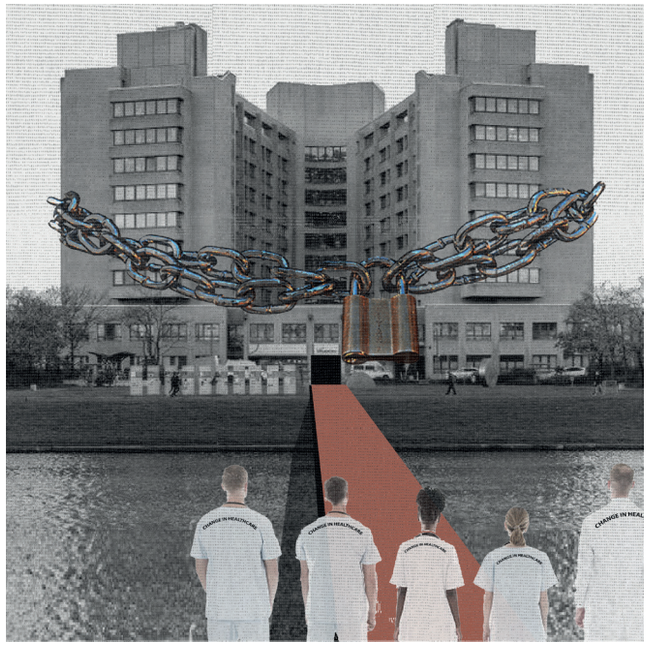


Figure - 6 graph depicts the rising medical innovation against declining hospital infrastructure | Image - 15 Collage depicting the currect hospitals as rigid

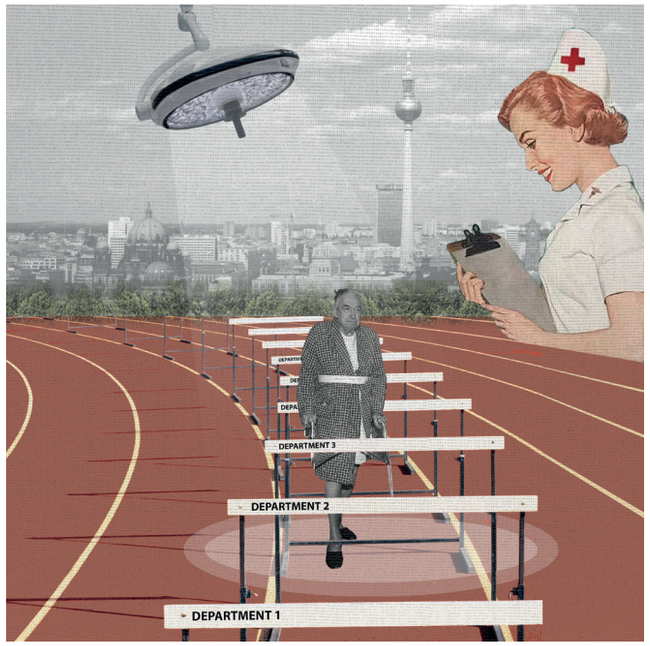


Image -16 Collage depicting the departmental setup of hosptial as the hurdels every patient have to cross irrecpective of its neccesity

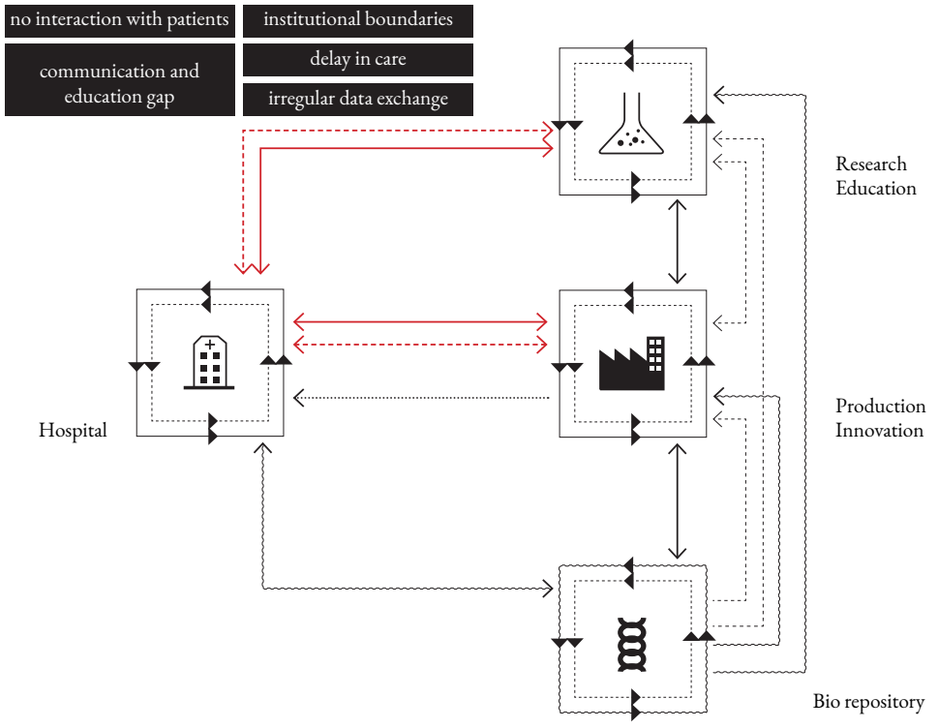


Figure - 7 Showing the current healthcare infrastructure have lacks between various parts of the industry

Apart from the issues discussed earlier, the current hospital model, often a mega-building typology, as depicted in Figure 8 can be overwhelming when placed on a site. It fails to connect with the surrounding urban fabric and the natural environment. The vertical stacking of functions limits circulation to just lifts or stairs, which makes emergency situations more difficult and hinders collaboration and interaction between different departments and people in the hospital.

Additionally, with patient rooms typically located at the top of these mega-structures, they are isolated from green or open spaces. Patients spend their recovery time in rooms that do little to support healing or psychological rehabilitation. The vertical design also complicates the delivery of care, as patients must move across multiple levels to access different departments. This leads to an unpleasant experience for both patients and staff, increasing unnecessary movement throughout the hospital.

Image -17 Collage showing sterile and non humane environment of the current hospitals

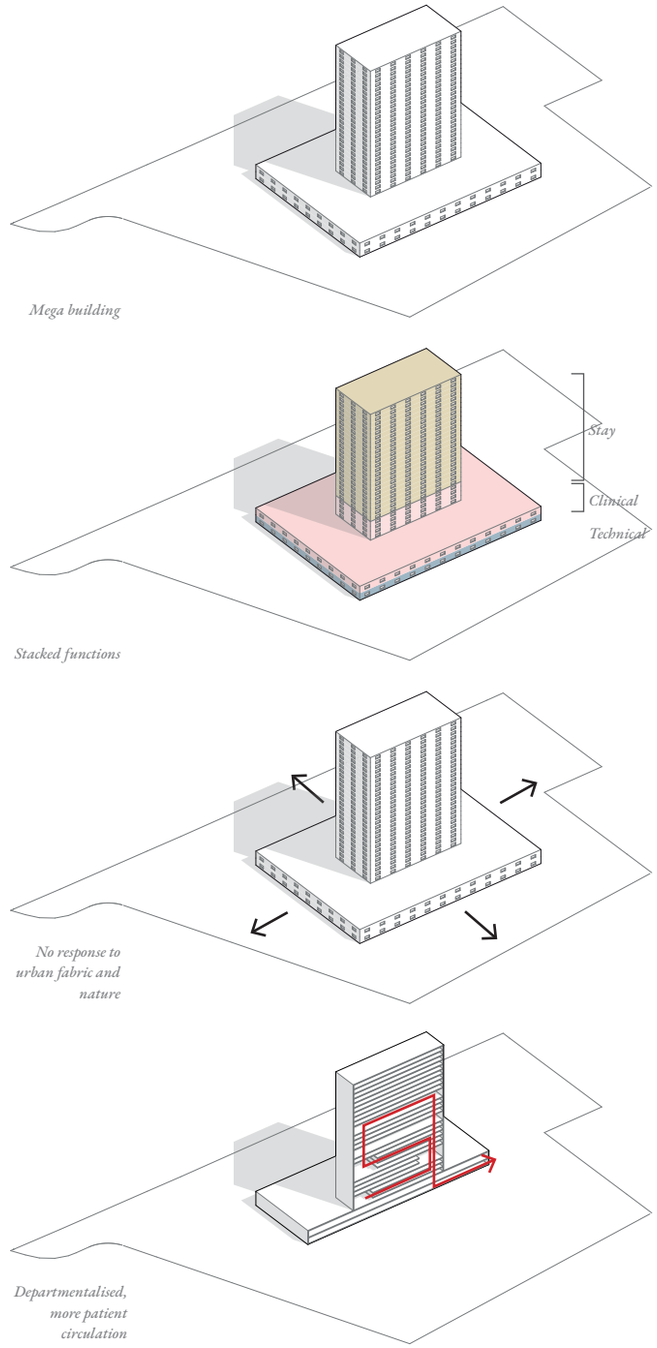


Figure - 8 Showing the cons of existing hospital infrastructure

The future of Healthcare

The future of healthcare lies in how architecture is used as a tool to shape it. Can the ever-evolving science behind treatments and procedures influence the design of healthcare spaces?

As seen in the previous chapter, current healthcare facilities are highly technical, rigid, and lack the capacity to evolve and adapt. They are not human-centered or welcoming to people. What if the science behind regeneration played a role in developing design parameters and determining the best location for such projects in the city, maximizing their potential—rather than simply housing hospital functions and reacting to existing needs?

The future hospital for regeneration will integrate the science of regeneration into its design. The project will be shaped by insights from the regeneration process, including functional requirements, patient needs, and usage patterns. Additionally, it will establish social and technical connections by selecting an optimal location based on the needs of regenerative care. Finally, the design itself will be driven by principles adapted from regenerative science, considering its impact on both patients and staff.

The framework shown in Figure 9 will guide the development of an optimal solution—an innovative design that will set a benchmark for the future of hospital architecture and regenerative healthcare.

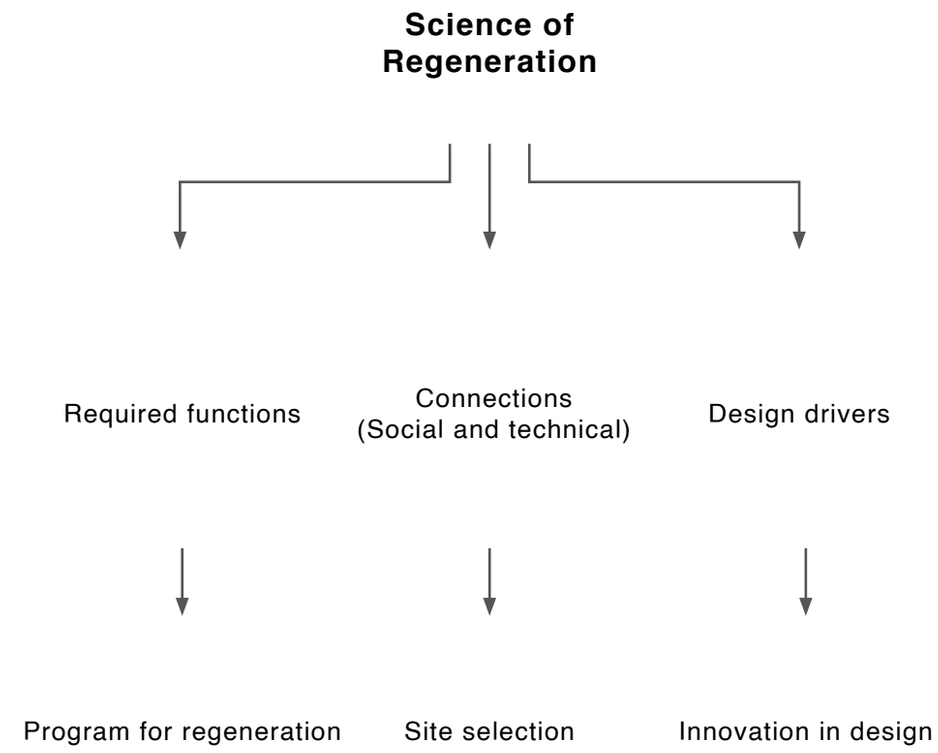


Figure - 9 Framework of project development

The Process & Collaboration

Unlike traditional healthcare formats and processes, regenerative care operates on a different model, incorporating additional steps that contribute to the overall regeneration of a patient. This process not only involves administering regenerative therapies but also includes the production of these therapies and bio-products using the patient's own cells and genes, ensuring treatments are 100% personalized.

As discussed in the previous section, the current healthcare infrastructure separates various critical processes such as research, analysis, storage, and production across different locations. This fragmentation leads to errors, delays in treatment delivery, and slowdowns in innovation and clinical trials. Additionally, the transportation of biological material poses a high risk of contamination. Any leaks or accidental releases could not only compromise the biological matter itself but also pose potential health hazards to the general population.

The hospital of the future must integrate all stages of regenerative medicine—from the procurement of biological material to production and administration of therapies—into a single, streamlined system. The proposed project consists of four key components:
Hospital Care ,Research, Education, and Analysis, Production and Innovation, and Bio-Repository.

This integrated model ensures a seamless, efficient approach to patient care. As highlighted in multiple scientific journals (referenced in Image 18), regenerative medicine can only reach its full potential if key components of the industry are brought together under one roof, fostering a collaborative and innovation-driven environment.

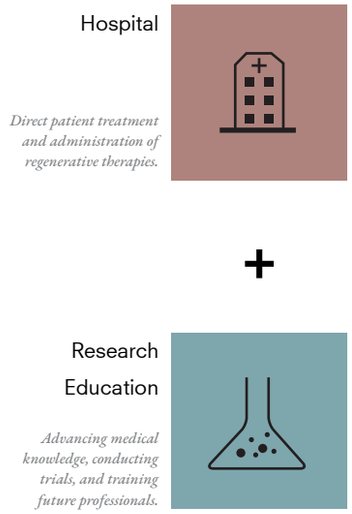


Figure - 10 Major parts of regenerative treatments

Not to forget in the spirit of ingenuity, regenerative medicine is a **collaborative effort**.

- Yannas IV. Tissue and Organ Regeneration in Adults. Springer, NY, USA (2001).

A successful regenerative medicine initiative requires the expert knowledge of **scientists, engineers, physicians, researchers and many others** in a multidisciplinary effort....

- Hutmacher, D. W. (2006) 'Regenerative medicine will impact, but not replace, the medical device industry', Expert Review of Medical Devices

The new ecosystem need to **co-locate** outpatient, inpatient, rehabilitation, wellness and prevention, ancillary support spaces, and industry (research and development) **all under one roof**.

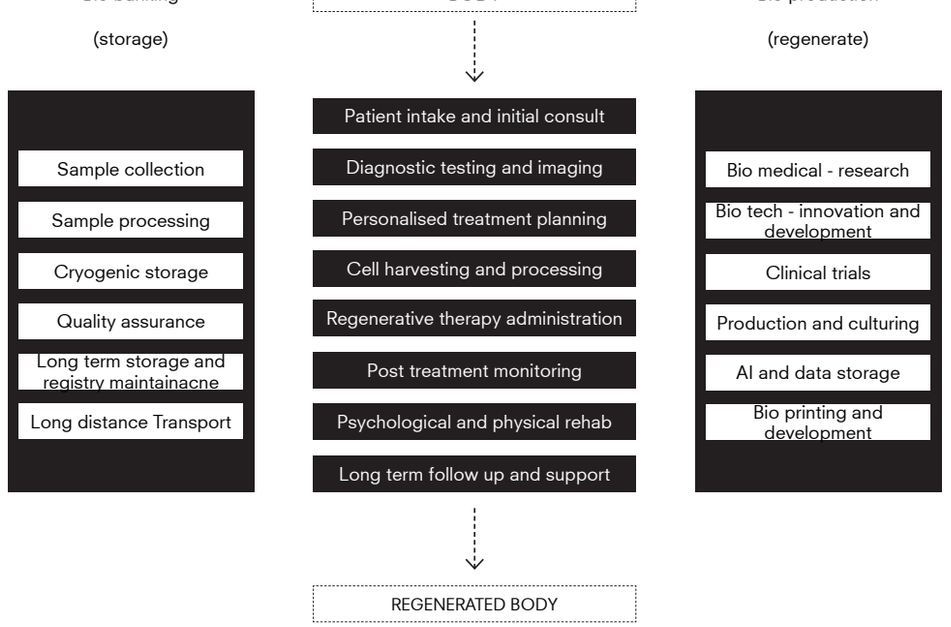


Image - 18 References from scientific journals | Figure - 11 The process and spaces involved in regenerative treatment

Hospitals need to evolve by integrating both the human aspect of care and the scientific advancements that drive modern healthcare.

“How does the architectural design of a hospital change to support the development and delivery of regenerative treatments while enhancing patient experience?”

1. Collaboration of different programs and its arrangements.
2. Creating an environment that provides optimal care and functionality

Program

Area & Spatial layout

Program formation

The main aim of the project is to introduce the future hospital for human regeneration, which can incoporate all the functions of human regeneration from procurement of bio samples to producing and delivering the final regenerative therapies and sometimes entire organs and at the same time the should be an hospital that can play a pivotal role in the urban context it is placed, incorporating funtions that will engage and encourage people to become part of this hospital, program and spaces that can create a collaborative environment between, staff, patients, visitors and other researchers and bio medical engineers.

To properly understand the working of a hospital and other parts of the functions proposed, a benchmarking casestudies are done to understand the area requirements, spatial layouts and flows. Being a verys specialised hospital the case studies were more focused on hospital that range between 100-200 rooms which fall into medium size hospitals. Further research buildings, production spaces and bio storage spaces were also studied to understand its working and scale. This study of various buildings will provide a framework for designing them and how big the project grows. Starting from the larger scale of whole buildings and areas the case study also look into smaller spaces, labs, diagnostic spaces, patient rooms and more. Most importantly as the operation/ treatment space becomes the most import part of change from traditional to regenerative treatement a detailed study of trends of how the operation theatres have been changing with medical innovations is done. (refer appendix)

Lastly the most important part becomes the public functions which will help in anchoring this project in a specific site, which will also be affected by the site it sits, in this case it sits in the Bayer pharma campus, Berlin (alloborated in next chapter of site). The project will incoporate functions of office spaces for the developing scientific companies invoved in regenrative care. This offices are related to education, training and innovation and incubator labs that will help in creating a wholesome environment of knowledge and experimentation. Supporting the development of startups and regenerative technology, the proposal will consist of spaces like auditorium, simulation spaces and consotium spaces also educating the normal people about the advancements in regenerative treatments.

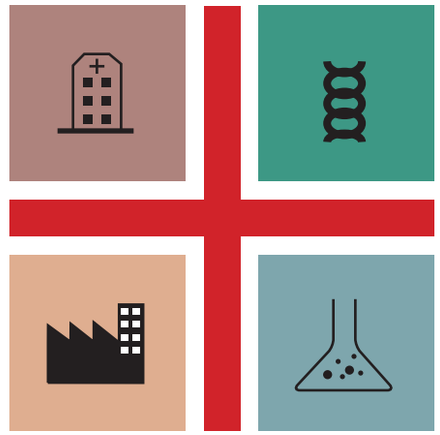


Figure - 12 Four main parts of regenerative care

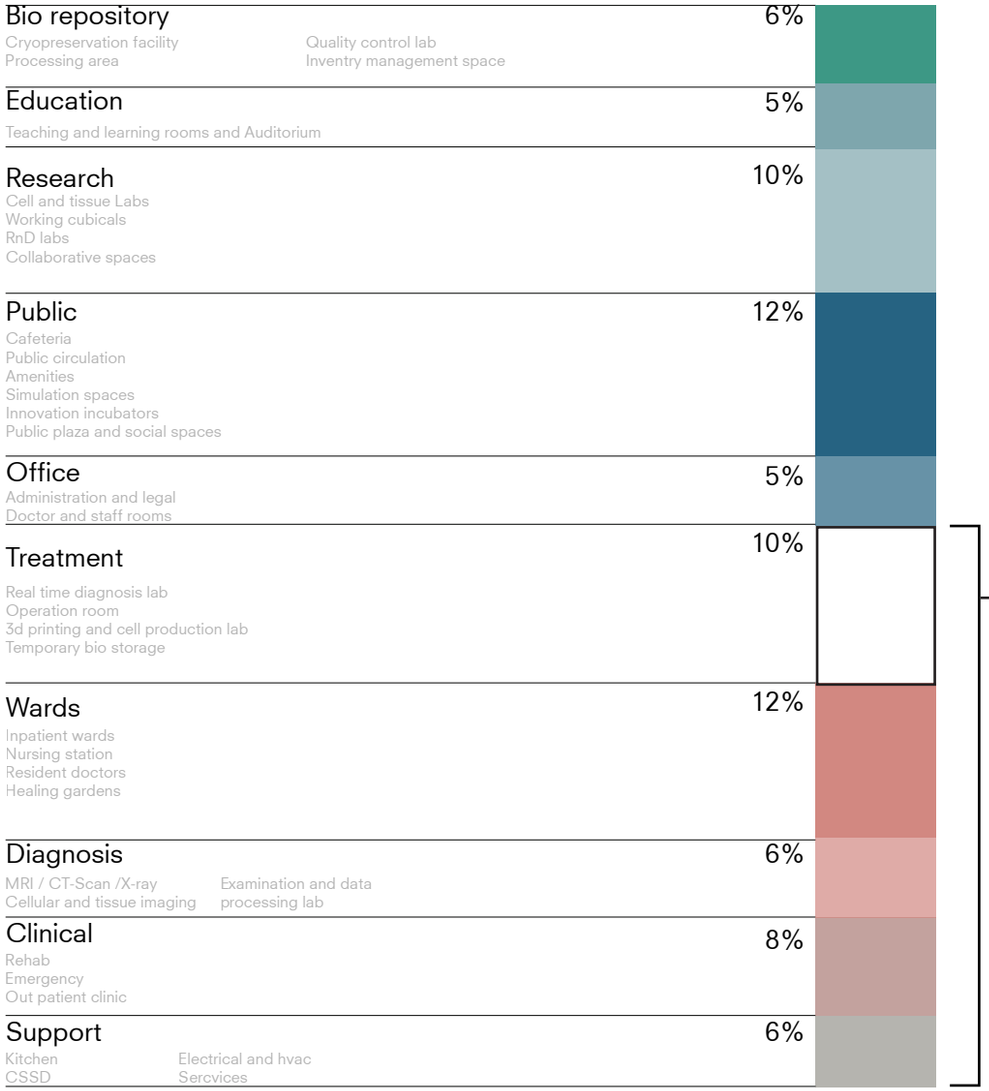
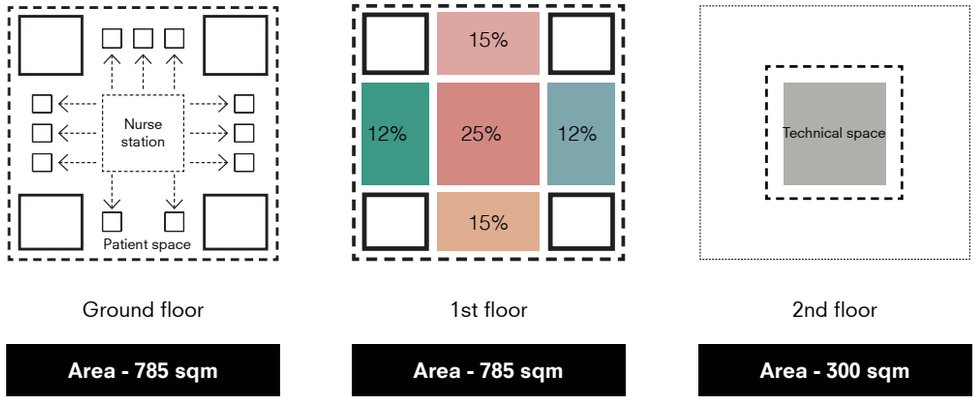


Figure - 13 Final program with area demarcation



Based on the requirements for the number of beds, the spaces needed to accommodate various regenerative activities, and the technical areas necessary for back of the wall operations, the overall program for the hospital is estimated to be around 51,000 sqm.
A significant portion of the hospital's program will be structured around regenerative modules (detailed in the later design chapter). Figure 14 illustrates the basic formation of these modules, consisting of three layers and key functional areas. The interrelation between these regenerative modules and the rest of the hospital is further explored in subsequent chapters.
Additionally, public spaces play a crucial role in the program, accounting for approximately 12% of the total area. This space will not only for a connetion between people and the regenerative science but will establish a physical connection between the hospital and the Bayer campus to the Spree river.

Figure - 14 Area and spaces as part of the regenerative module

Clients and Users

Ambitions and usage

Patients | Medical staff | Bio matter | Family

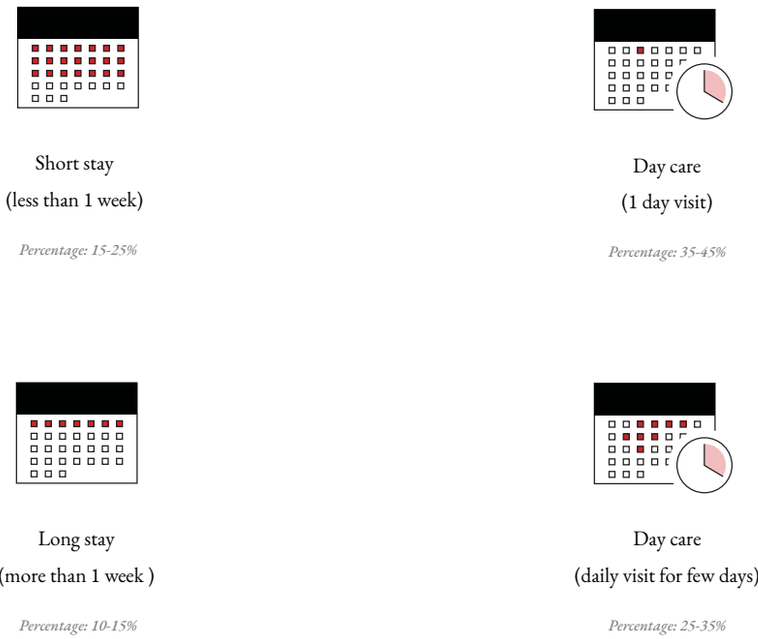
Visitors | Locals | Researchers | Engineers and innovators

Users

With the future hospital serving as a hub for collaboration across various functions, new actors traditionally not part of the hospital also become integral to its ecosystem. The introduction of research, analysis, production, and public functions expands the scope of stakeholders beyond doctors, patients, and clinical staff to include researchers, bioengineers, innovators, officials from biomedical companies, and, most importantly, the local community, as the hospital becomes an active part of the city.

A key aspect of regenerative medicine is its reliance on biological matter namely cells, tissues, and organs which, in itself becomes a crucial “actor” within the hospital. As these biological components are transported from one space to another, their presence adds a new dimension to circulation within the hospital, creating a dedicated movement system while also interrelating with the rest of the facility.

Figure - 15 Various users/ actors of the future hospital



Short stay
(less than 1 week)

Percentage: 15-25%

Day care
(1 day visit)

Percentage: 35-45%

Long stay
(more than 1 week)

Percentage: 10-15%

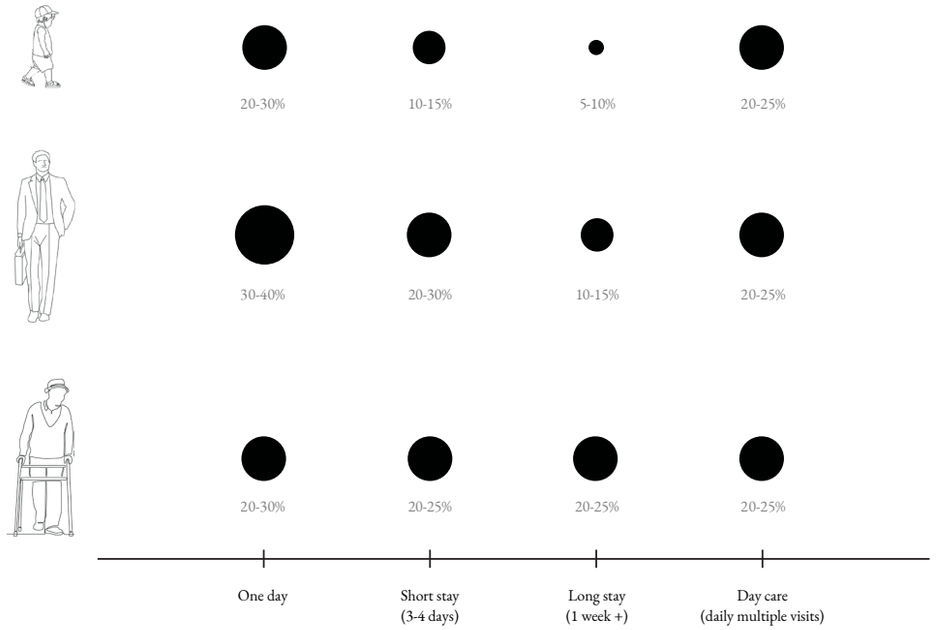
Day care
(daily visit for few days)

Percentage: 25-35%

Users - Patients

To design spaces dedicated to regeneration, it is essential to understand patient profiles. This study focuses on identifying the types of patients who will use the facility and their duration of stay. Since regeneration primarily involves personalized treatments and therapies, mostly non-invasive or minimally invasive procedures, except for major organ or tissue transplants, the hospital’s design and programming must adapt accordingly.
As a result, the need for long-stay hospital beds decreases, while the demand for short-term care, such as day-care treatment beds, increases. Figure 16 illustrates the percentage of patients based on their hospital stay duration, while Figure 17, 18 further analyzes the age distribution of these patients. Additionally, patients can be categorized into three main types based on their purpose of visit:
Patient A - Visits to deliver and store biological material.
Patient B - Seeks non-invasive or minimally invasive treatments.
Patient C - Undergoes major surgeries or transplants and requires extended rehabilitation.
(Figure 19, 20 visually represents these patient categories.)

Figure - 16 Patient’s stay duration and their percentage



Children

(0-18 years)

Percentage: 15-20%

Adults

(19-64 years)

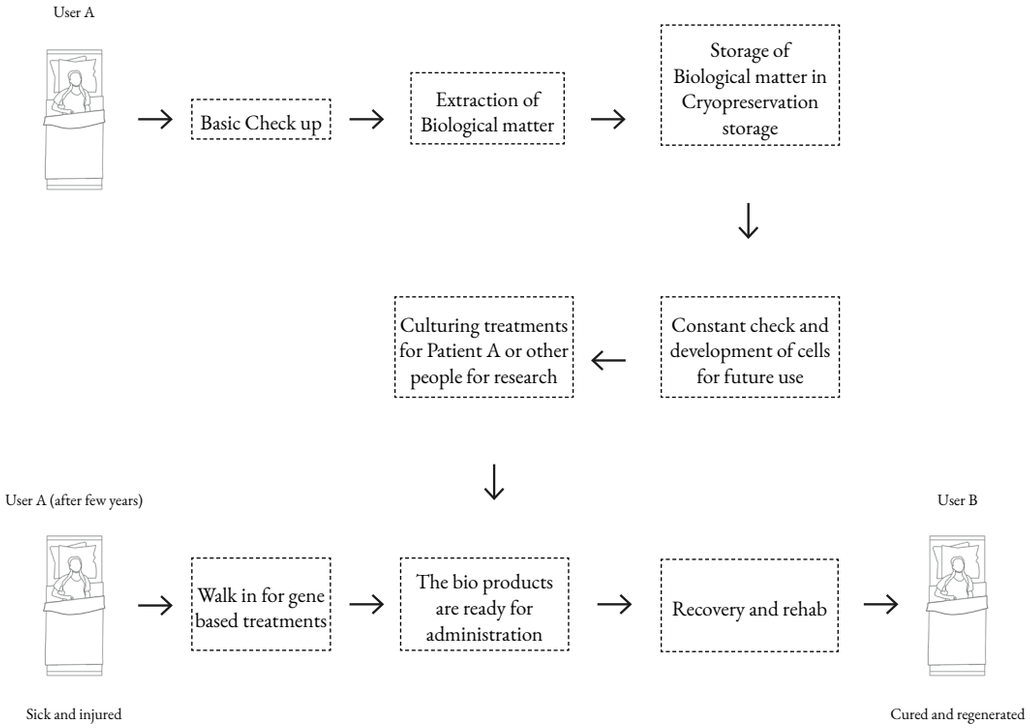
Percentage: 50-60%

Elderly

(65+ years)

Percentage: 25-35%

Figure - 17 (above) Patient age profile and their reation with stay duration | Figure - 18 (below) Visiting patient age profiles and its percentage



Patient A

(For biological deposite)

Percentage: 30-40%

Patient B

(regenerative therapies)

Percentage: 30-40%

Patient C

(Transplants/ undergoing operation)

Percentage: 10-20%

Figure - 19 (above) Process of regeneration showing different stages and the type of patient involved |
Figure - 20 (below) Patient type based on what stage of treatmentnt they are on.

Clients

Berlin, Germany, has long been a global leader in healthcare innovation and advancement. The city is home to numerous world renowned healthcare facilities and biotech companies. The future hospital for regeneration will operate with two primary focuses: treatment and research/production.

Charité, one of the largest hospital networks in Berlin, has recently expanded into regenerative medicine and cell-based treatments, making it a key stakeholder in the future regeneration hospital. Alongside Charité, Bayer Pharma currently playing a significant role in researching and developing cell-based therapies, emerges as the second major stakeholder. Both institutions have recently announced plans to establish a Center for Cell and Gene Therapy in Berlin, reinforcing their position as the most suitable clients for this hospital project.

Additionally, the hospital will collaborate with other leading organizations involved in regenerative medicine, such as the Max Delbrück Center and BIH Regeneration, to establish a major hub for regenerative research and foster focused collaboration.

On a regulatory level, the International Stem Cell Forum and EuroStemCell will oversee the transport and storage of biological material within the hospital's Bio-Repository. Lastly, the Federal Ministry of Health and the Berlin State Government will oversee administrative regulations and urban planning to ensure seamless integration into the city.

Figure - 21 (above) Main stake holders of the future regenerative hospital | Figure - 22 (below) Berlin shown as the global leader in healthcare on a world map

EINSTEIN CENTER
Regenerative Therapies

Berlin-Brandenburg Center for Regenerative Therapies **BCRT**

BSRT Berlin School fo

Research centers

Past consortiums

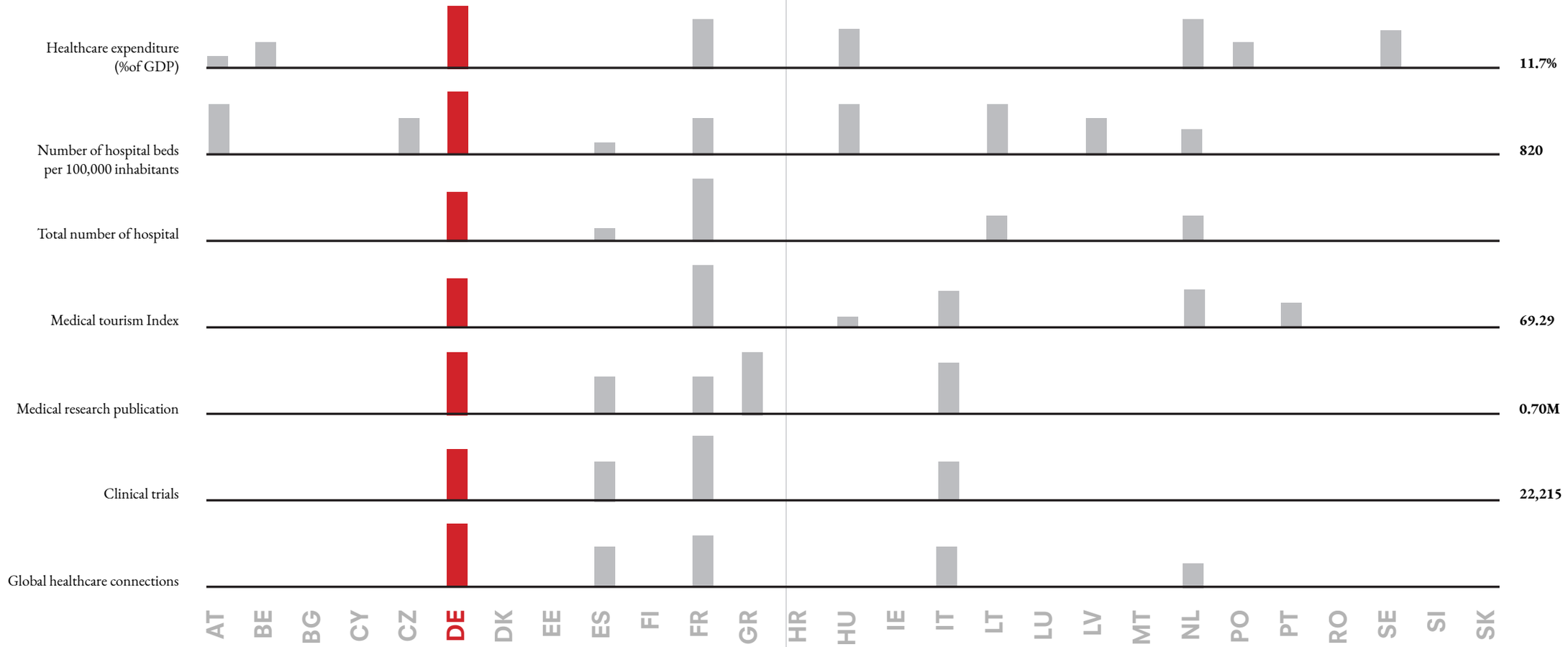


Figure - 23 Berlin and its involments and advancements in medicine and healthcare making it the global leader

‘THE STATE OF BERLIN SETS A FOUNDING STONE FOR BERLIN AND BRANDENBURG CENTER FOR REGENERATIVE MEIDICNE’

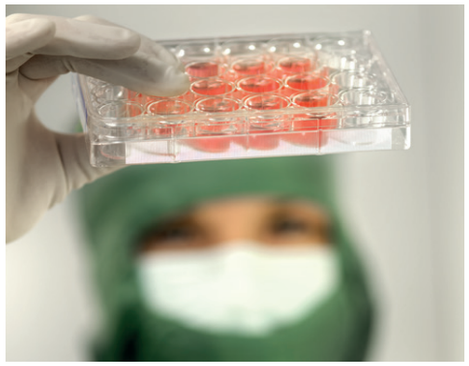
‘THE STATE OF BERLIN HOSTS CONSORTIUM AND CONFERENCES FOR REGENERATIVE MEDICINE’

‘BERLIN TO BECOME FIRST CITY TO HAVE A SPECIALISED HOSPITAL FOR CELL / GENE THERAPIES AND REGENERATIVE THERAPIES’

By Charite, BIH, BIFOLD, and Max Delbruck center for molecular medicine

2006 ***2009*** ***2023***

2007 ***2019*** ***2024***



‘CHARITE AND OTHER HOSPITALS AND RESEARCH INSTITUTES JOIN THE CHANGE, Einstein center for regenerative therapies, by charite

‘THE STATE OF BERLIN, BAYER AND CHARITE ARE PLANNING A HEALTHCARE LIGHTHOUSE PROJECT IN THE MITTE BOROUGH’

focusing on cell based treatments and regeneration.

‘THE STATE OF BERLIN SETS A FOUNDING STONE FOR BERLIN AND BRANDENBURG CENTER FOR REGENERATIVE MEIDICNE’

Figure - 24 Timeline showing Berli's relation with regenerative medicine

Client ambitions

One time solution to Chronic diseases and old age problems

Understanding the healing power of Human body

Berlin as the hub of regeneration

Human and technology symbiosis
AI driven systems

Centralised stem cell repository
(Large scale storage bank)

Realising the potential of Collaborations

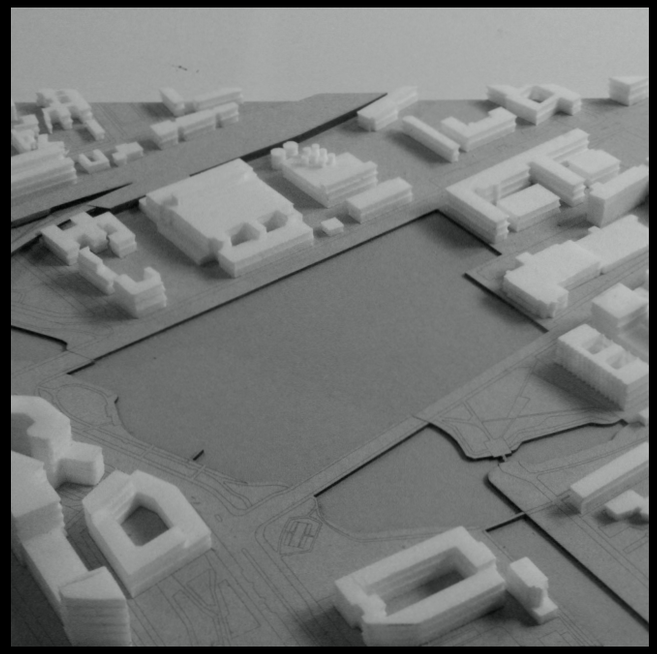
A step forward in creating a center that works on Translational science.
Bench to Bedside and Bedside to Bench

A holistic approach to health and well being
- more patient centric

Figure - 25 Berlin demarcated as the center of regeneration both globally and nationally for research innovation and transport of cells

Site

Selection and Analysis



Site parameters

To identify the most suitable site for the Future Regeneration Hospital, a detailed study of various parameters was conducted. These parameters were carefully chosen to address different aspects of the project at multiple scales of site selection. They can be categorized into three main sections:
Mobility
Regeneration Requirements
Urban Considerations

1. Mobility Considerations
The mobility criteria are adapted from group research on Berlin's transportation network, particularly focusing on the concept of a polycentric ring following the Berlin S-Bahn. This strategy aims to strengthen public mobility and enhance accessibility by positioning key facilities along the S-Bahn ring, giving Berlin's transport system a unique identity. To align with this vision, the following three parameters were adopted:
Travel time from the city center - The site must ensure a reasonable commute from central Berlin.
Proximity to an S-Bahn station - Easy access to public transport is crucial for patients, staff, and researchers.
Travel experience and visibility - The hospital should be visually connected to key S-Bahn stations, reinforcing its presence and accessibility.

2. Regeneration Requirements
Since regeneration is an emerging field, the site must support the hospital's long-term growth and adaptability. Key factors include:

Proximity to Biotech Clusters & Hospitals - The hospital should be located in a collaborative nexus with existing hospitals and biomedical research centers to foster innovation and knowledge exchange.
Future-proof expansion - The selected site should offer sufficient space for future growth as regenerative medicine advances.
Healing landscapes - The hospital environment should support both physical and mental regeneration. Nature plays a crucial role in healing, making proximity to green spaces essential.
Proximity to water - A waterfront location would contribute to a calming atmosphere while also enabling natural cooling systems and introducing water based transport options for patient care and bio-matter transfer.

3. Urban Considerations
From a public perspective, the hospital must be a visible and prominent urban landmark. A central location with strong connectivity will enhance its accessibility and public identity, ensuring it is an integral part of the city rather than a secluded facility.

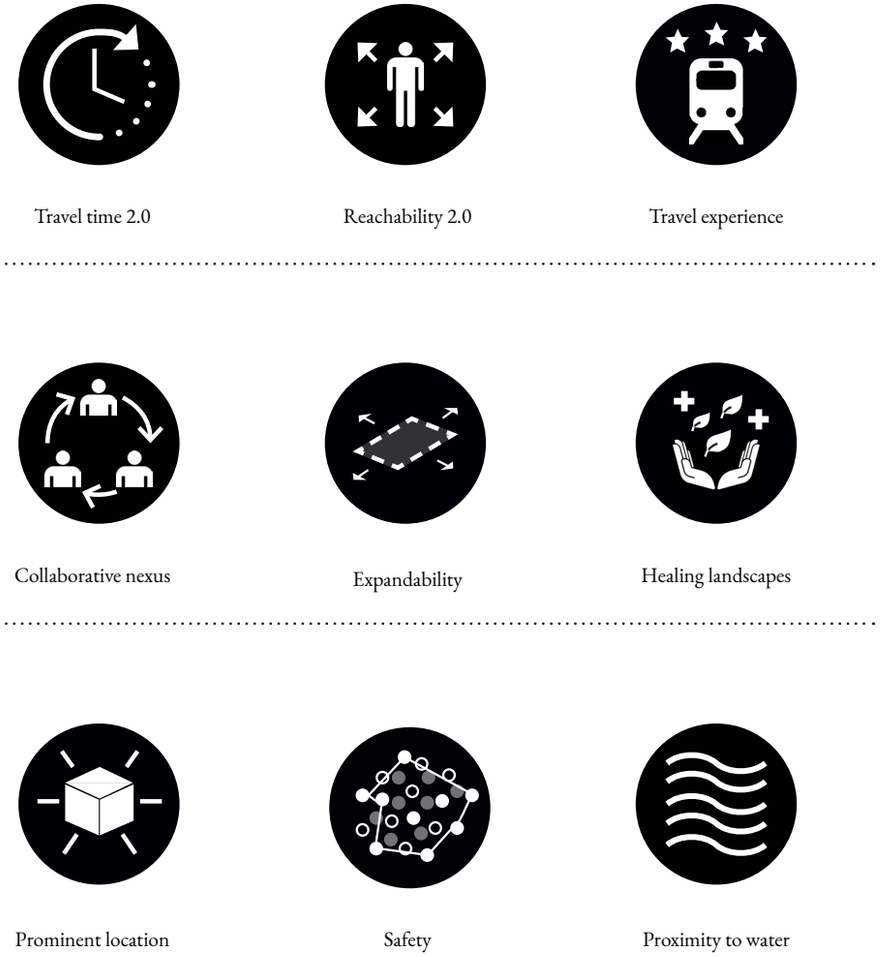


Figure - 26 Site parameters

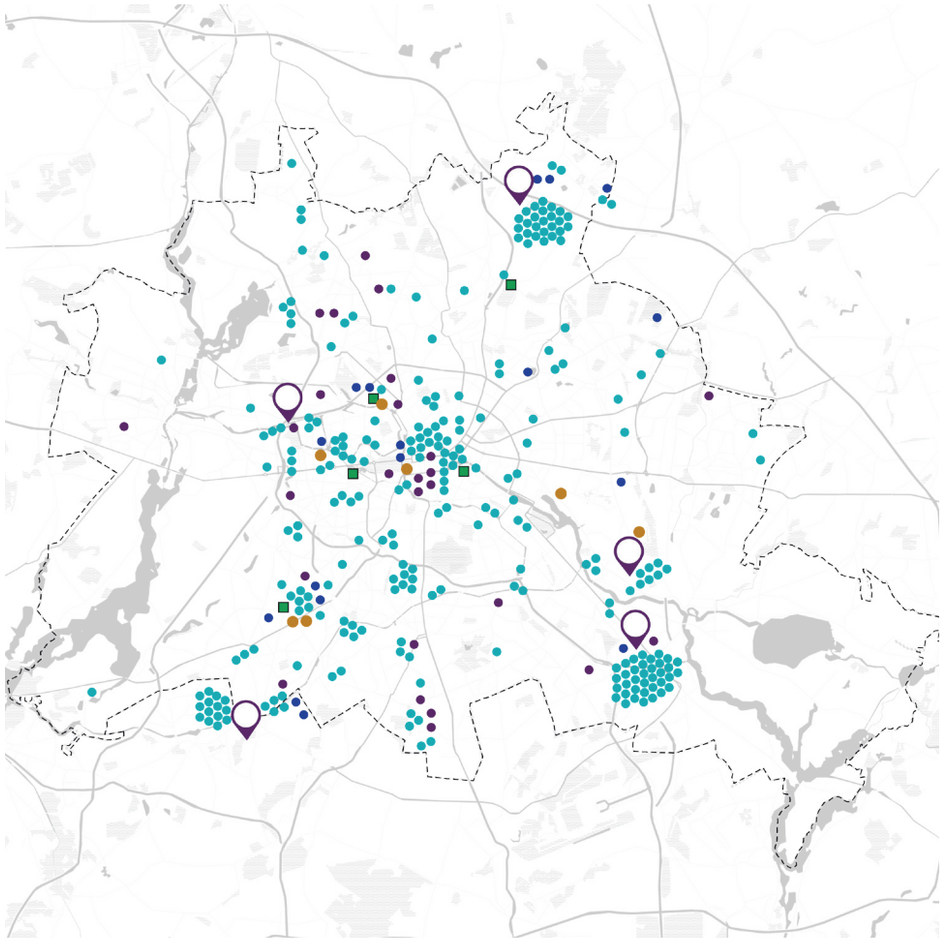


Figure - 27 Map with all biotech clusters in Berlin

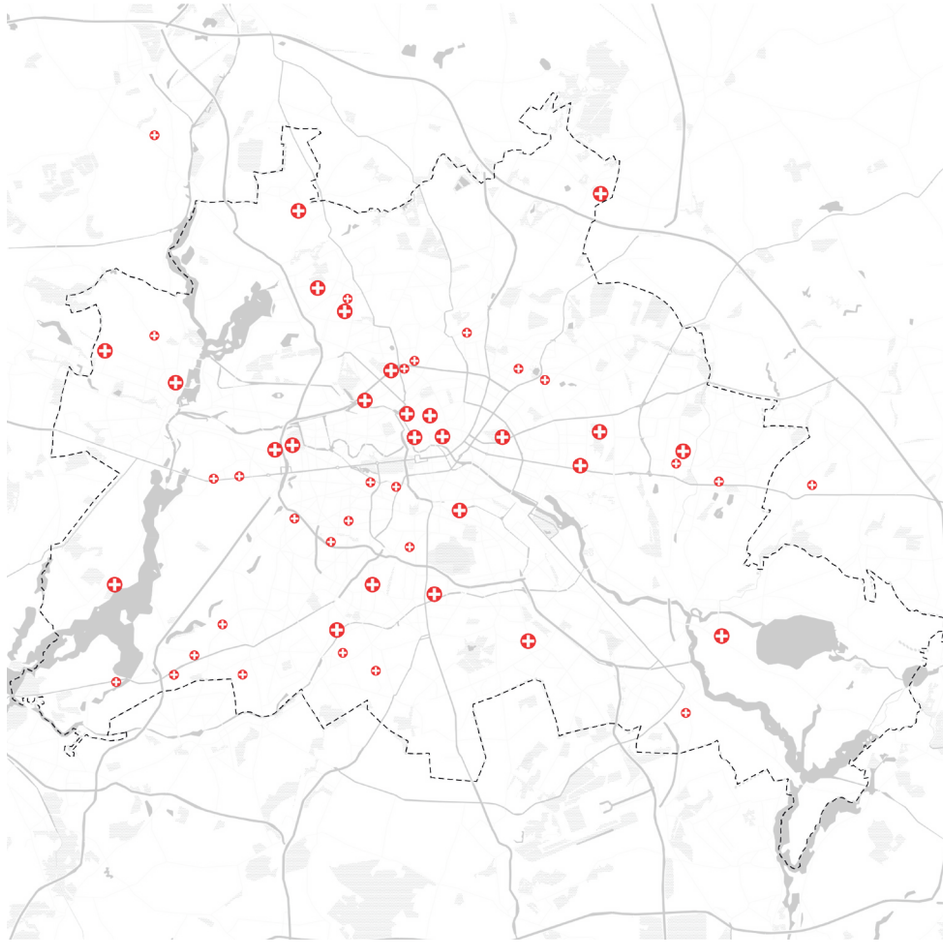


Figure - 28 Map showing all the exiting hospital infrastrcuture

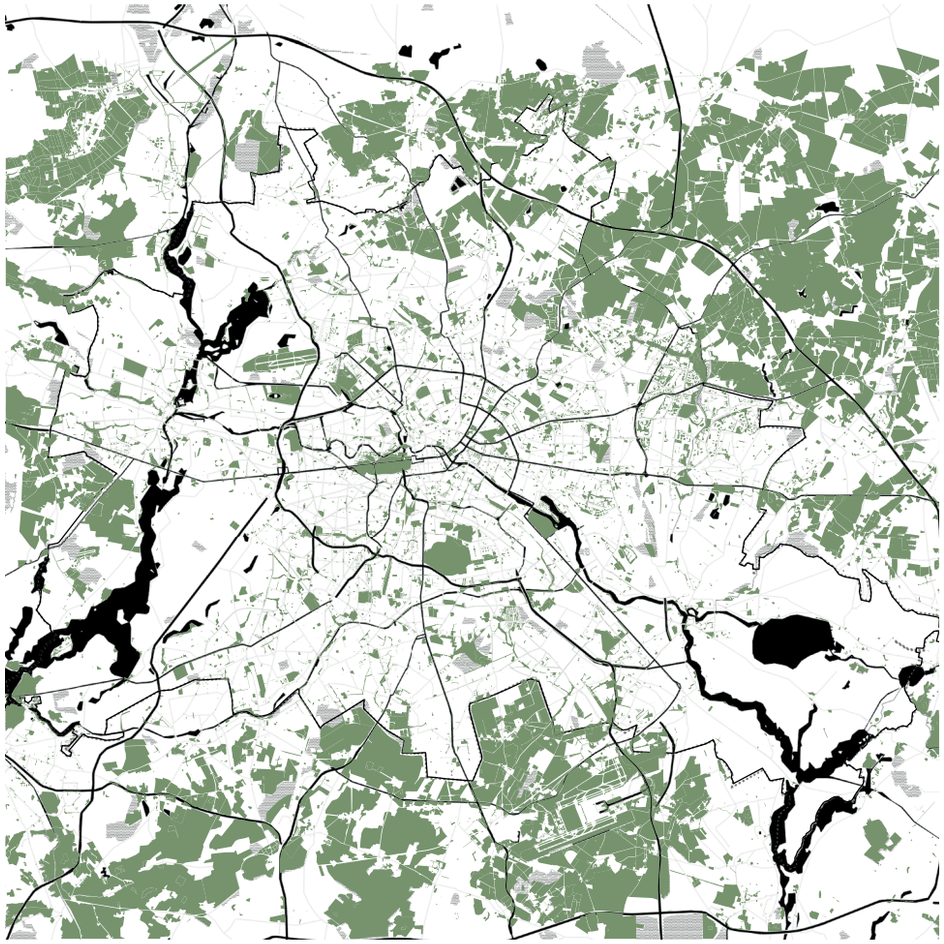


Figure - 29 Map showing the green/ natural layer of Berlin

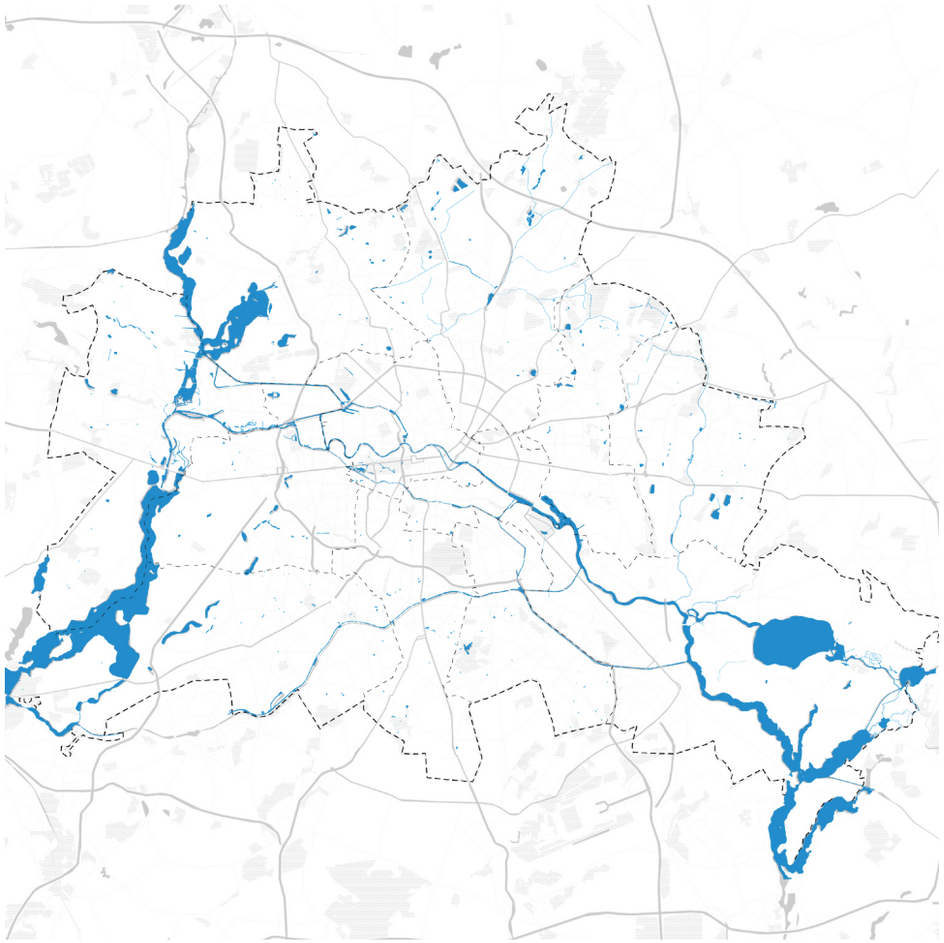


Figure - 30 Map showing the blue/ water bodies of Berlin

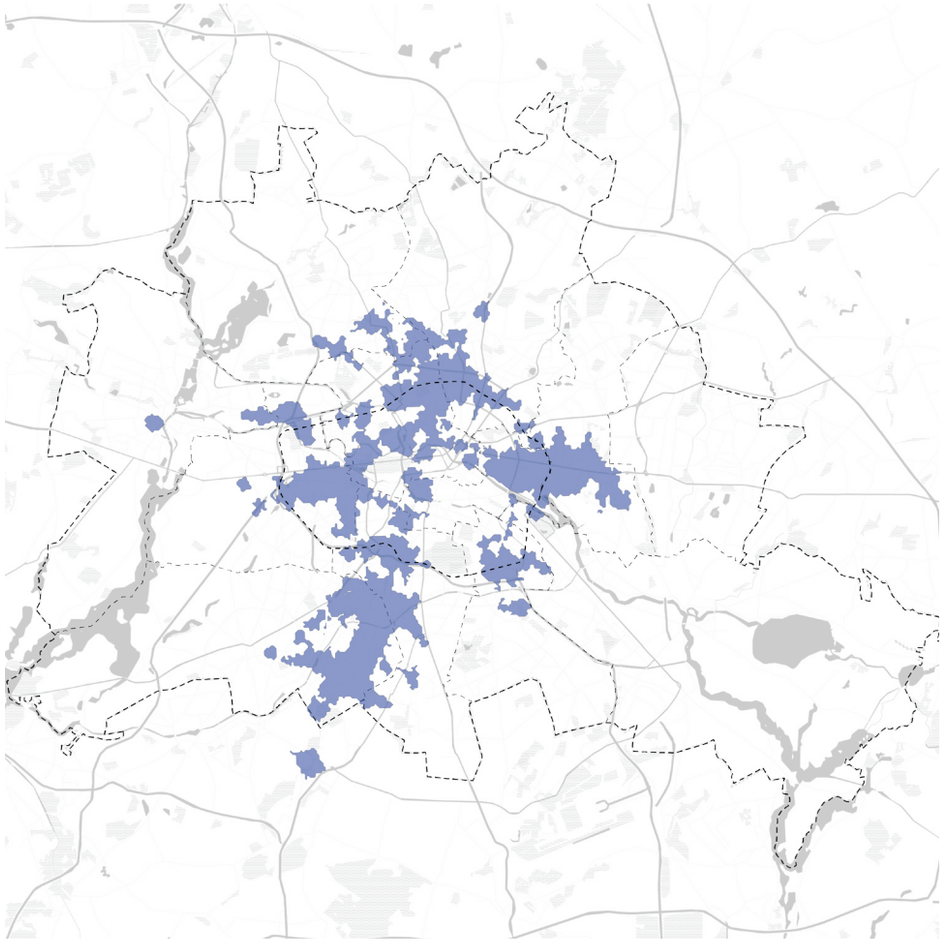


Figure - 31 Map showing 15min travel distance from the city center via public transport

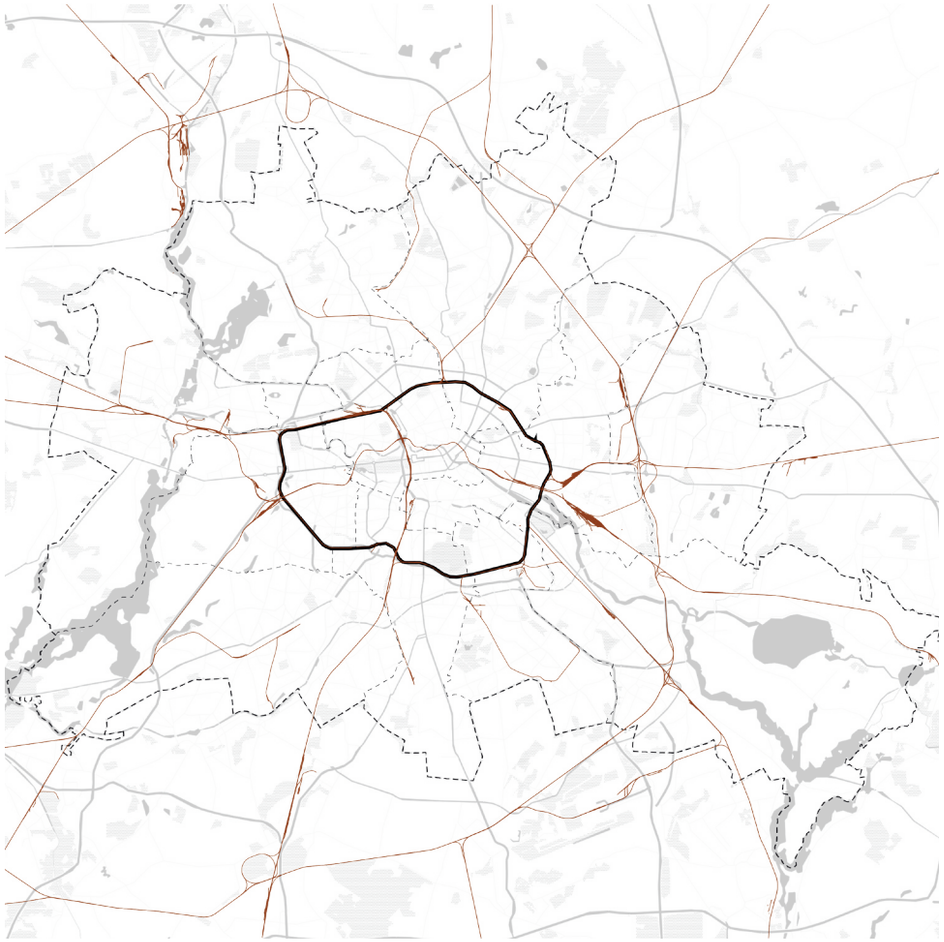


Figure - 32 Map showing Berlins SBahn route and other train lines

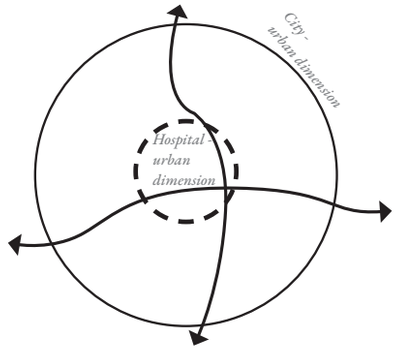
The urban hospital

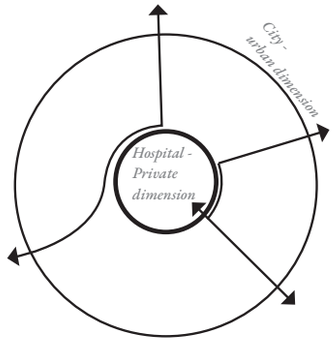
Hospitals today tend to follow two distinct approaches in terms of location. Some are placed outside the city, surrounded by nature, to enhance openness and promote healing through a connection with the environment. However, this isolates the hospital from the urban fabric, making it a private and secluded entity. On the other hand, hospitals located within the city are often highly enclosed and controlled, resembling a fortress in the urban landscape.

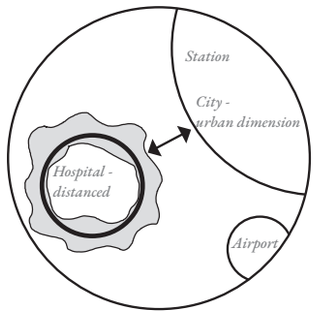
Looking back in history, hospitals were once true urban entities, integrated into city centers and fully open to the public, fostering learning, collaboration, and accessibility.

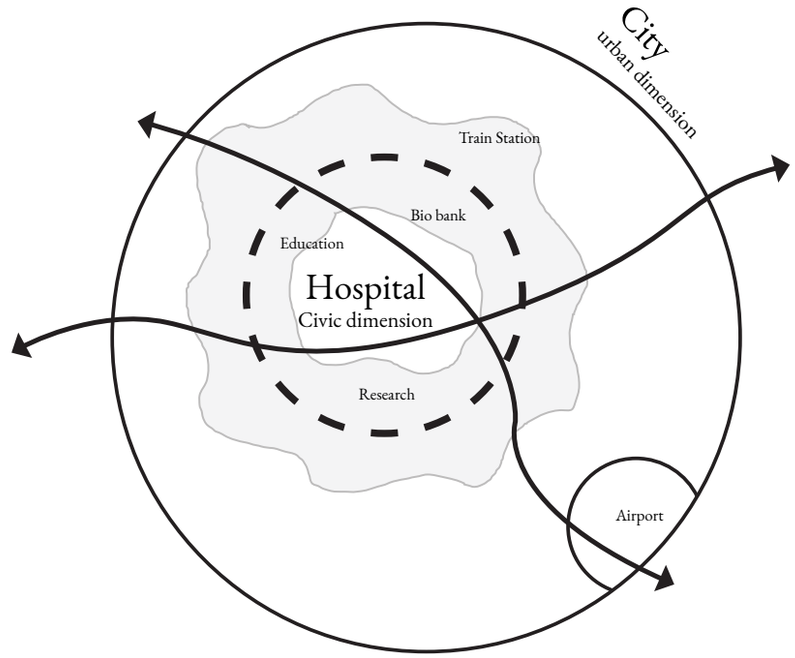
With regeneration being a relatively new concept, it is crucial to create opportunities for people to engage with advancements in human health. Making the hospital open and accessible will encourage public confidence in investing in regenerative treatments, preserving cells and genes for future medical use, and participating in innovative therapies and clinical trials.

To foster this environment, the hospital must be located in a place that is easily accessible while simultaneously serving as a true urban hospital, integrating with the city and opening up to the people, ensuring inclusivity and engagement.









A new urban form of the hospital that is open and accessible by all.

Figure - 33 (Left) Hospital to city relation in the past and current situation | Figure - 34 (above) Proposed hospital to city relation for regenerative hospital

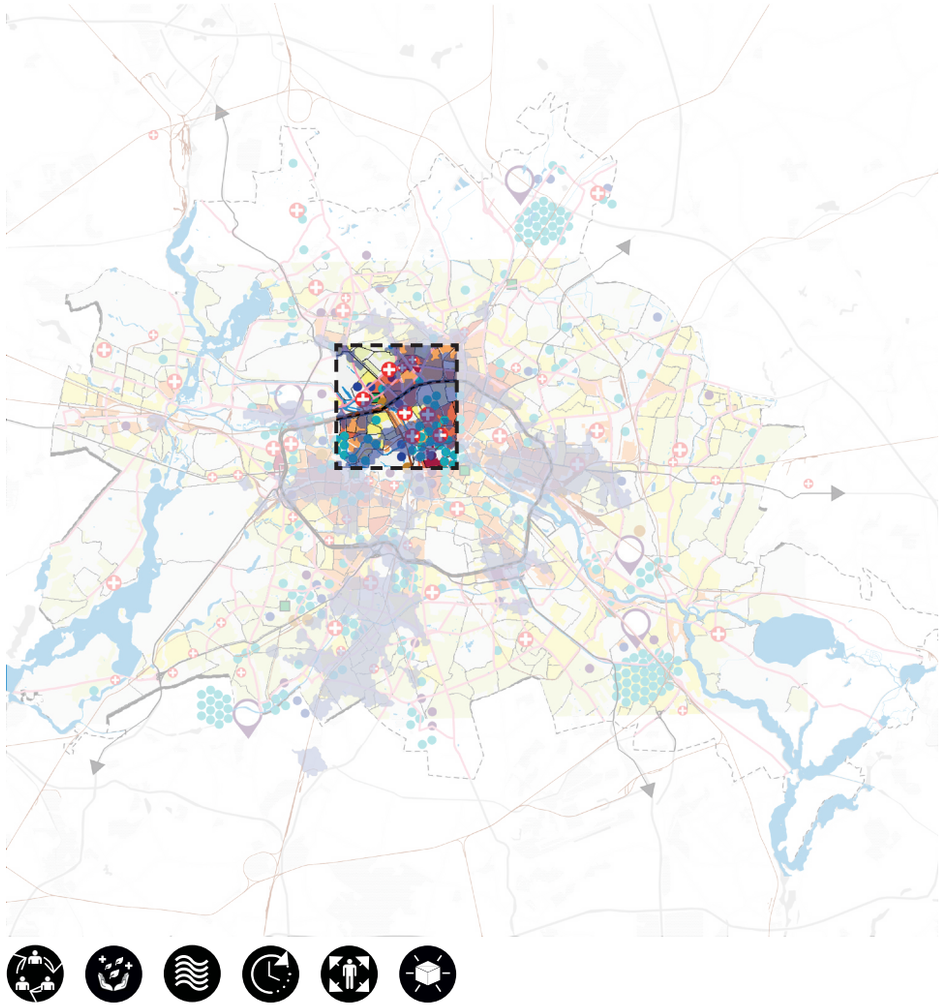


Figure - 35 Map showing consolidated layers of all the site parameters

Figure - 36 Map showing the final site located at Northhaven Berlin

Nordhaven

After evaluating various parameters, the Future Regeneration Hospital will be located in Nordhafen as part of the existing Bayer Pharma biomedical campus. The site is right next to the newly developed Europa City, which extends from Berlin Hauptbahnhof to Nordhafen. Its prominence is further enhanced by its connectivity to Bayer Pharma, while also being within a 5km radius of two Charité campuses. Additionally, the lush green riverfront and Nordhafen Park contribute to creating a healing environment, reinforcing the hospital's vision of regeneration not just physically but also mentally.

The site carries significant historical value as Nordhafen was once a major port for West Berlin, later becoming an important location in Albert Speer's Germania plan. According to this plan, the site would have served as the High Command of the Kriegsmarine (Navy), with Nordbahnhof as a major railway station right next to it. However, with the defeat of Nazi Germany, these plans were never realized, and the site has since evolved into a space of new urban and scientific potential.

Sitting within a diverse urban fabric, the site is positioned between corporate offices, production centers, and research labs on one side, while being bordered by a park on the other. Across the Spree River, the developing Europa City comprises residential and commercial spaces. This unique location allows the hospital to act as a missing link, integrating these currently fragmented urban environments and fostering a new connection between research, healthcare, and everyday city life.

Originally part of the city as Nordhafen, the site was later acquired by Bayer Pharma and is now being developed for future biomedical initiatives in partnership with Charité hospitals. The presence of these key stakeholders makes it an ideal location for a hospital focused on regenerative medicine, ensuring close collaboration between medical research, treatment, and innovation.

The site is well connected by various forms of public transportation, ensuring accessibility from all over the city. Its strategic location along the S-Bahn provides a direct connection to the airport, further strengthening its accessibility. Additionally, with a proposed new train station at the tip of Europa City, the site will soon gain even stronger connections to different parts of Berlin. This development will ensure that the hospital is not an isolated entity that people visit only for medical purposes but rather an active urban space seamlessly integrated into the daily movement and activities of the city.

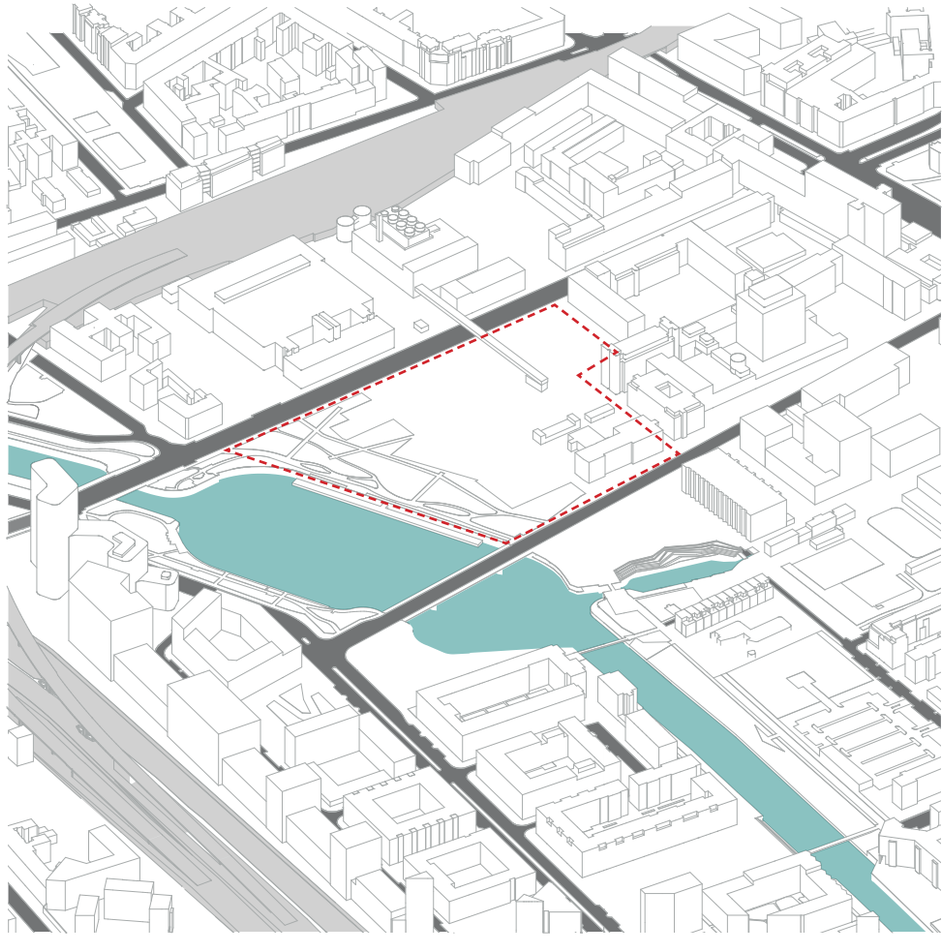


Figure - 37 Axometric view of the site and its surroundings

Image - 19 Site from opposite river bank

Image - 20 Site with Bayer's main buiding in the background

Image - 21 Bayer's production unit on the top of the site

Image - 22 Historic energy buiding on south side of the site next ot the park

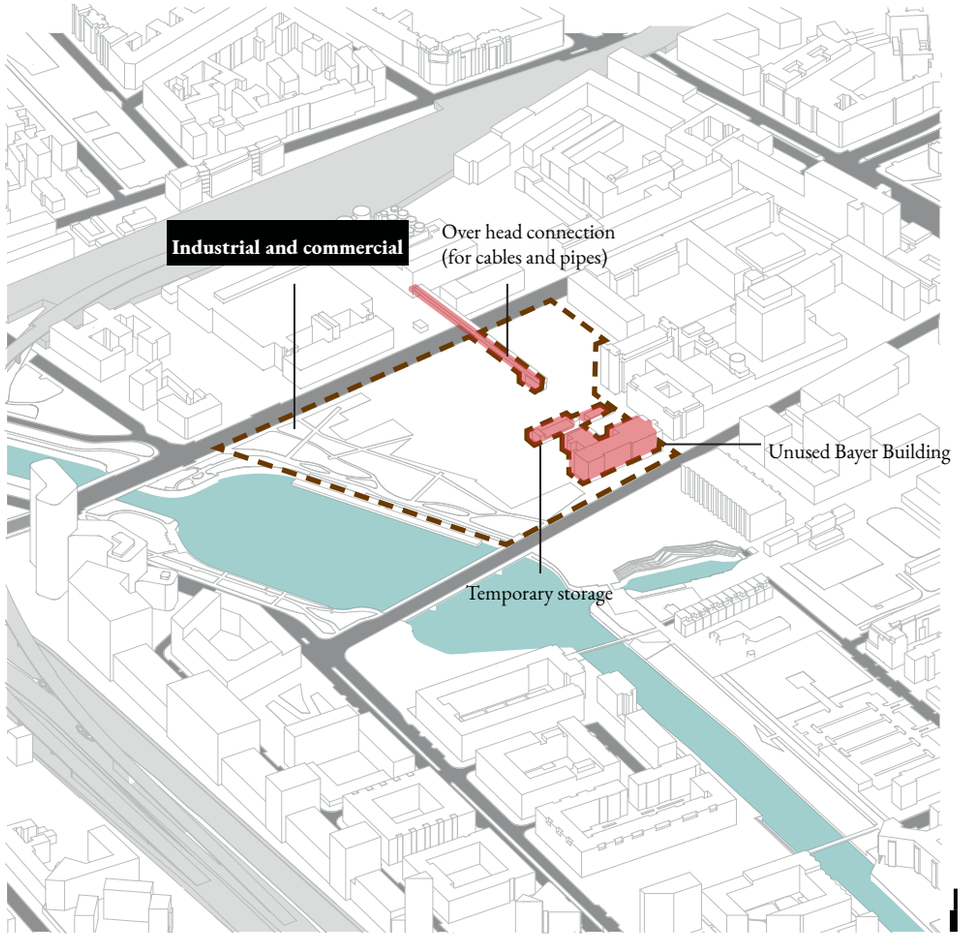


Figure - 38 Axometric view showing site and site situation

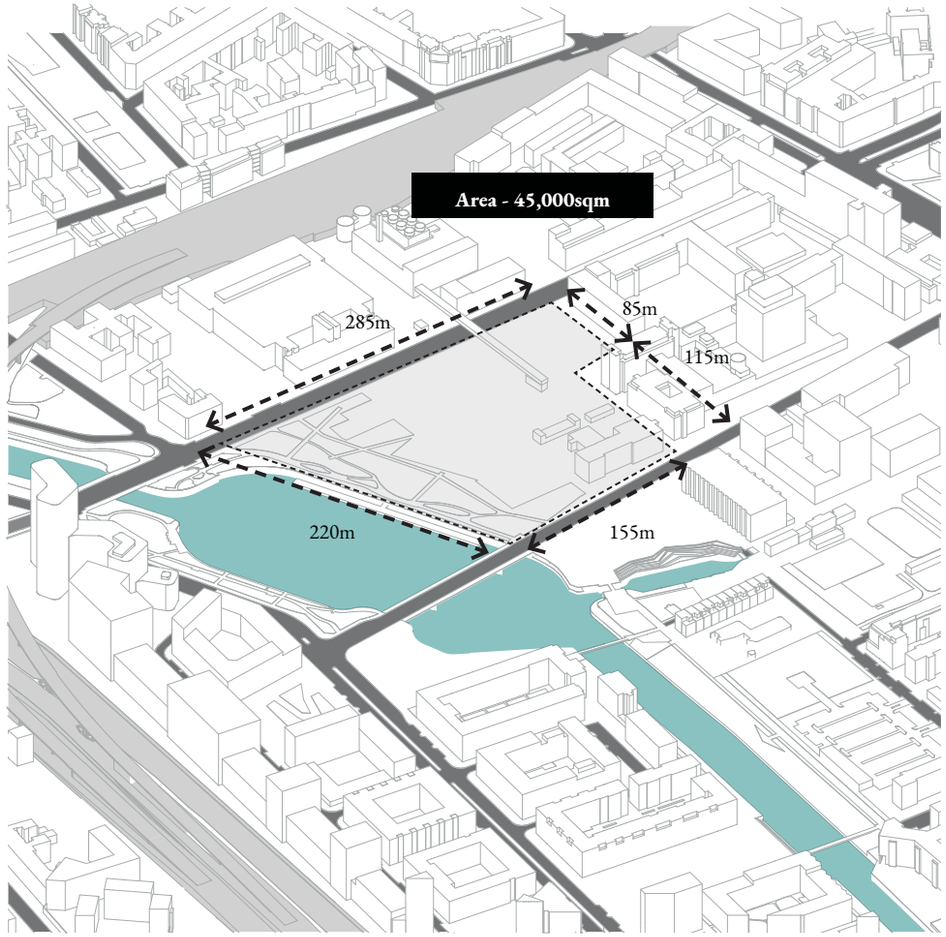


Figure - 39 Axometric view showing site and site dimensions

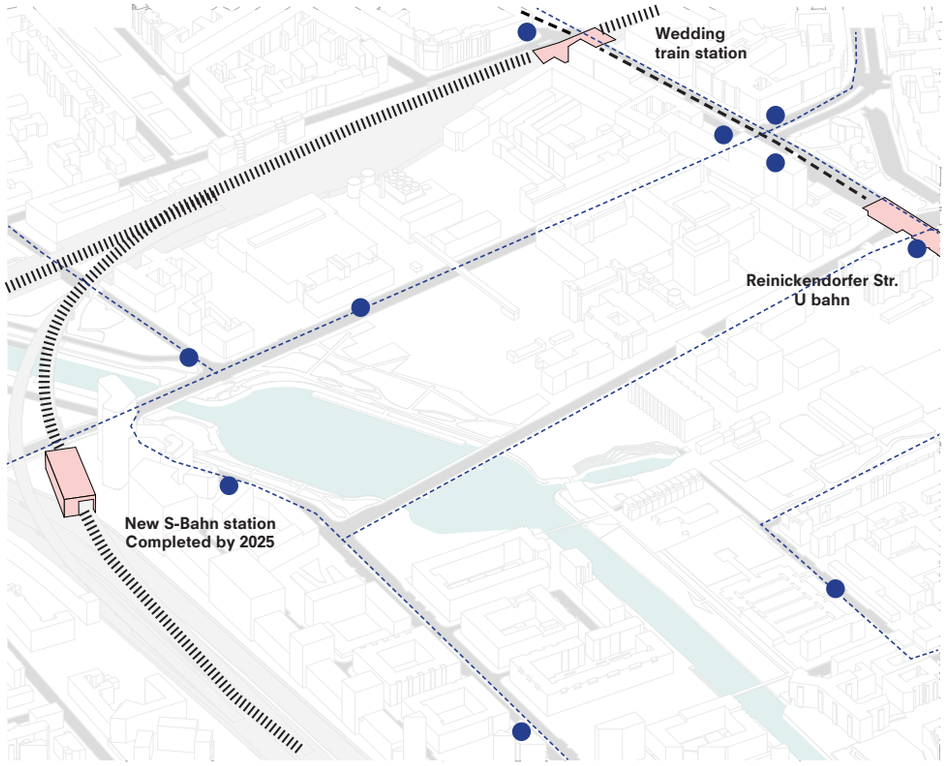


Figure - 40 Axometric view showing site and accessibility by public transport

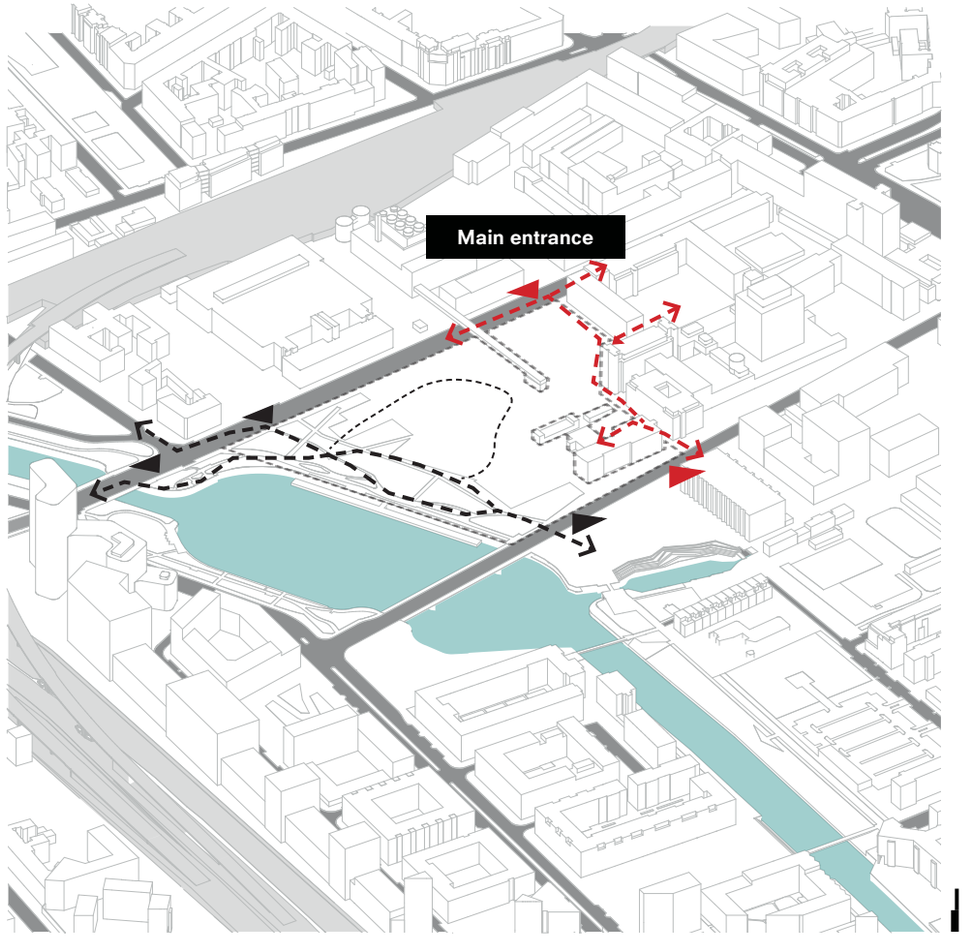


Figure - 41 Axometric view showing site and its access routes

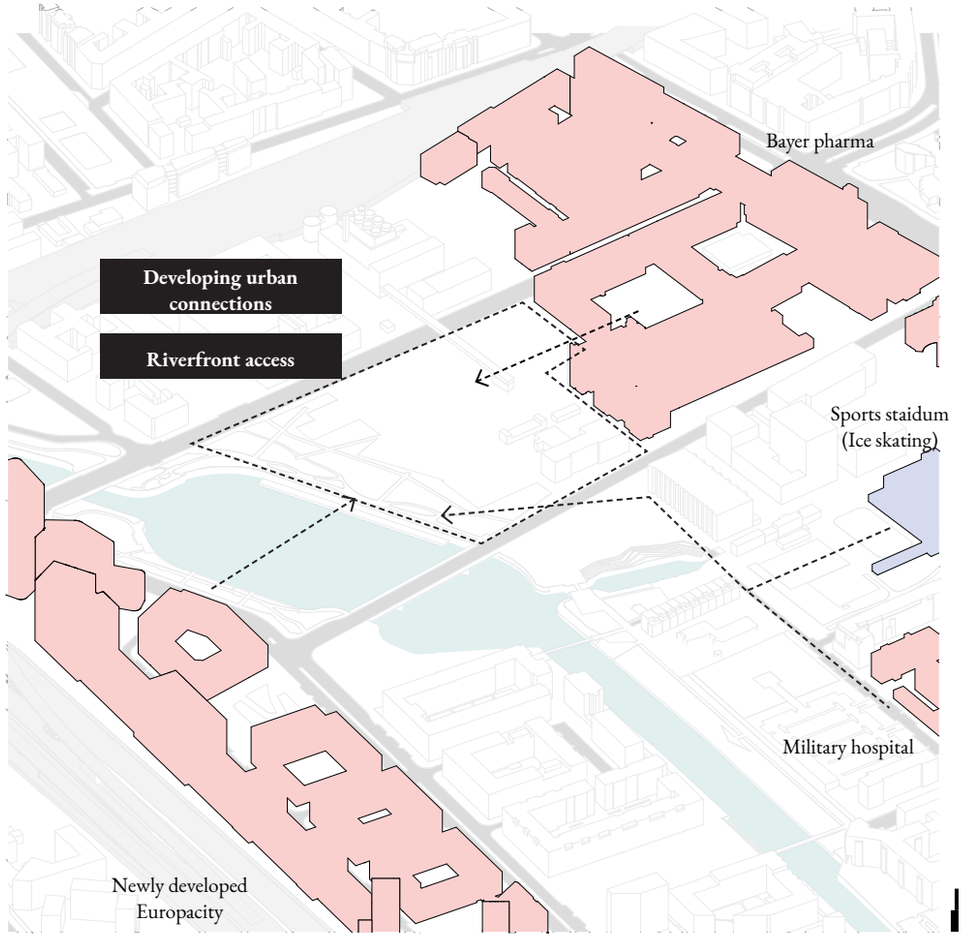


Figure - 42 Axometric view showing site and surrounding major buildings and public hotspots

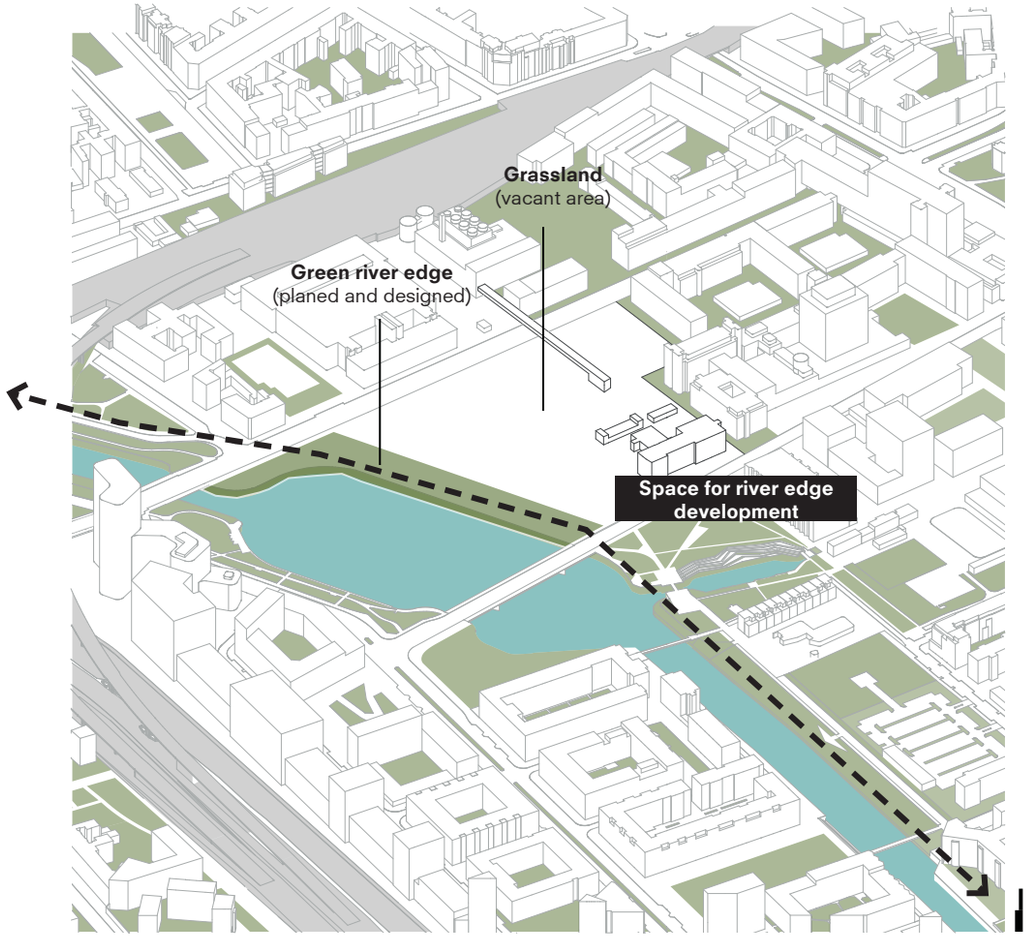


Figure - 43 Axometric view showing site and the green belt running through it

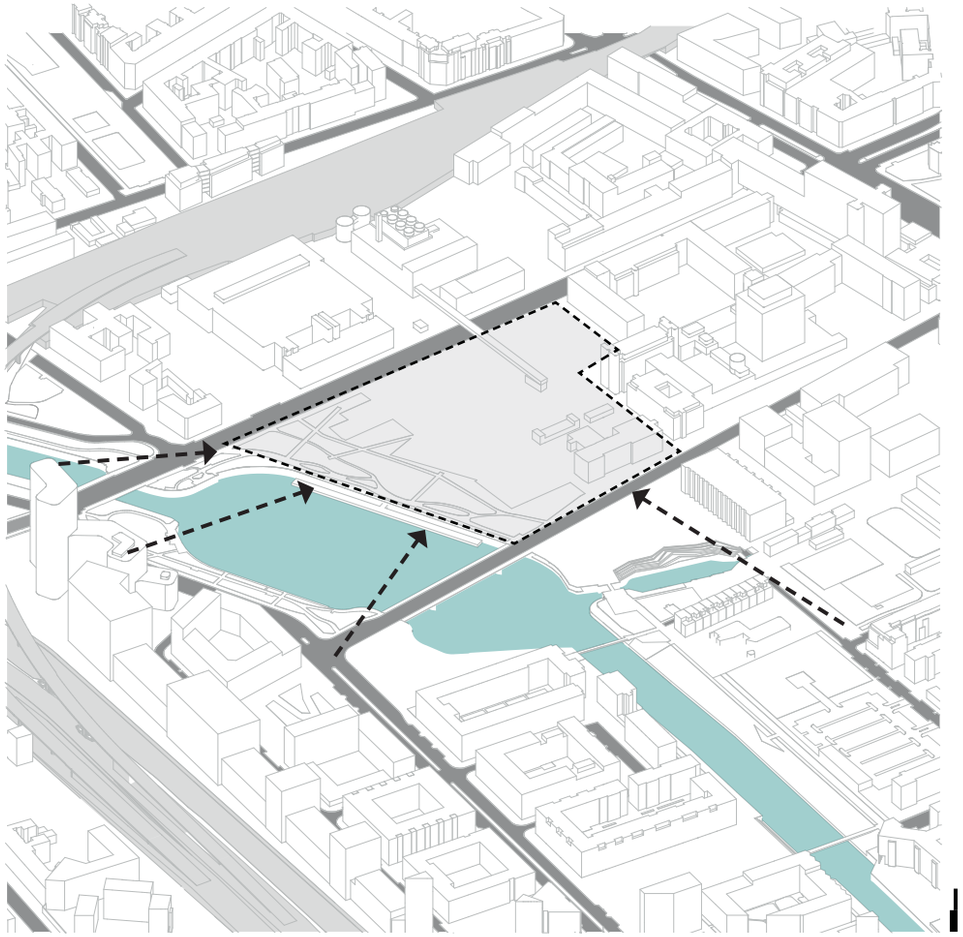
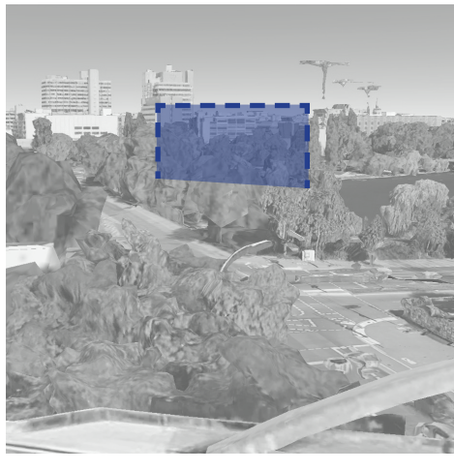


Figure - 44 Axometric view showing site and its visual connection from public transport routes



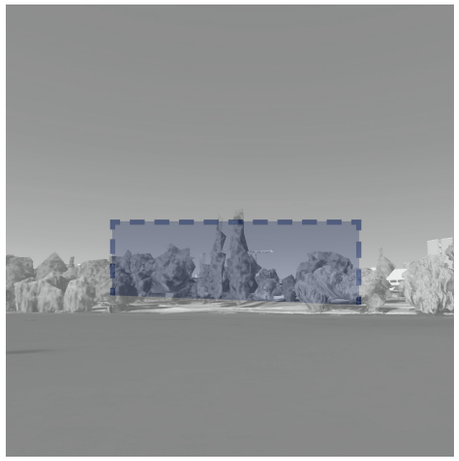
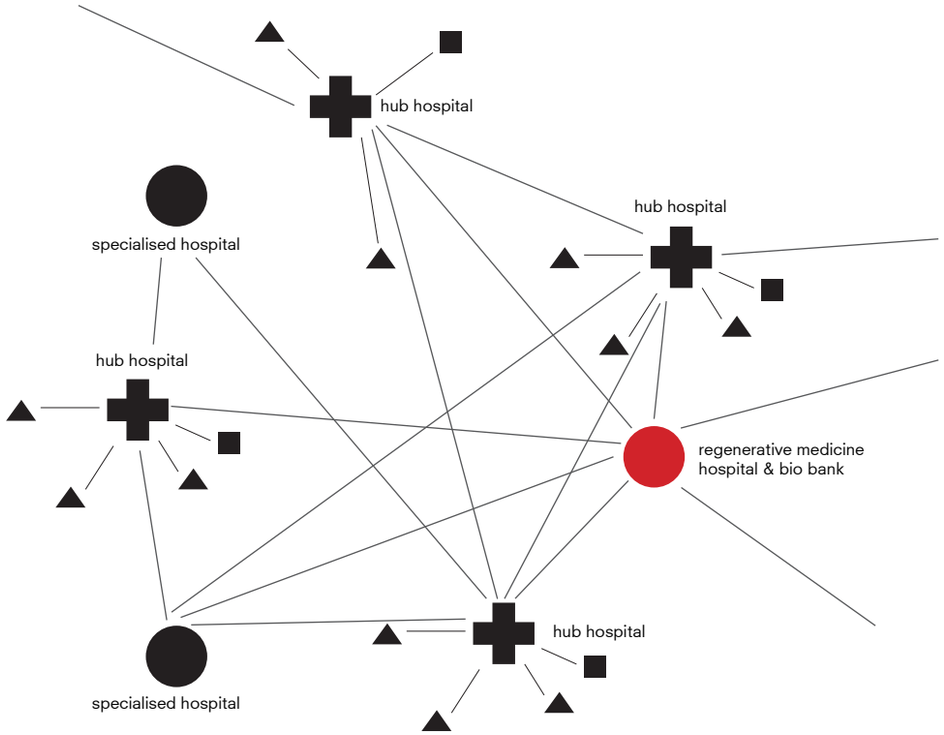


Image - 23 (above) View of future hospital from SBahn train line |
Image - 24 (below) View from water based transport in the river Spree



Regenerative corridor

The placement of the hospital will play a crucial role in establishing a regenerative corridor that connects all major players in the field of regeneration across Berlin, with the hospital positioned centrally within it. This corridor will not only create a strong network via road but will also introduce a seamless connection via water, utilizing the Spree River as a secure and efficient transportation route for biological materials, medical supplies, and even patient transfers.

By integrating multiple modes of connectivity, the regenerative corridor will ensure a smooth and controlled flow of information, research, and bio-matter between key institutions such as Charité, Bayer Pharma, Max Delbrück Center, and other biomedical hubs. This setup will reduce transportation risks, minimize contamination, and significantly improve the efficiency of regenerative treatments by decreasing delays in research translation and clinical application.

Figure - 45 The web of healthcare infrastructure in the city

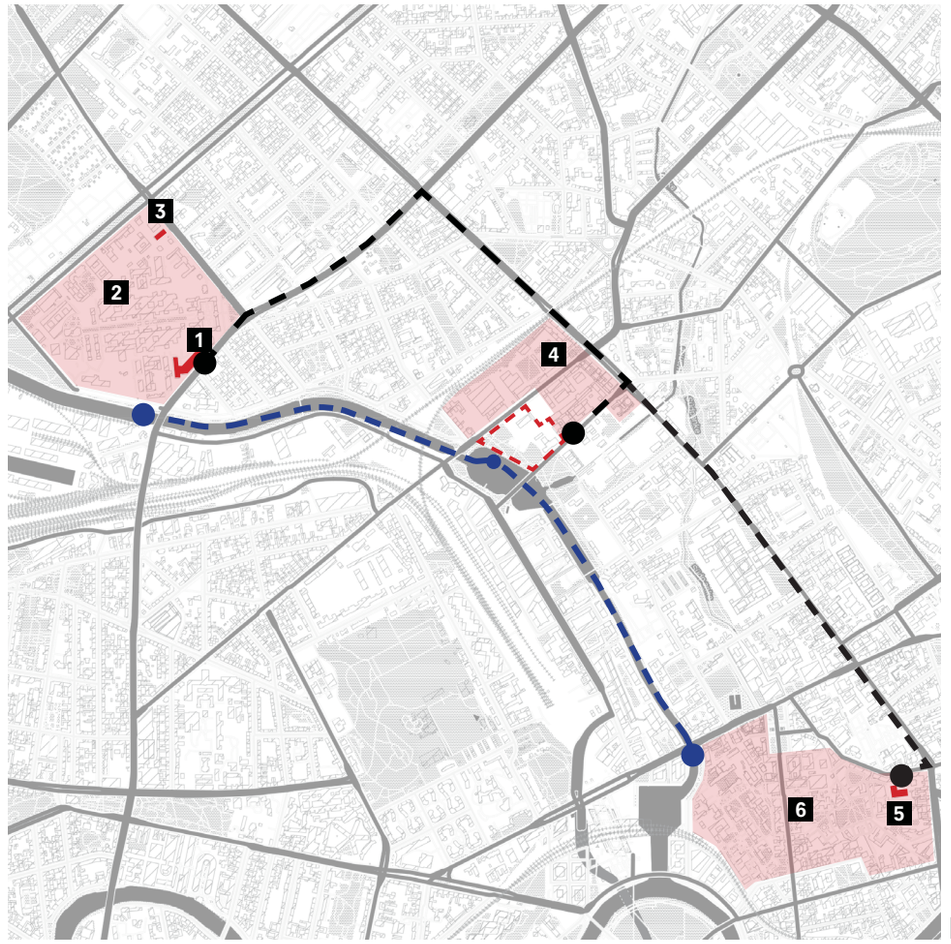
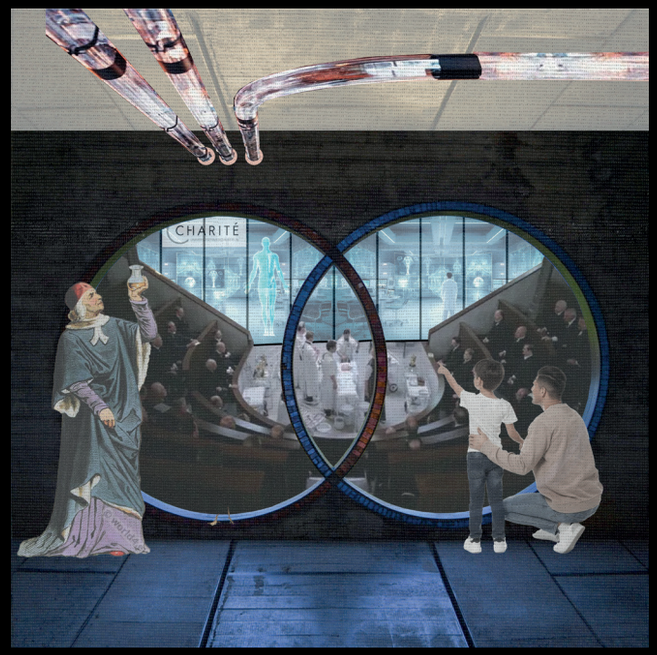


Figure - 46 Map of the proposed regenerative corridor via water based transport

The Regenerative Hospital

Research, Concept and design development

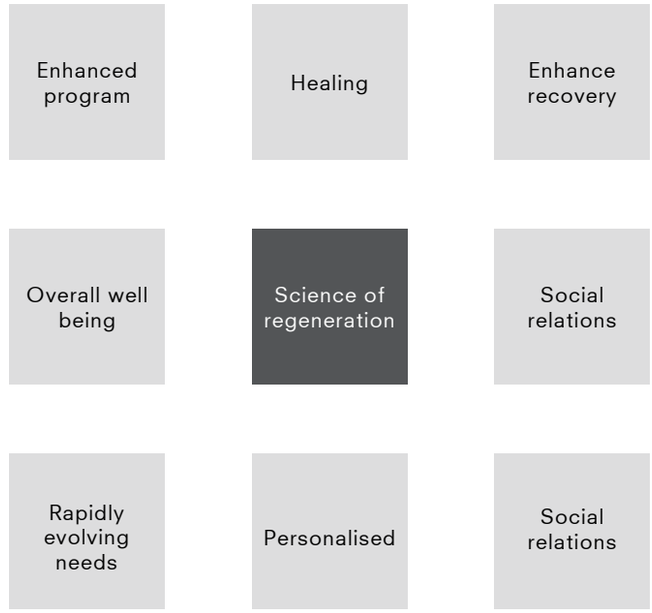


Form - Design drivers

Design drivers mark the final stage of connecting the science of regeneration to defining the architectural design of the future regenerative hospital. Based on the multiple markers essential for the science of regeneration, several design drivers are adapted.

With the project's focus on creating an environment that ensures efficient workflows and enhanced programs for regeneration, while also fostering human well-being and healing environments, this vision translates into specific design drivers. These include incorporating nature into the project, designing smaller, more human-centric and ergonomic spaces, and integrating elements that enhance the user experience. The design aims to create spaces that not only serve their technical purpose but also promote collaboration, such as wide corridors with seating areas to encourage unplanned encounters and knowledge exchange.

Similarly, the form is designed to be flexible enough to adapt to the evolving needs of regenerative medicine. At the same time, spaces are planned to enhance transparency in medical processes, bringing patients and their families closer to medical procedures and the reasoning behind them. The overall design integrates all the identified drivers (as shown in Figure - xx), ensuring an environment that simultaneously responds to both scientific and human needs.
The collages (images - 25, 26, 27, 28) shows conceptual ideas of translating these drivers into design decisions.



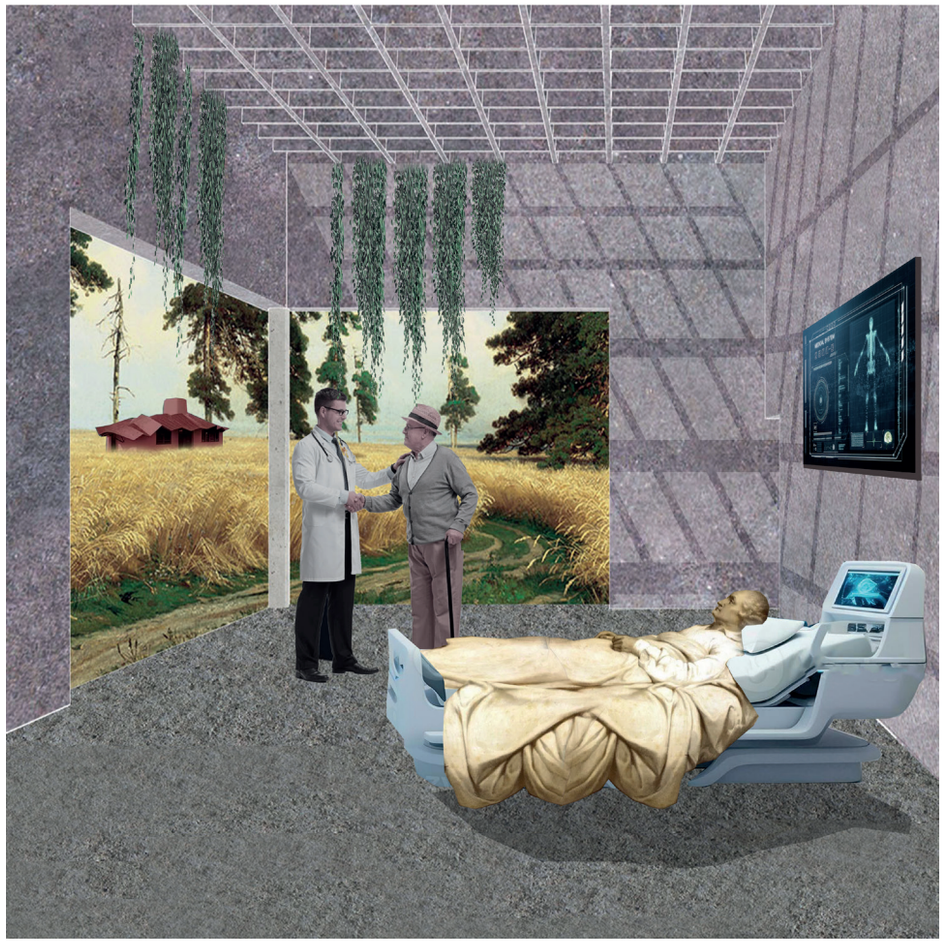


Image - 25 Collage depicting the future patient rooms with natural light and connection with nature

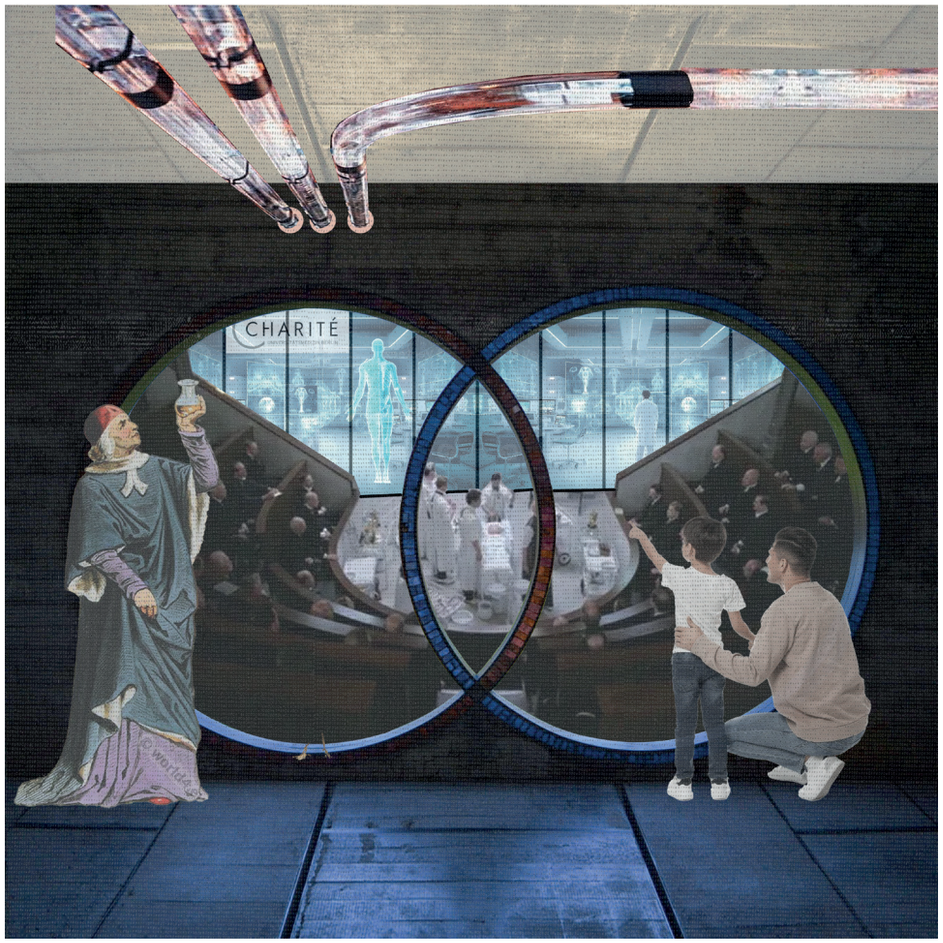


Image -26 Collage depicting how the services and spaces will be transparent and accessible to general people

Image -27 Collage depicting how the hidden hospital spaces can become major public attractions in hospital and a interactive space

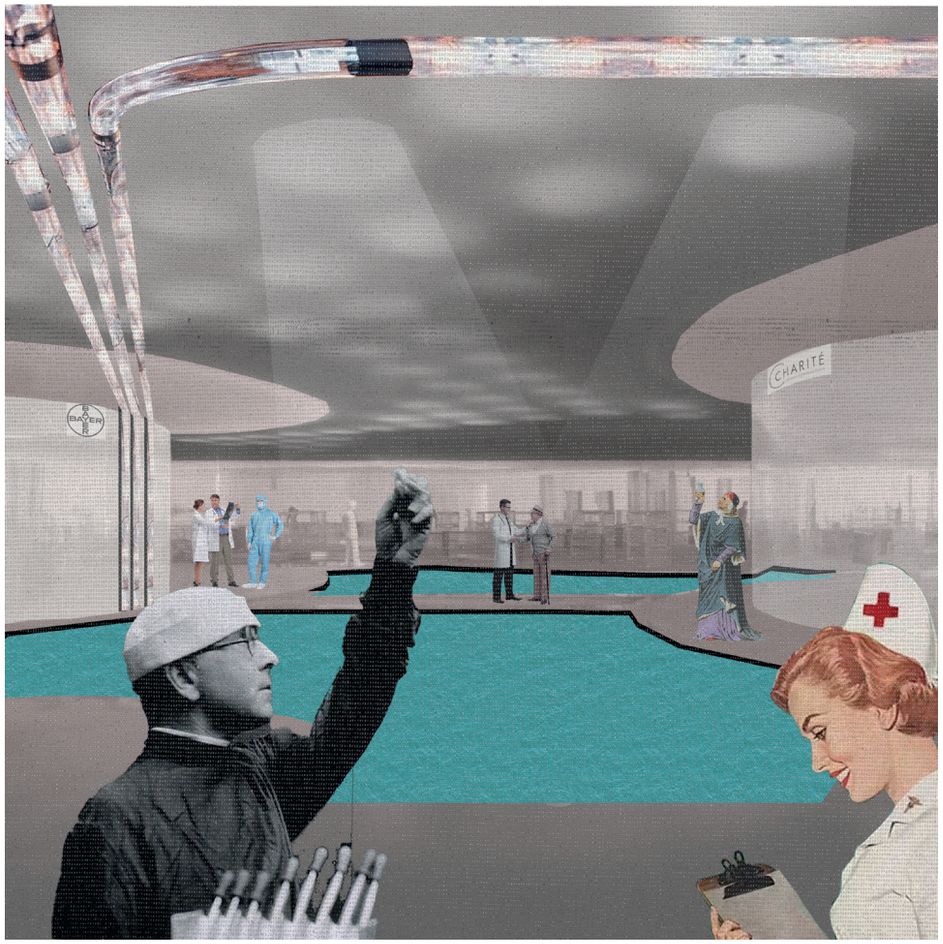
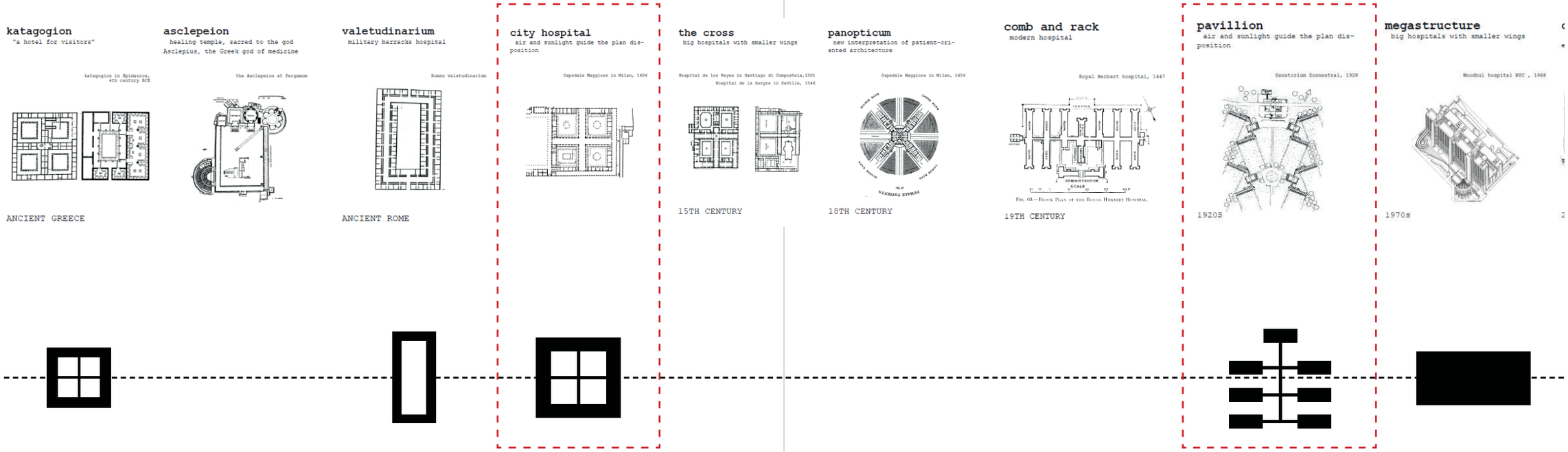


Image -28 Collage depicting how the future research spaces will be, collaborative setups and floating floors to minimise the vibrations affecting the bio research



Form - historic learnings

Studying the historic evolution of hospitals in order to understand the reasons behind their change and what has led to the form of hospitals we see today. Looking back into history highlights various forms that could potentially form a starting point for the future hospital, matching the desired ambitions for the project. The city hospital as a space for the people in the city resonates with the urban fabric it is sitting in and is open to the people to engage with it and become a part of it. At the same time, its low and open form enhances the ability to create a human-friendly environment and engage with natural light and surroundings. On a similar pattern, the pavilion type, which was well known for its connectivity to the surrounding natural environment, functioned on an abundance of natural light and air, breaking the hospital into small pavilion-like structures sitting in nature.

Figure - 47 Historic evolution of hosptial built forms

Form - Horizontal

The future hospital, unlike traditional hospitals, will take a horizontal form rather than a large mega-building standing tall in the urban fabric. Adopting a horizontal form helps create a more human-friendly environment, avoiding an overwhelming atmosphere. Additionally, the horizontal layout brings all the hospital's actors and functions onto the same level, fostering a more harmonious and collaborative environment. This enhances knowledge exchange among different professionals, expanding the reach of regenerative medicine and creating a fluent and innovative workspace in healthcare.

Going horizontal also reduces the building's reliance on technical vertical circulation elements such as elevators and escalators. This layout provides patients with the freedom to move around more easily, ultimately aiding in physical rehabilitation. At the same time, the horizontal form blends seamlessly with the existing urban context rather than creating a stark contrast.

For the regenerative hospital, the horizontal form responds to the current site conditions, creating axes that connect different parts of the site and linking the waterfront to the hospital and other areas of the Bayer campus. The major intersections of these axes form open courts, acting as key gathering spaces. The hospital's form wraps around these courts, incorporating publicly accessible functions within the hospital complex.

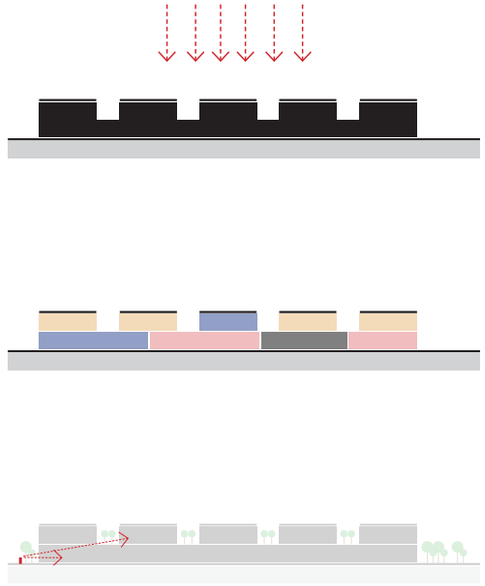
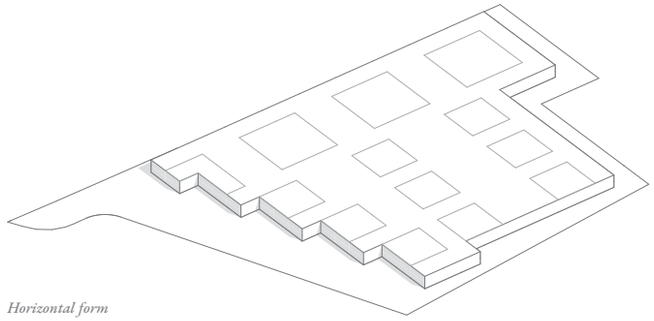
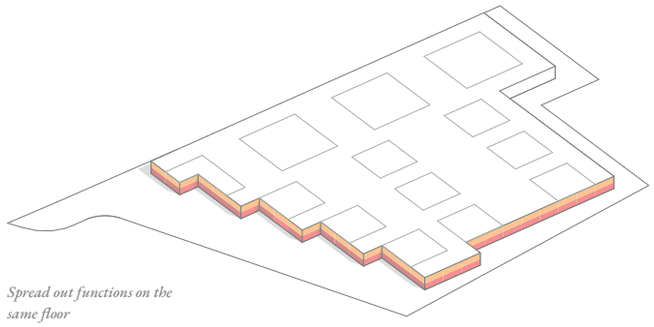


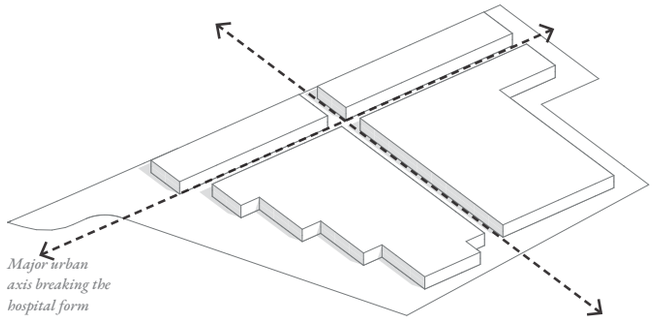
Figure - 58 Future hospital's proposed horizontal form and its benefits in reation with surroundings and program arrangement



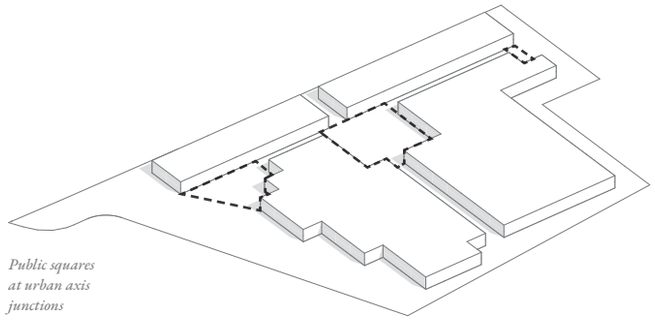
Horizontal form



Spread out functions on the same floor

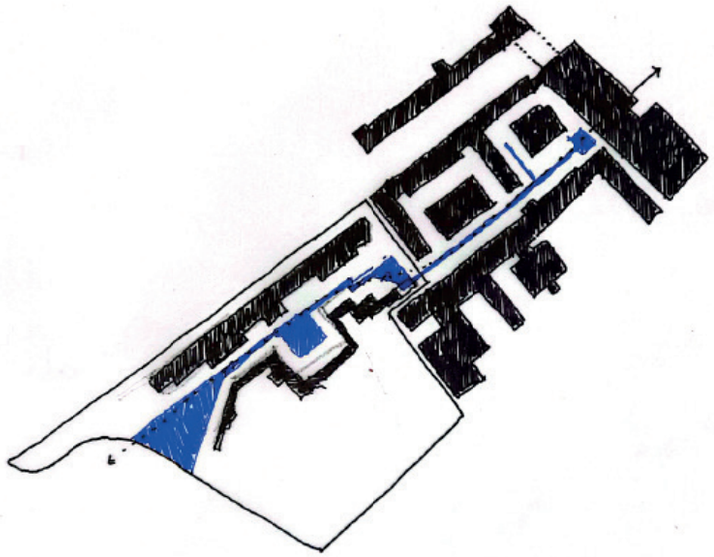


Major urban axis breaking the hospital form



Public squares at urban axis junctions

Figure - 59 Form formation



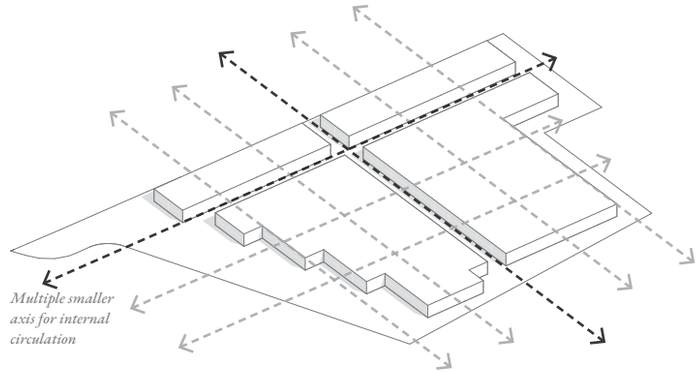
Form - Response to site and Bayer pharma campus

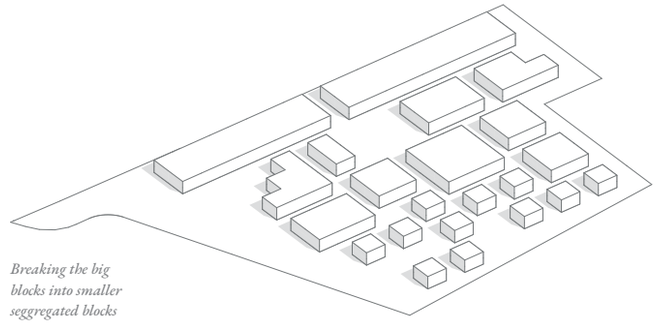
Responding to the site and the existing pattern of the Bayer Pharma campus, the horizontal form plays a vital role in absorbing all contextual elements to create a holistic environment, fitting perfectly into the setting like a missing jigsaw piece. In order to create a space that is more human-centric in scale and volume, without feeling overwhelming, the building is broken down into smaller blocks, separated by multiple circulation axes, as seen in Figure - 61.

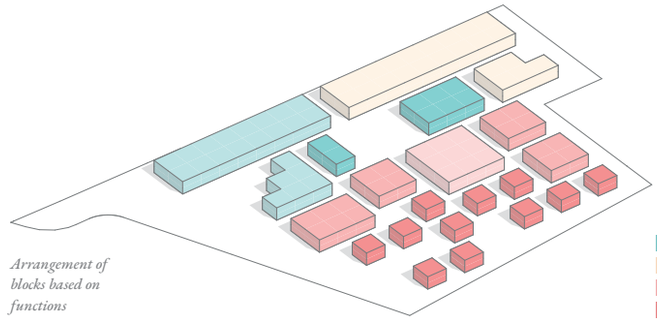
Further, the broken-down blocks are arranged according to their functions and sizes, responding to the site and their usability. As seen in Figure - 61, the blocks scale down as they move toward the southern part of the site, where they directly connect to the adjacent park. Additionally, the functions housed within the blocks become more private as they move southward. The functions of research, education, and public relations form a solid barrier on the north side, shielding the private spaces from factory noise while directly connecting to the office and research spaces of the existing Bayer campus. The decreasing of the scale of modules towards the south, reflects the increasing privacy of functions, ultimately scaling down to individual patient rooms. These smaller, segregated blocks provide more breathing space and a home-like scale.

A key feature of the master plan is the central axis running perpendicular to the river, which serves as the main public corridor, hosting all public functions and the main hospital entrance while also connecting to the existing Bayer campus. This central spine plays a crucial role in linking other Bayer buildings to the water. A central water feature extends the river edge and waterfront throughout the hospital and continues to the far end of the Bayer campus, tying everything together and giving the development a cohesive central identity, also creating more pleasant environment for the hospital and supporting the sustainable feature of the project .

Figure - 60 Master plan for the future hospital and the existing Bayer campus







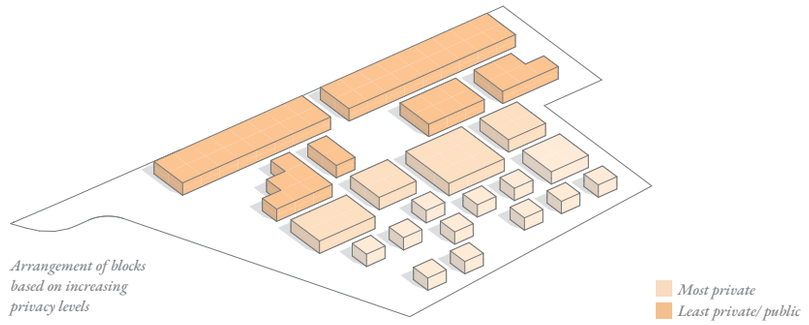
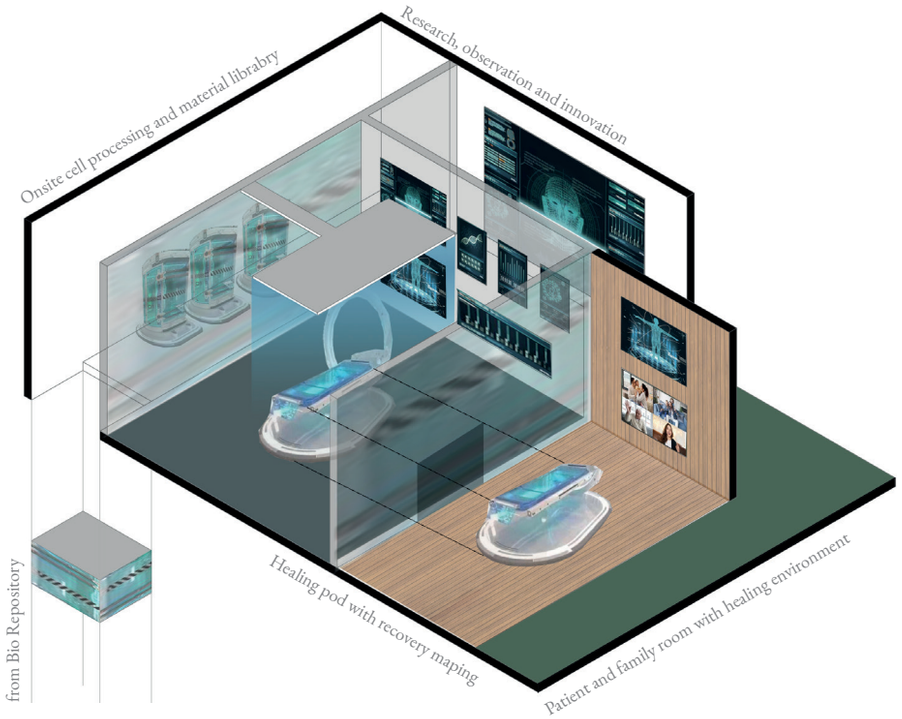


Figure - 61 Form development



Module - The key element

When it comes to creating an environment that facilitates circulation for both patients and staff while also bringing together all stages of regeneration and major actors involved in the process, a dedicated module is designed to house all regenerative functions in one space, like an extended treatment area. This module helps bring care directly to the patients, functioning as a single-destination treatment space, eliminating the need for patients and their families to circulate throughout the hospital for different functions. (as seen in the image - 29 that shows a one to destination for treatment connected to all parts of the regerative treatment with swift transfer to patient rooms/ pods)

Additionally, this setup supports a decentralized approach that aligns with the growing needs of regenerative treatments. These small modules can be adapted based on evolving requirements, creating the possibility for personalized and specialized treatments. This modular approach ensures an effective layout for fast and optimized movements while also catering to the specific needs of patients.

Image - 29 Regenerative module concept for the regenerative treatments showig its indivually functioning ability, all included in one module

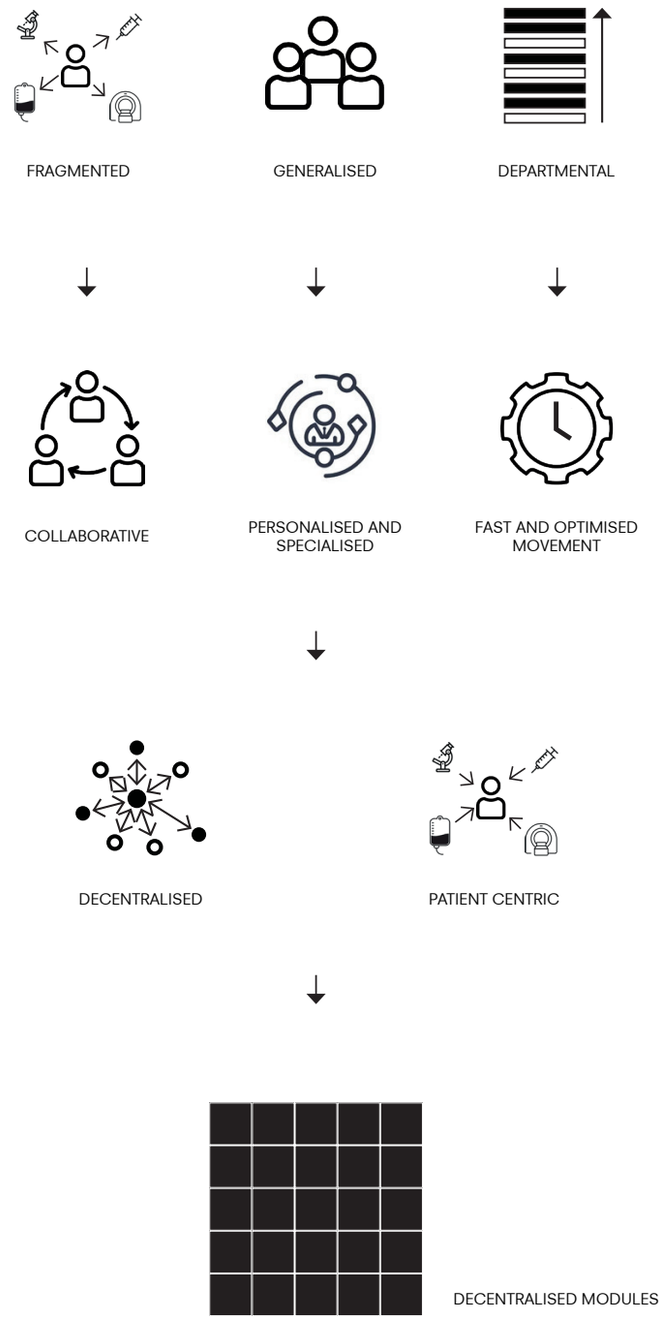
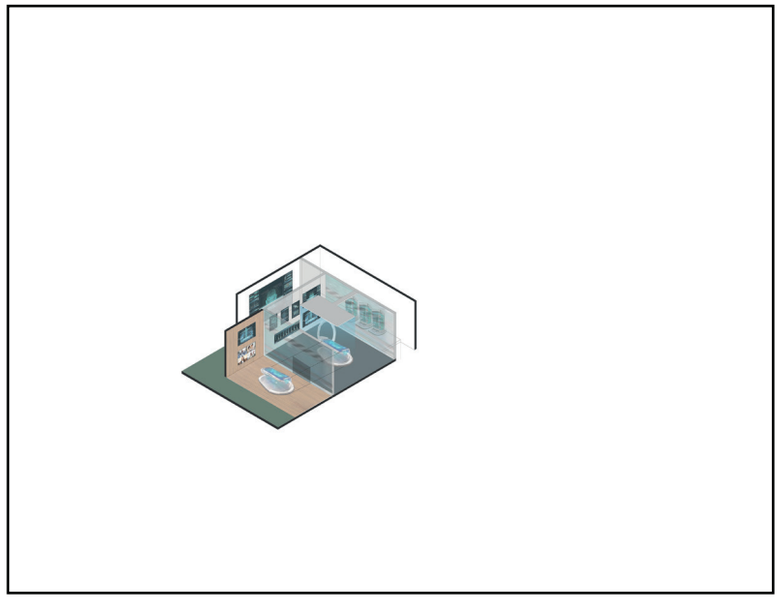
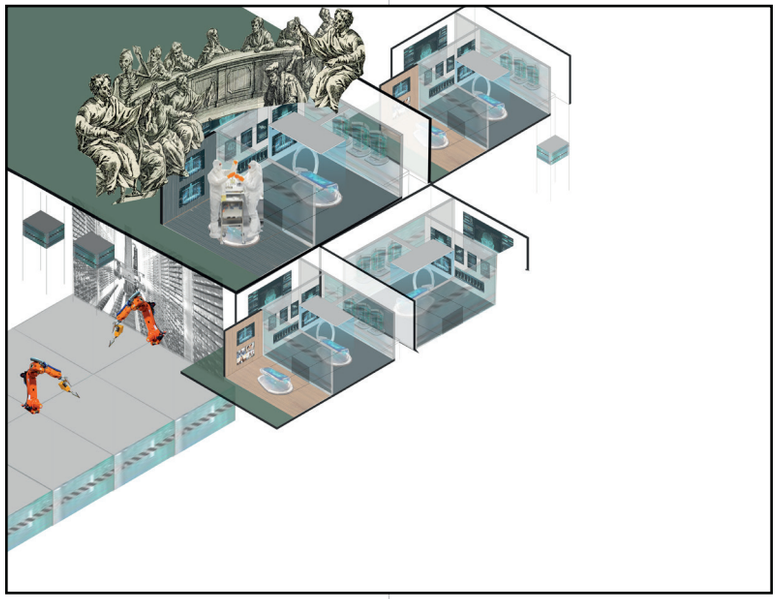


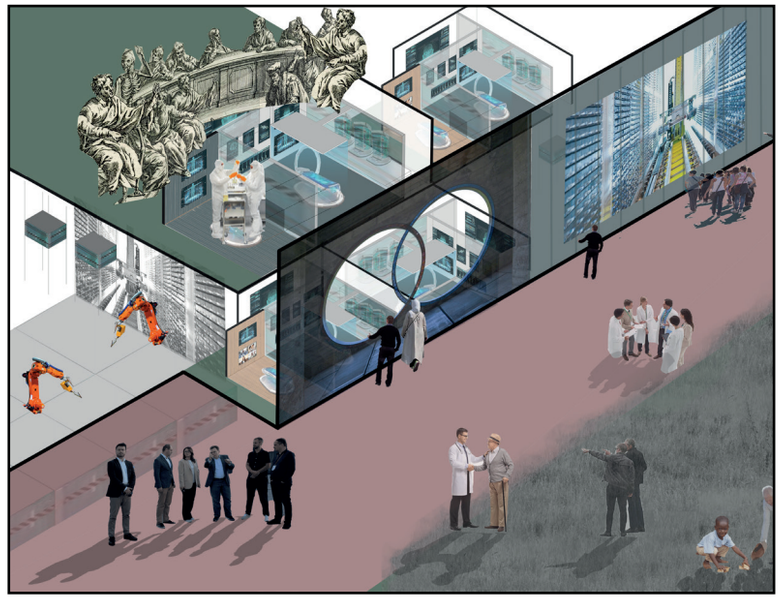
Figure - 62 Parameters leading to creation of a hospital with modules and not like traditional hopsital



Single regenerative module



Combination of modules



relation to public

The regenerative module was developed as the key element of the project, uniquely tailored to the process of regenerative treatments. It is considered a highly important aspect of the development and growth of regenerative treatments and regenerative science. This module introduces a shift in traditional healthcare architecture and the way hospitals function. This change aims to create a future-proof hospital infrastructure while also bridging the gap between various stages of treatment by integrating research directly into the treatment space.

Until now, hospitals have always been seen as centralized entities with various departmental barriers. This modular approach will overcome those limitations. Multiple modules will form an entire ecosystem for human regeneration, functioning like a farm that produces and delivers regenerative treatments in the same space.

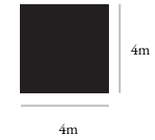
Image - 30 Series of collages showing hos a single module with various attachennts become a whole hospital

The Modules

The sizing and number of modules play a crucial role in ensuring the hospital functions efficiently. It is essential that the modules are not randomly sized but are proportionally related to each other to form a cohesive spatial grid when placed together. To achieve this, key spaces were analyzed, starting from patient rooms, operating theaters, and diagnostic areas to larger spaces like laboratories and public zones.

Considering technical requirements, a 4×4m grid was established as the smallest usable unit, beginning with the patient room (excluding auxiliary spaces). This grid also aligns well with the required width for circulation areas. Unlike the traditional 7.5×7.5m hospital grid, this updated system offers a slight increase in space, enhancing functionality for regenerative medicine. When expanded to 8×8m, it accommodates additional regenerative functions. For example, a patient room not only houses a companion space but also integrates a 24/7 monitoring and analysis system, continuously tracking post-treatment changes in the body.

Similarly, standard corridor widths, which are typically 3 - 3.5m, are increased to 4m to facilitate Automated Guided Vehicle (AGV) transport for moving patients and essential medical supplies. Overall, this repetition of the 4×4m grid ensures both adaptability and efficiency, allowing for the creation of open spaces when necessary while maintaining a structured and functional layout.



All buildings have been designed with a straightforward grid of 4x 4m in mind.

Basic width requirement for circulation and also associates with the smallest entity of patients room

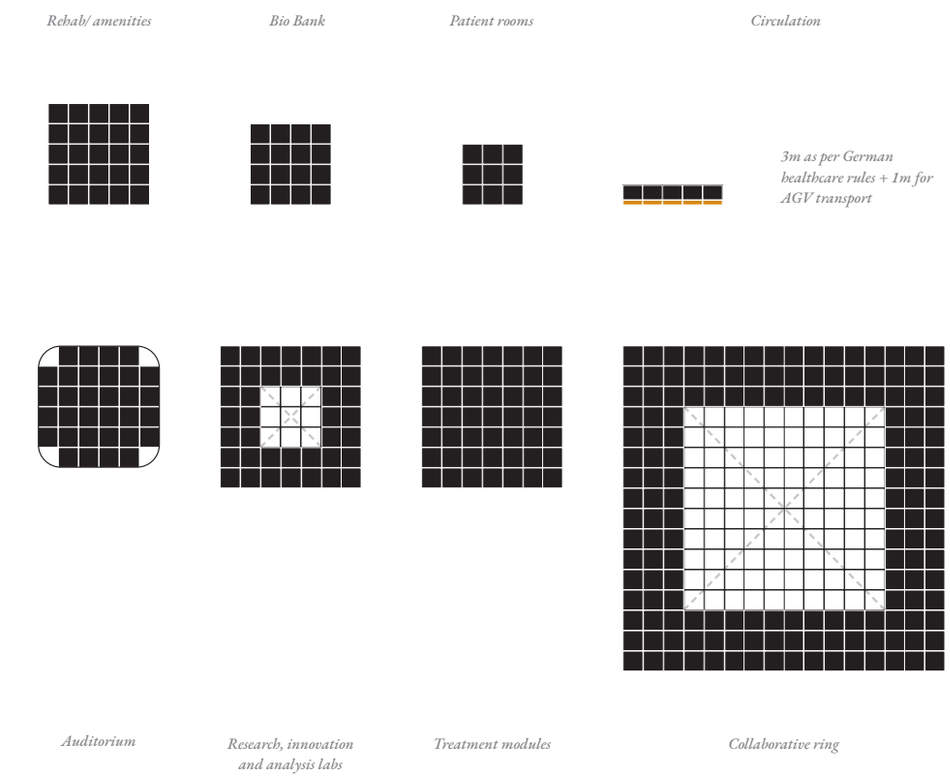
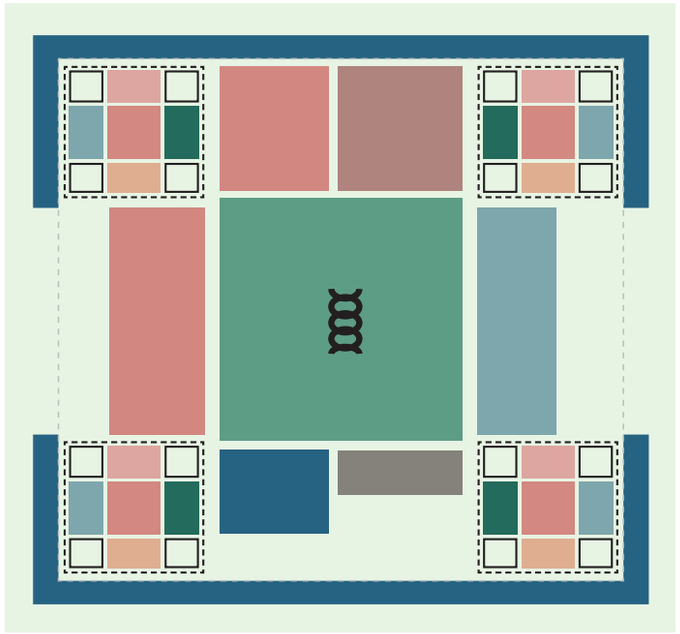


*Figure - 63 All modules depicted in its 4*4m grid*



The game of modules

With the different modules, it becomes important to determine how these modules will be placed on-site, creating a whole campus that not only facilitates easy circulation but also resonates with the surrounding context. In order to come up with the most optimal setup for the campus, a game of modules was created based on the interrelation diagram, as seen in figure - 64. All modules are set up with basic rules of interrelation, as illustrated in figure - xx, which defines the size of the modules and the specific functions they need to be connected with. Following these rules for all modules, multiple options were generated to explore the best possible arrangement (image - 31, 32, 33, 34). This form-making activity was carried out through model-making to achieve the best outcome not only in terms of functionality but also in terms of spatial quality and overall form.

Figure -64 Spatial arrangement of the regenerative hospital

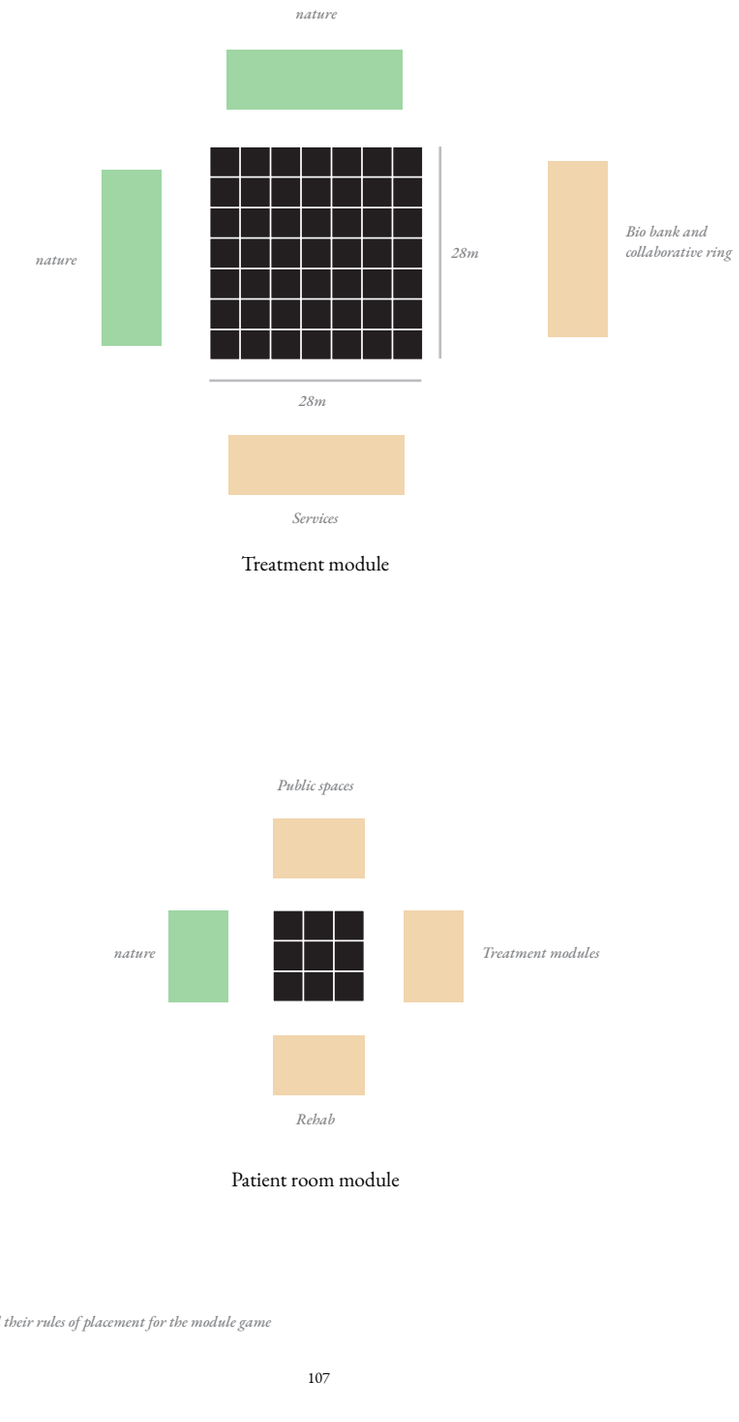
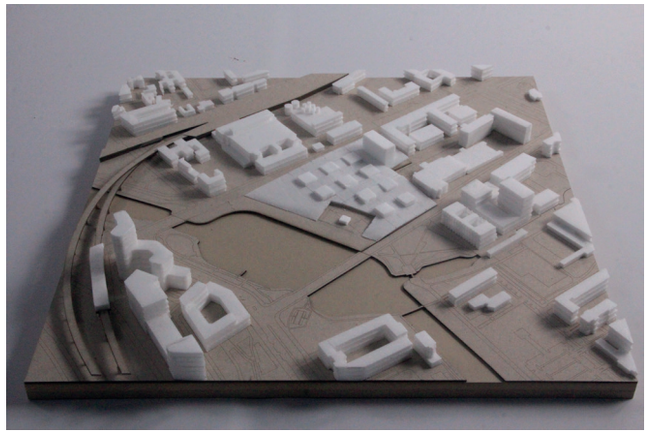
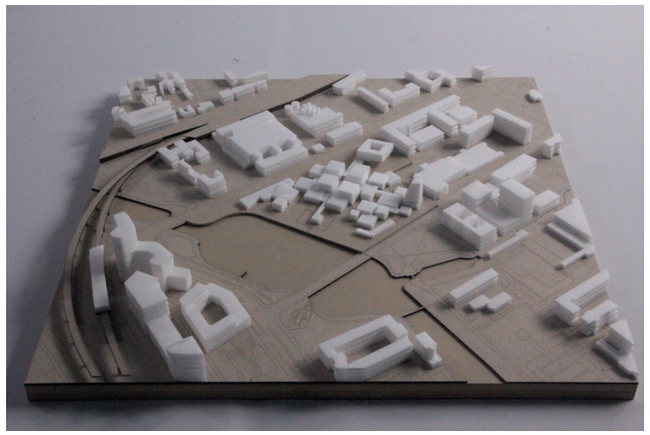


Figure - 65 Modules and their rules of placement for the module game





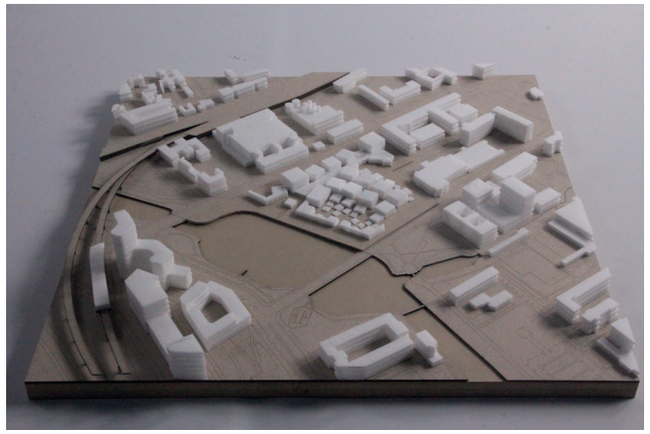
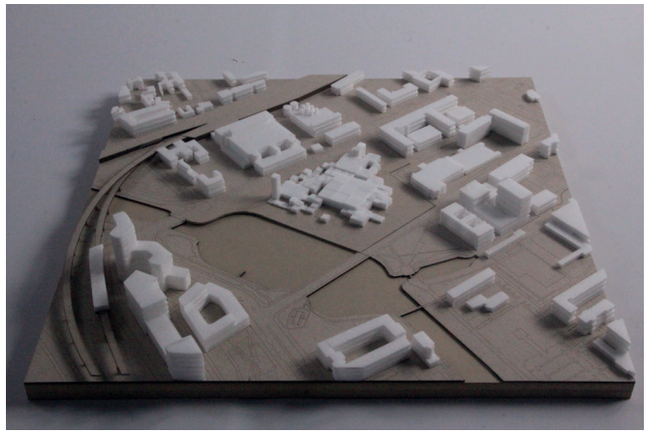
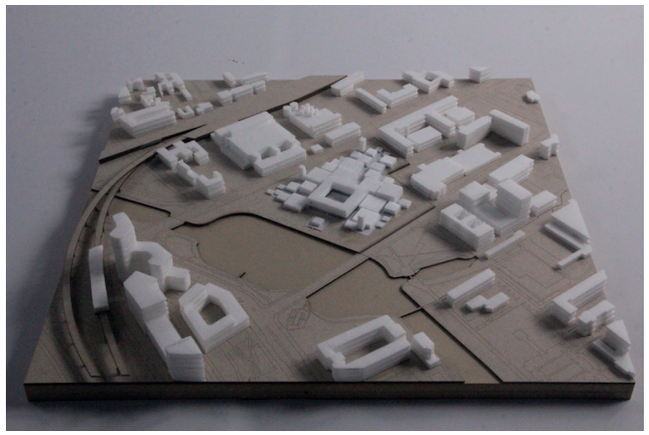


Image - 31 Results of the game of module - Massing options





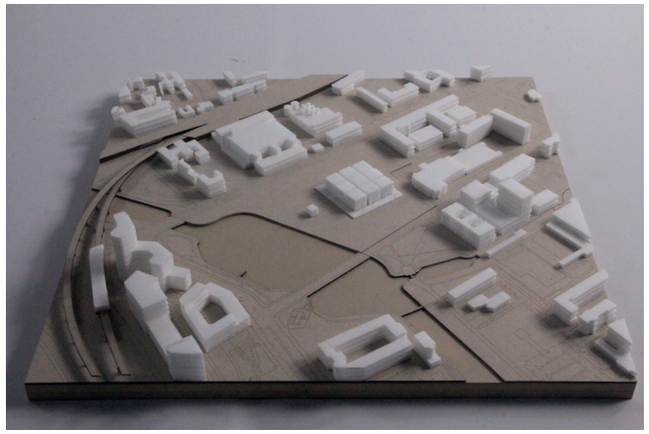
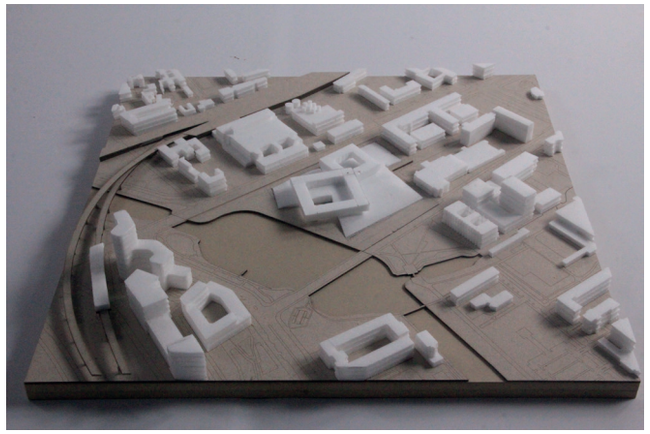
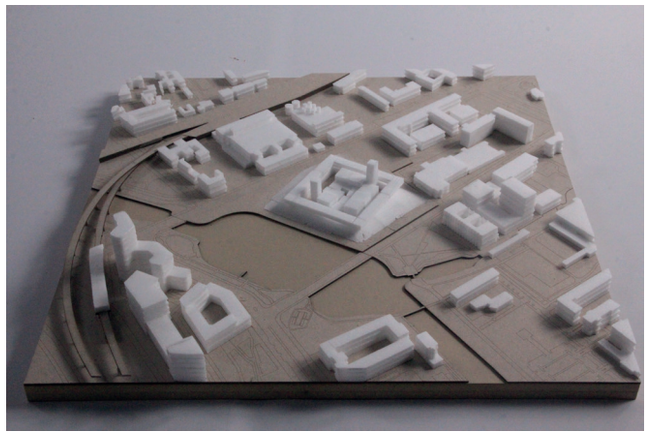


Image - 32 Results of the game of module - Massing options





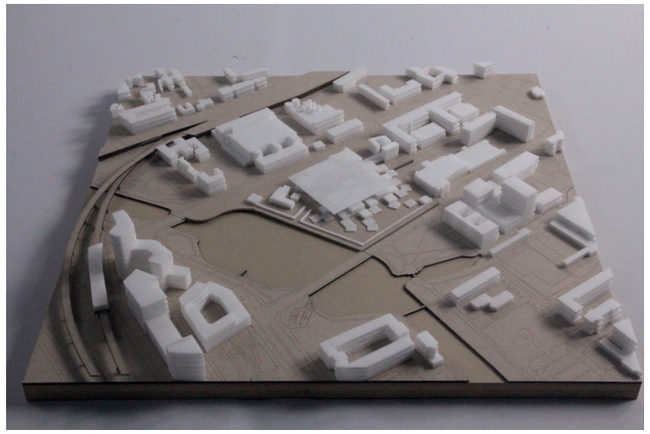
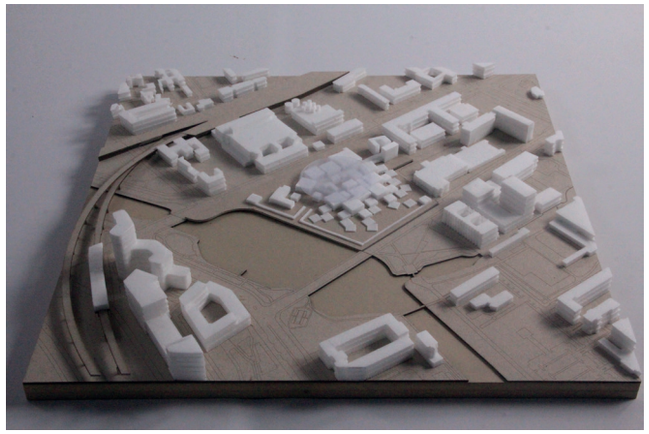
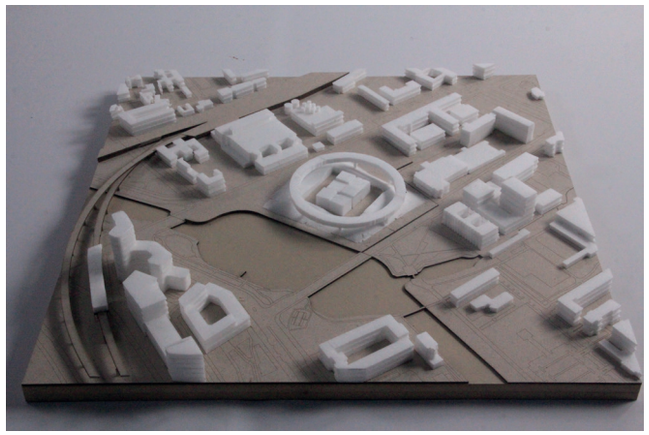


Image - 33 Results of the game of module - Massing options





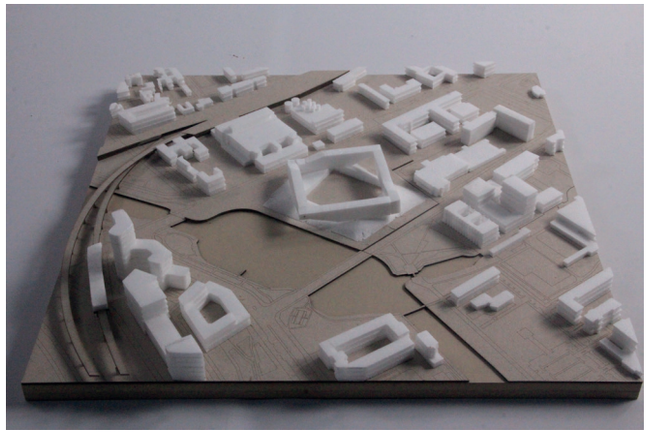
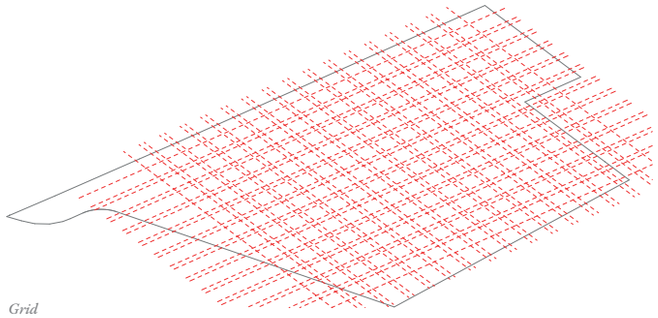
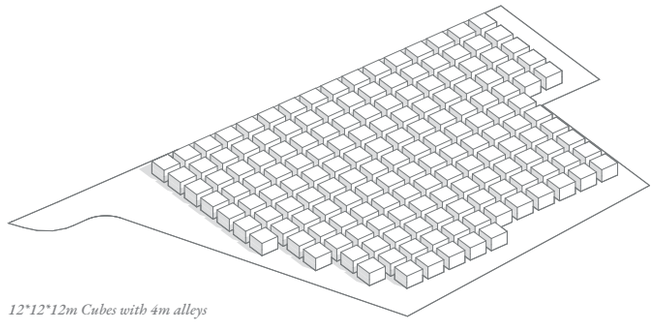


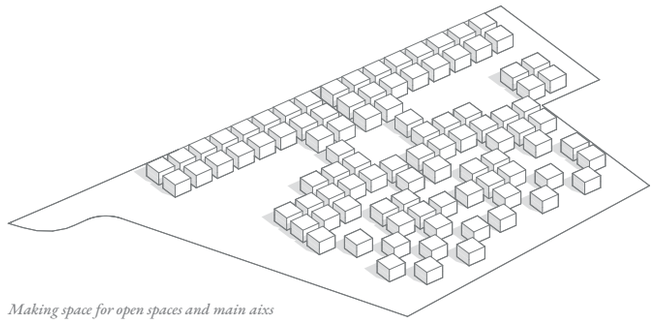
Image - 34 Results of the game of module - Massing options



Grid



*12*12*12m Cubes with 4m alleys*



Making space for open spaces and main aixs

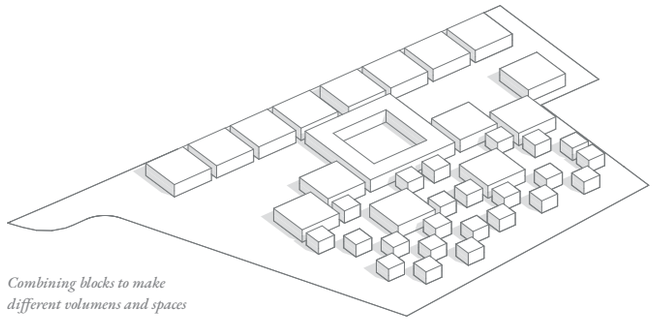
Form - Module placement

The final form was achieved by creating a 12m × 12m grid of solid modules with a 4m-wide cavity in between. The design follows the concept of positioning the research and education modules on the northwest side, forming a solid barrier, while the modules become increasingly displaced as they move toward the southeast side of the site, which directly connects to the park. This gradual displacement is driven by function, with the most displaced modules being the patient rooms, set up as pavilions within the green spaces to create a more open and breathable environment.

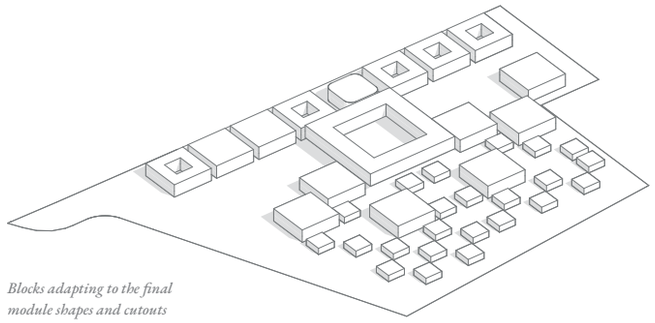
The ring structure serves as the crown of the campus, housing the main collaboration spaces for staff and other key actors.

To maintain a seamless and patient-friendly environment, all modules are connected through an underground technical layer that supplies essential services while keeping technical movements away from spaces designated for patients and visitors. At the heart of the campus, the Bio Repository stands as an iconic structure, positioned within the central water feature at an angle that disrupts the rigid hospital grid, drawing special focus to its significance.

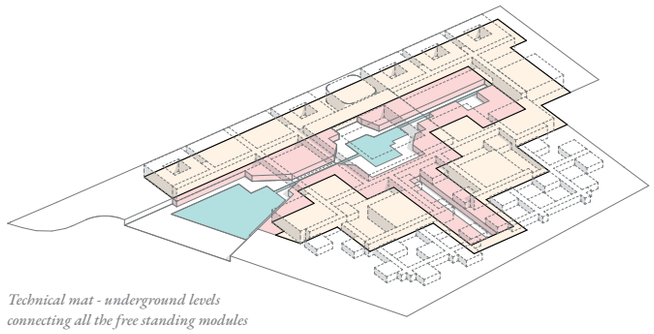
Figure - 66 Final form development



Combining blocks to make different volumens and spaces



Blocks adapting to the final module shapes and cutouts



Technical mat - underground levels connecting all the free standing modules

Figure - 66 Final form development

Image - 35 Historic reference of open green spaces in the hospital

Integration of Nature

A key advantage of these modules is that when arranged together, they naturally create multiple open spaces in between, which can be transformed into green areas. These green spaces play a crucial role in integrating nature into the hospital environment, fostering a healing atmosphere for patients and a pleasant workspace for staff. Historically, nature has been essential in patient recovery and mental rehabilitation, and this principle is reintroduced in the future regeneration hospital.

The core idea of the hospital is embedded in these green pockets, which will evolve with the changing seasons, giving the hospital a dynamic identity as a nature-based campus. By incorporating seasonal landscapes, the hospital creates an environment that supports patient regeneration and enhances overall well-being, making the experience of recovery both comforting and engaging.

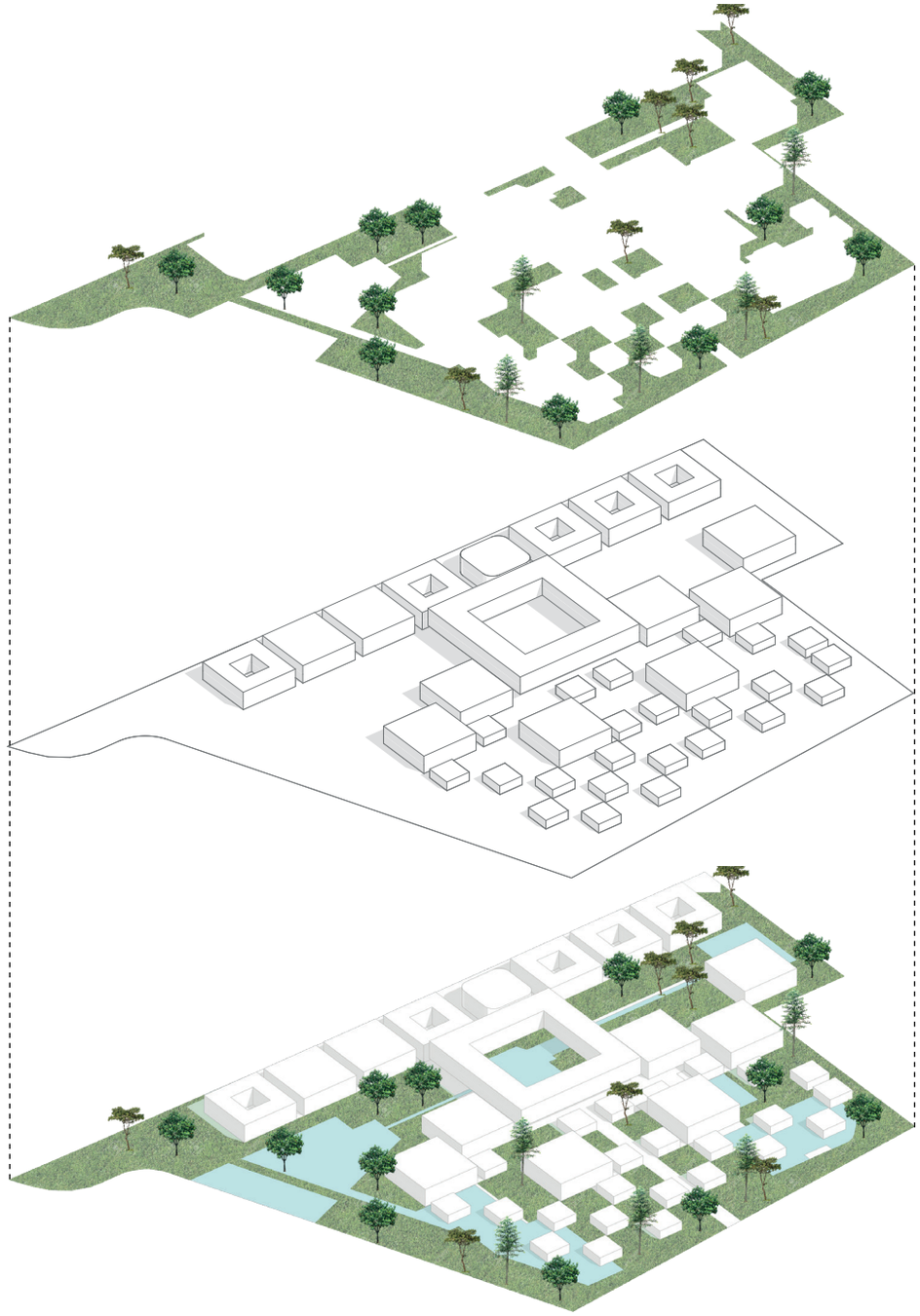
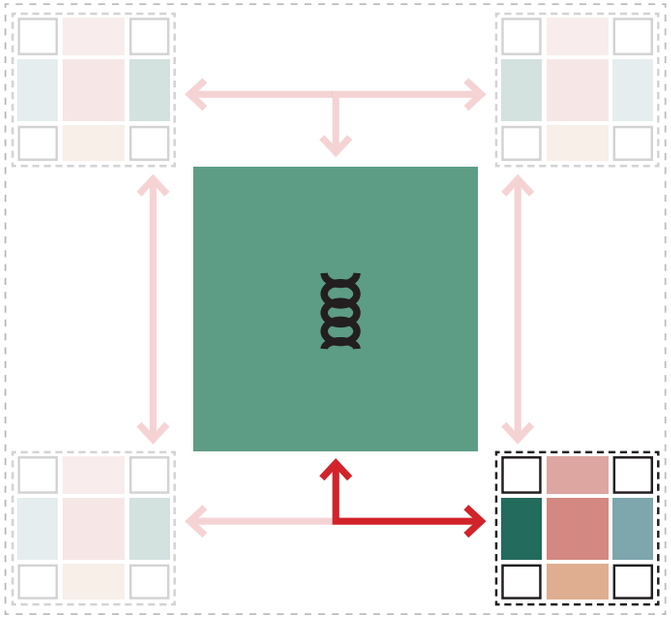


Figure - 67 Layers of built and nature



Connections - Pneumatic tubes

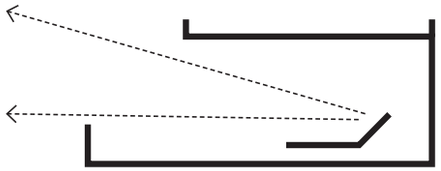
As discussed in the Users and Clients chapter, biological matter is considered a major user of this hospital, with a separate circulation format designed for easy and contamination-free transport throughout the facility. This system minimizes human effort in transporting bio matter while ensuring efficiency and safety.

To achieve this, a pneumatic transport system is implemented, consisting of tubes that run throughout the hospital, following the circulation corridors. These tubes seamlessly connect all the modules to the bio repository, creating an efficient transport network. Each module will have small receiving hubs, while the bio repository will house a major hub for centralized collection and distribution.

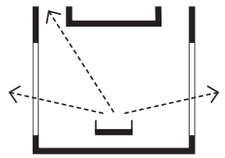
The tubes will be transparent with colored accents, openly passing through public corridors, visually engaging visitors and emphasizing the hospital's futuristic and innovative nature. Imagine watching various biological samples travel overhead in concealed shuttles, making you feel like you're part of a sci-fi movie. These tubes will not only serve a functional purpose but will also act as a design statement integrating into the hospital's aesthetics and doubling as wayfinding elements within the large hospital complex.

Figure - 68 Pneumatic tubes connecting the modules to the Bio repository

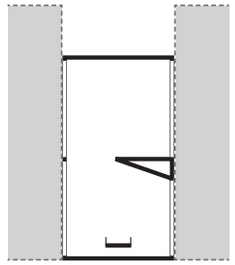
Image - 36 Pneumatic tubes as the design elements in the hospital and as wayfinding elements



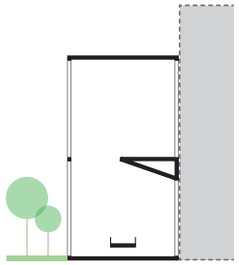
Corridor - junctions



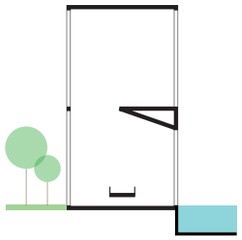
Corridor



Closed - Double loading



Semi open - Single loading



Open - independent

Connections - Corridors

The corridors are a major element supporting the concept of a hospital that is both horizontal and always connected to nature. Unlike traditional hospitals, where corridors are typically enclosed interior spaces that merely connect functional areas, this concept reverses the approach by bringing the inside out.
Here, the corridors are placed outside the modules, acting as the main circulation space. As seen in Figure - 69, the idea is to create circulation that allow patients and staff to engage with the surrounding natural environment. The corridors follow a clear grid, wrapping around the modules and altering how the space is perceived.

These corridors create a dynamic experience by playing with light, openness, and enclosure, constantly shifting between three distinct spatial conditions, as illustrated in Figure - 70 - Corridors enclosed by spaces on both sides, Corridors with a functional space on one side and an open connection to nature on the other and lastley corridors that act as independent elements, seemingly floating within the natural landscape.

This design approach enhances the healing environment by blending movement with natural surroundings, making circulation spaces more than just transitional zones of movement.

Figure - 69 (above) Visual connections to outside world from corridors | Figure - 70 (below) Types of corridors based on connections

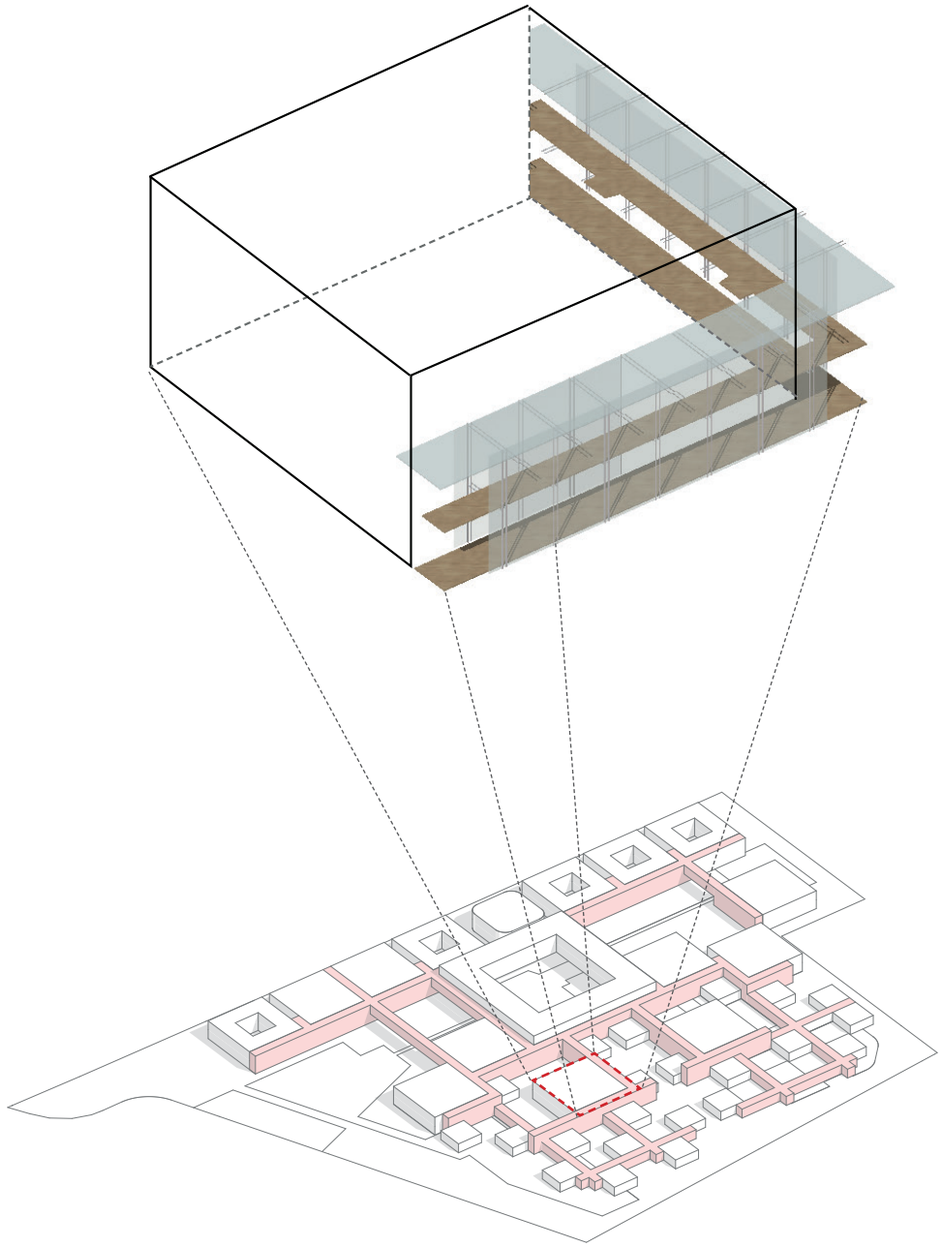


Figure - 71 Location of all corridors and how it wraps around the modules

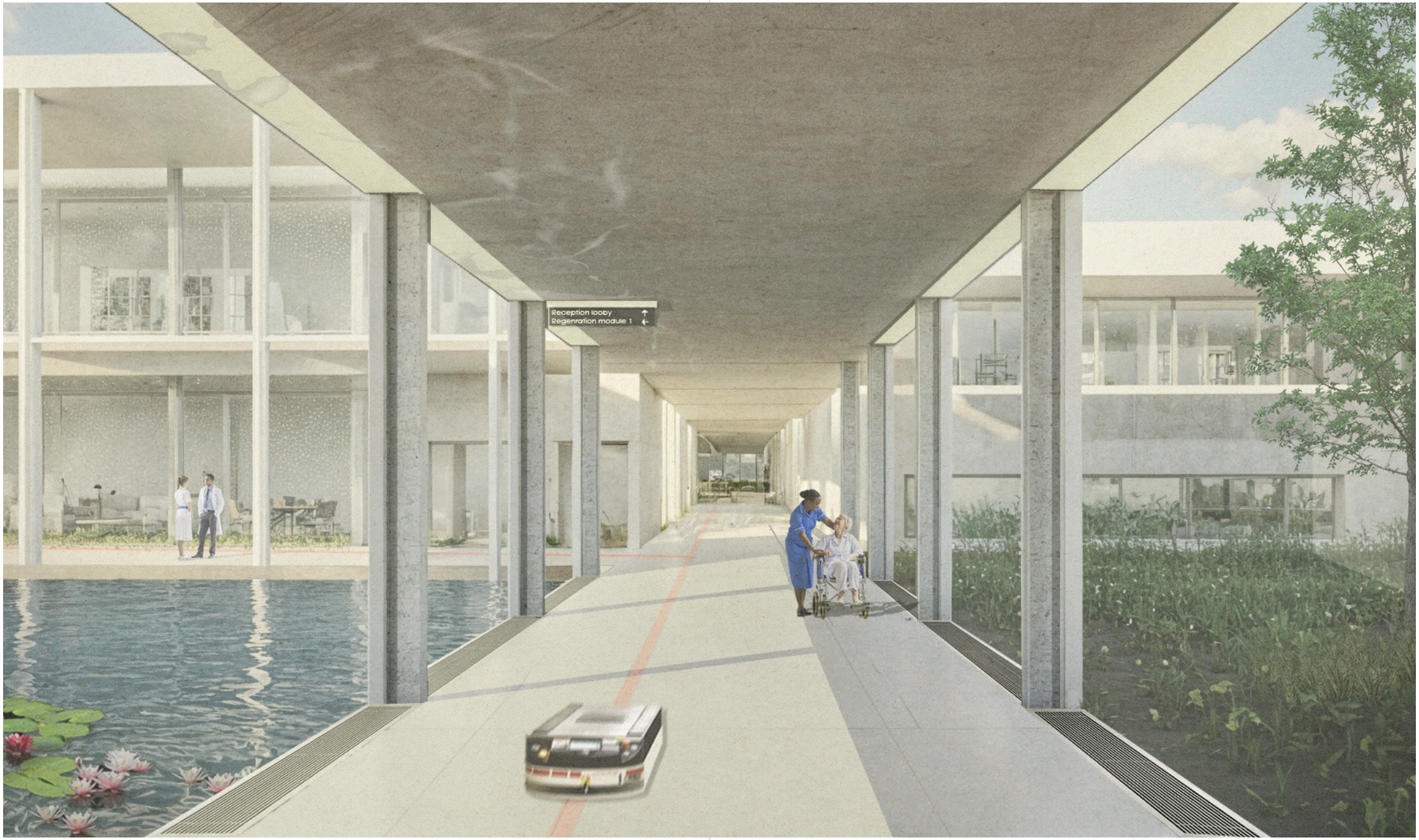


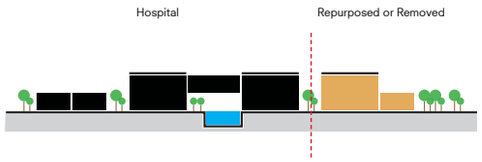
Image - 37 Render showing the corridor and its realtion with nature

Form - Ability to regenerate

As seen in the previous chapter, hospitals are becoming obsolete when it comes to adapting to the changing needs of future healthcare. Additionally, the existing centralized setup and mega-building format of hospitals do not allow much flexibility in altering or repurposing spaces as required. However, since regenerative treatment is still a relatively new field and will undergo immense changes in terms of spatial requirements, it is crucial that the future regenerative hospital can be constructed, adapted, and repurposed to accommodate these evolving needs.

The invention of modular design, which makes the hospital horizontal and decentralized, becomes the key to ensuring that the future hospital remains highly adaptable in terms of both size and function. For instance, the project can be developed in phases without disrupting any regenerative processes while still providing all necessary functions and treatments for regenerative medicine to advance.

Once fully built, future changes in patient profiles and regenerative treatments may necessitate repurposing certain parts of the hospital to support new functions while allowing the remaining sections to continue operating as originally intended. This flexibility in construction and repurposing makes modular adaptation the best possible solution for the evolving needs of human regeneration.



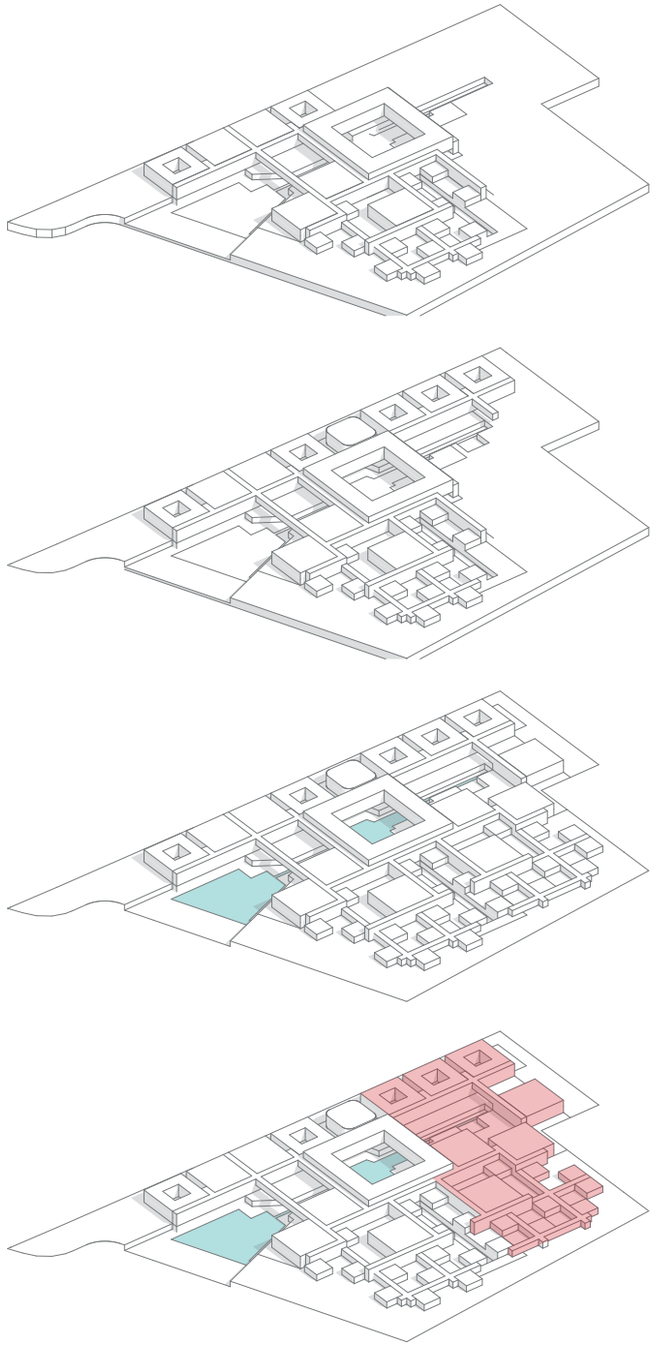


Figure - 72 Development of hospital in phases and regenerating to other functions in parts

The Regenerative village

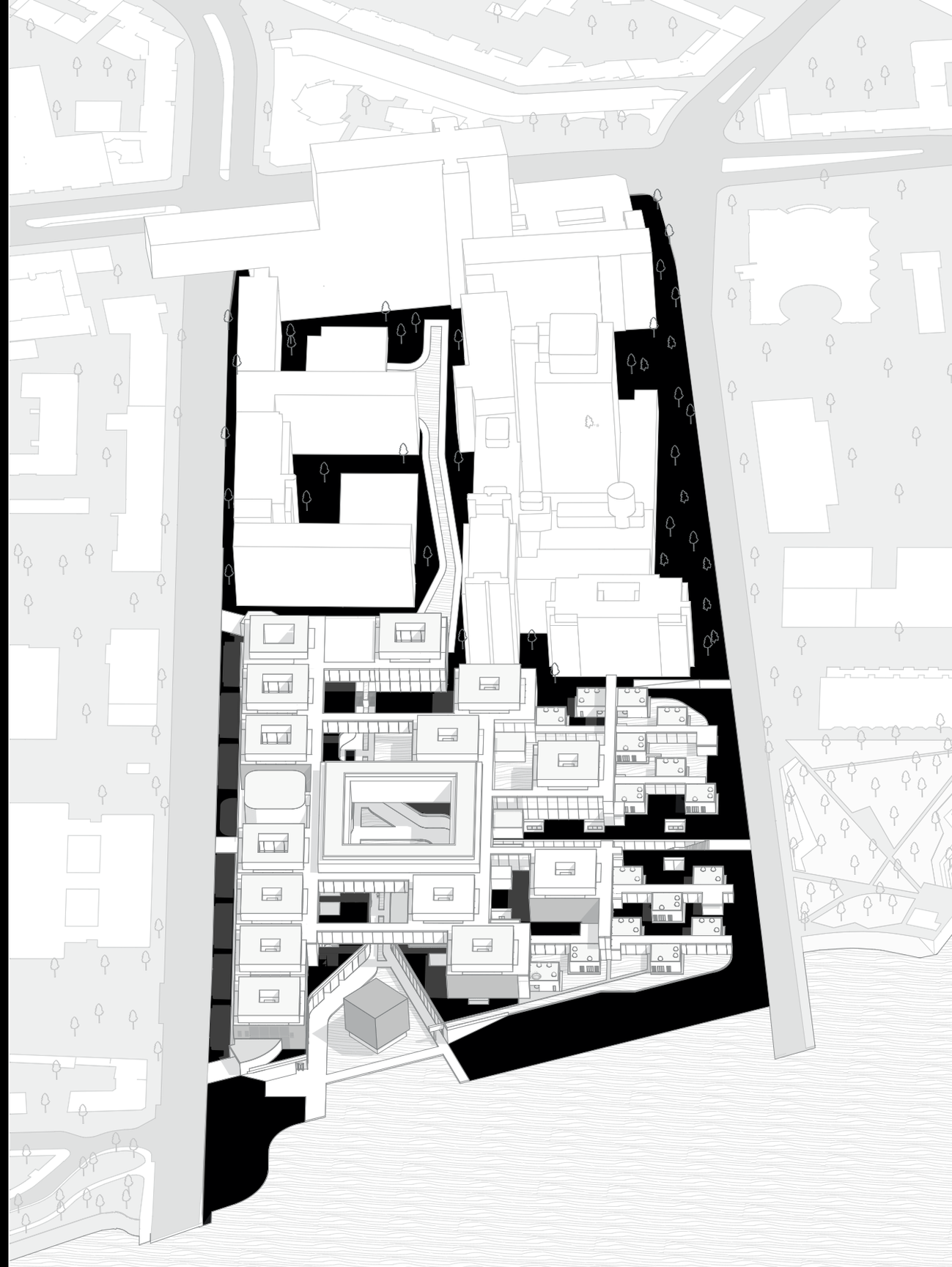


Image -2 Sectional model showing the main module and the patient room

The Regenerative Module

The regenerative module is the core around which the entire project revolves. These modules represent the most innovative advancement for the future of regenerative medicine and healthcare. They take healthcare architecture to an entirely new level, breaking away from traditional norms and conventions of hospital design.

The regenerative module is designed to decentralize the hospital, reducing patient and staff movement across the facility by creating a one-stop destination for treatment. This means each module functions as an independent entity, housing all essential components of regenerative treatments. It is supported by patient hub on the lower level, a technical floor on top. All modules are interconnected via a continuously running basement floor for technical operations, glass tube-like corridors for human circulation, and pneumatic tubes for the transportation of biological matter.

Each module operates independently, encompassing all stages of regeneration, including storage, research and analysis, production, diagnostics, treatment delivery, and patient care.

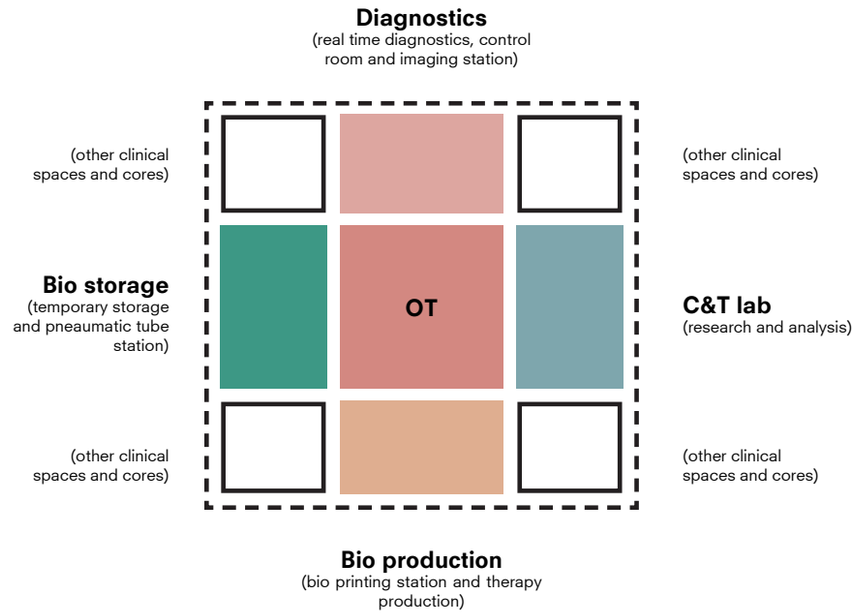
The concept of the module was inspired by the evolution of operational spaces, which are becoming larger and more integrated, incorporating multiple functions within or adjacent to treatment areas to facilitate seamless data exchange and intermediate diagnostics. Today's hybrid operating spaces, for example, include CT and other diagnostic facilities within the same environment. (Refer to the appendix for an overview of the evolution of operating spaces.) The regenerative module expands on this concept, serving as an extended treatment space that is directly connected to all necessary functions for human regeneration.

The module is designed as a perfect square with three levels. The ground floor accommodates patient spaces, including patient beds, ICUs, and critical care areas. The first floor is dedicated to treatment spaces, challenging the traditional hospital layout, where patient rooms are typically placed on higher floors while treatment areas remain below. This new approach, combined with a horizontal hospital design, ensures that patients remain on the ground floor, connected to nature, while clinical spaces on the first floor remain easily accessible to medical professionals.

The main clinical floor is divided into four distinct sections, each dedicated to a core function of regenerative medicine, surrounding the central treatment space where operations and therapies are administered. The size and configuration of these sections are based on multiple case studies of similar facilities, including bioproduction labs, in-house diagnostics, biological material storage and reception, and, most critically, a monitoring room and research and analysis lab. These soaces oversees the entire process, analyzing biological matter, tailoring treatments to individual patients, and ensuring proper administration. It remains connected via smart systems to track patient progress even after surgery when they are recovering on the lower floor.

Supporting these primary functional areas, the module includes a series of smaller technical and auxiliary spaces essential for the full-scale operation of labs and treatment areas. As illustrated in figure - xx, the lower floor features patient beds arranged to face outward, ensuring access to natural light and outdoor views. This integration with nature plays a crucial role in the psychological rehabilitation and overall well-being of patients.

Multiple iterations were conducted to integrate all these functions into a single, compact module, creating a one-stop destination for patients undergoing regeneration. Each iteration was carefully designed, taking into account the movement flows of patients, technicians, and clinical staff while ensuring the proper maintenance of positive and negative pressure zones based on the separation of clean and dirty corridors, while maintaing the architectural quality of spaces and connection with outside nature.



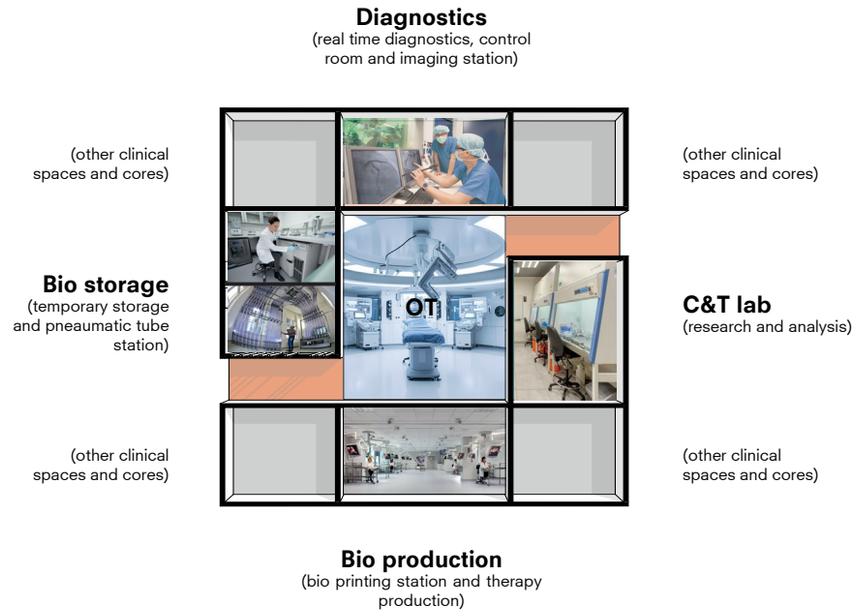
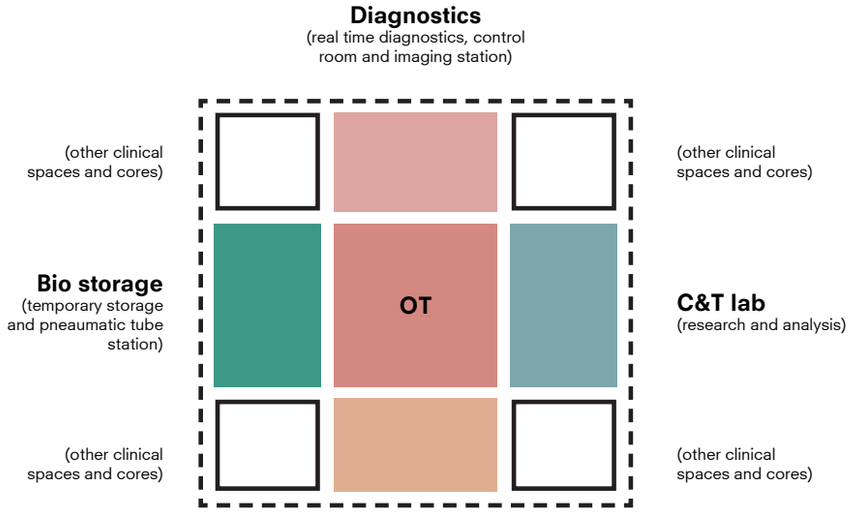


Figure - 73 (above) Schematic arrangement of regenerative module treatment floor | Figure - 74 (below) With example casestudy of major spaces of module



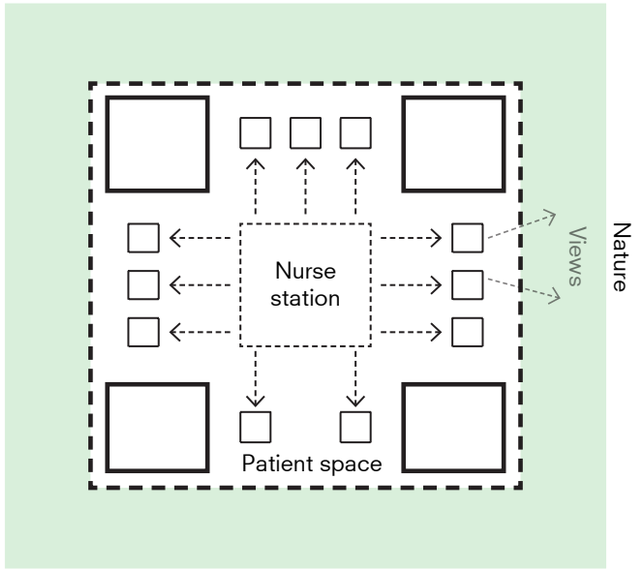


Figure - 75 Schematic arrangement of both module floors

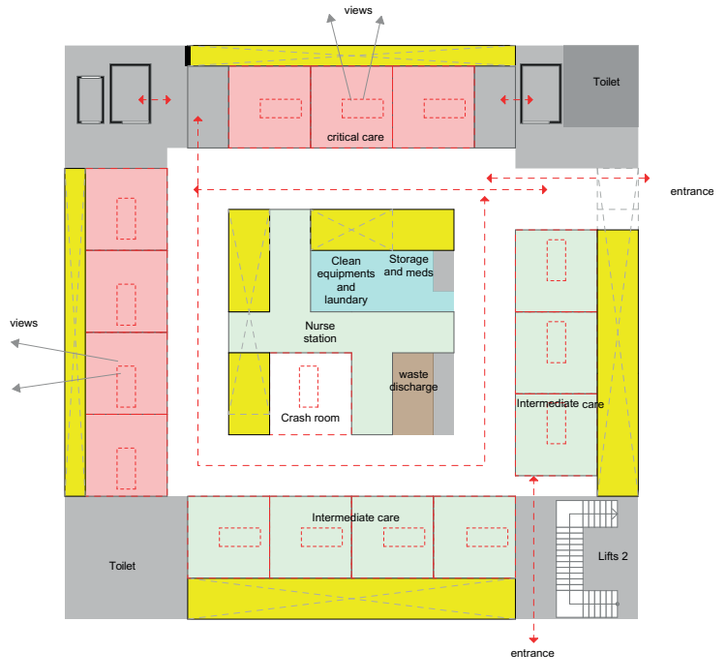
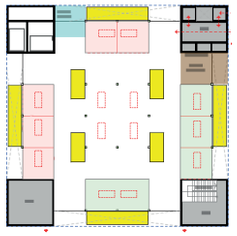
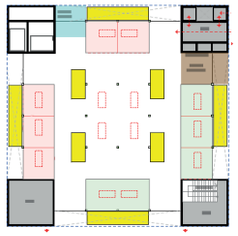
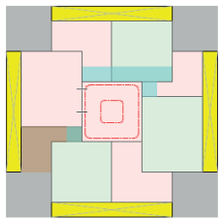
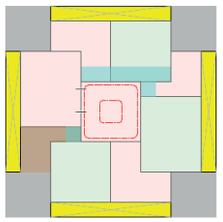


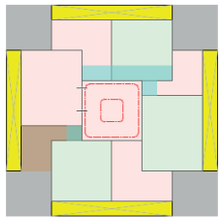
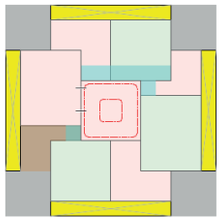
Figure - 76 Detailed schematic plan of the module

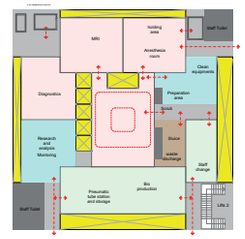
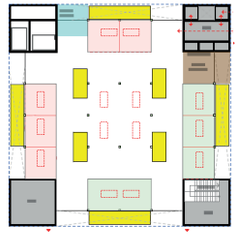
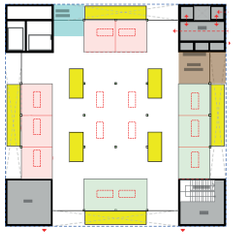
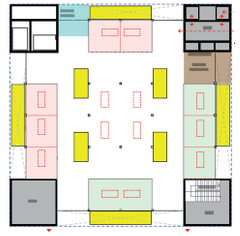




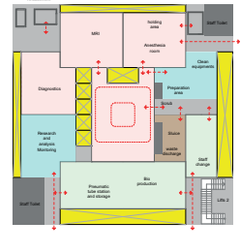




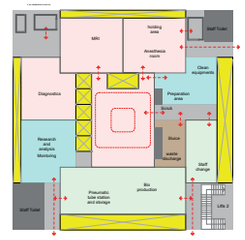



Figure - 77 Multiple itterations of the plans of the module

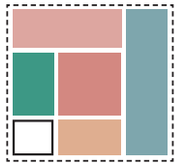
Types of Regenerative module

These regenerative modules were designed with the understanding that different regenerative treatments require varying spatial allocations for different functions. For example, a module dedicated solely to research and monitoring will have expanded research and analysis spaces while reducing production and bio-storage areas. As seen in Figure - 79, multiple setups can be created by simply expanding certain spaces to meet the specific requirements of each treatment type. Considering current needs and future advancements, the regenerative hospital will house three distinct module setups tailored for specific purposes:

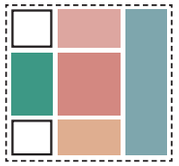
Biological Matter Collection & Analysis Module – This module is designed primarily for the collection, temporary storage, and analysis of biological samples before they are deposited in the bio repository. As a result, it reduces the need for production spaces and certain diagnostic areas while expanding research laboratories and temporary storage facilities. On the lower floor, where patients are placed, the setup differs from the critical care module. Instead of individual enclosed spaces, this module features open resting pods, as patients typically stay for only a few hours rather than extended periods.

Non-Invasive Therapy & Treatment Module – This setup caters to non-invasive therapies, requiring a larger area for therapy administration. The first floor is adapted to accommodate a higher number of treatment stations, doubling the patient capacity compared to the surgical module. Additionally, production areas are expanded to meet the increased demand for regenerative therapies.

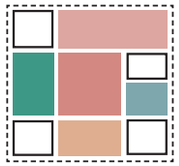
Surgical & Critical Care Module – This module is designed for critical regenerative surgeries. It features enclosed individual patient rooms with controlled pressure environments to maintain sterility and ensure optimal recovery conditions. Unlike the therapy module, where multiple patients can receive treatment



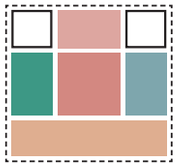
More focused on both research and monitoring



More focused on research



More focused on imaging and monitoring

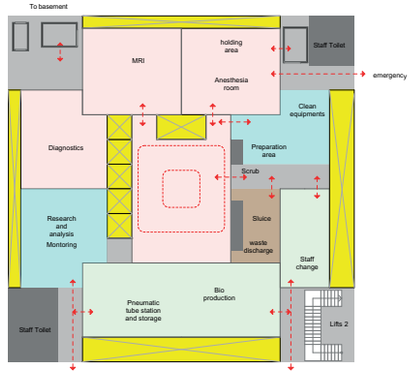


More focused on production

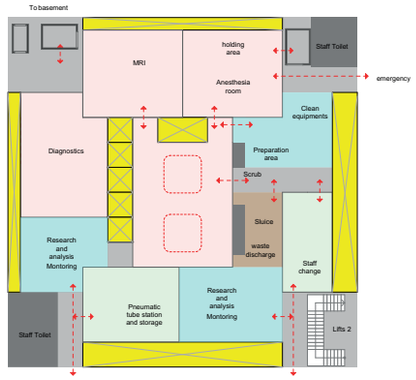
simultaneously, this setup prioritizes surgical precision, treating one patient at a time. Since these modules are the ones that deal with lengthy and critical surgeries the patients are supposed to be hospitalised for a longer period, and to do so to the surgical or critical care modules are directly connected to patient modules, making it perfect for human circulation and easy connectivity.

These three distinct modules repeat throughout the hospital, forming a cohesive system that addresses the varied needs of regenerative medicine within the current and evolving healthcare landscape. As per the current requirements, the hospital is planned with 2 bio-collection modules, 4 therapy modules, and 2 surgical or critical care modules.

Surgical module



Therapy module



Bio sample collection module

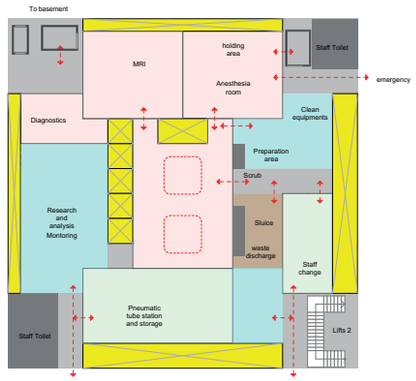


Figure - 79 3 main types of regenerative modules for 3 distict stages of regeneration

Figure - 80 Ground level plan for surgical unit

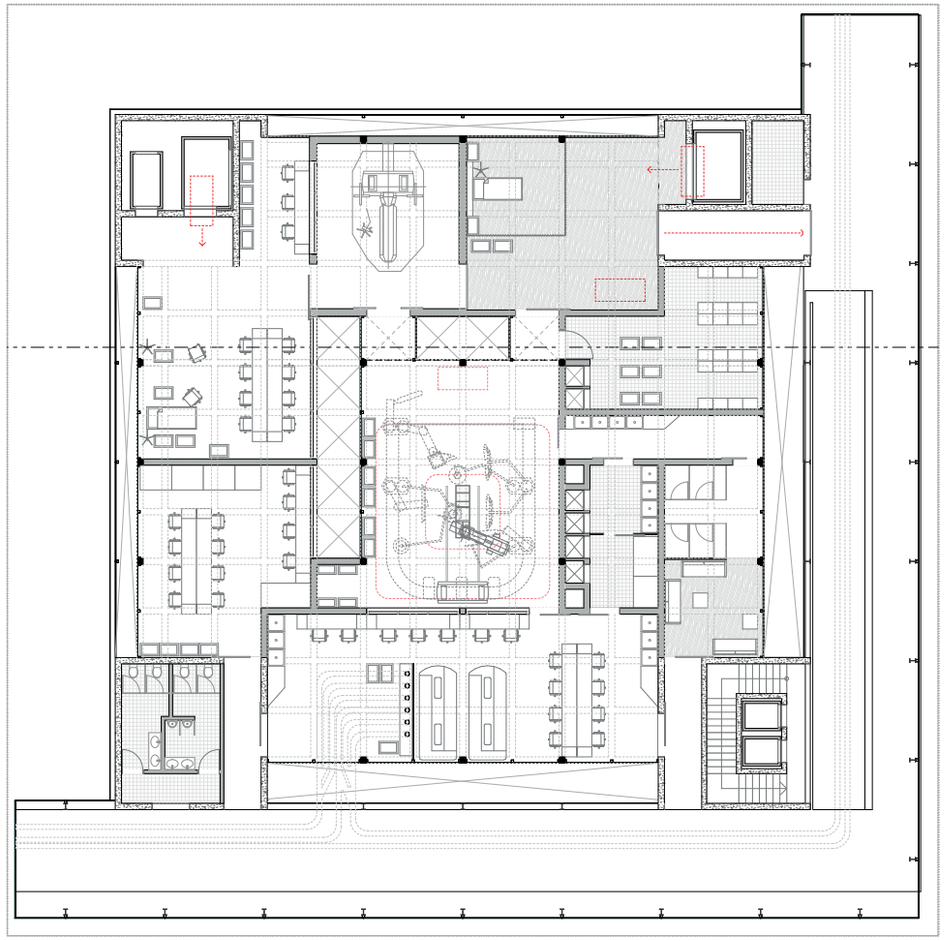


Figure - 81 First floor plan for the surgical unit

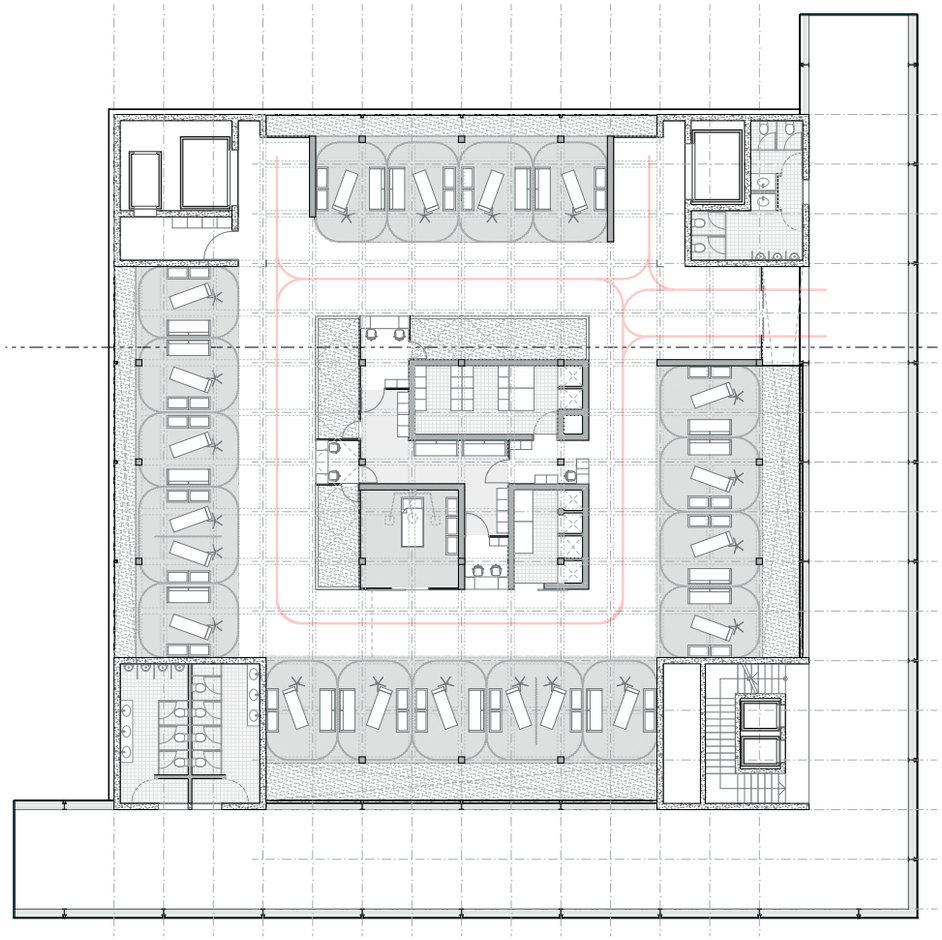


Figure - 82 Ground floor plan for the threapy unit

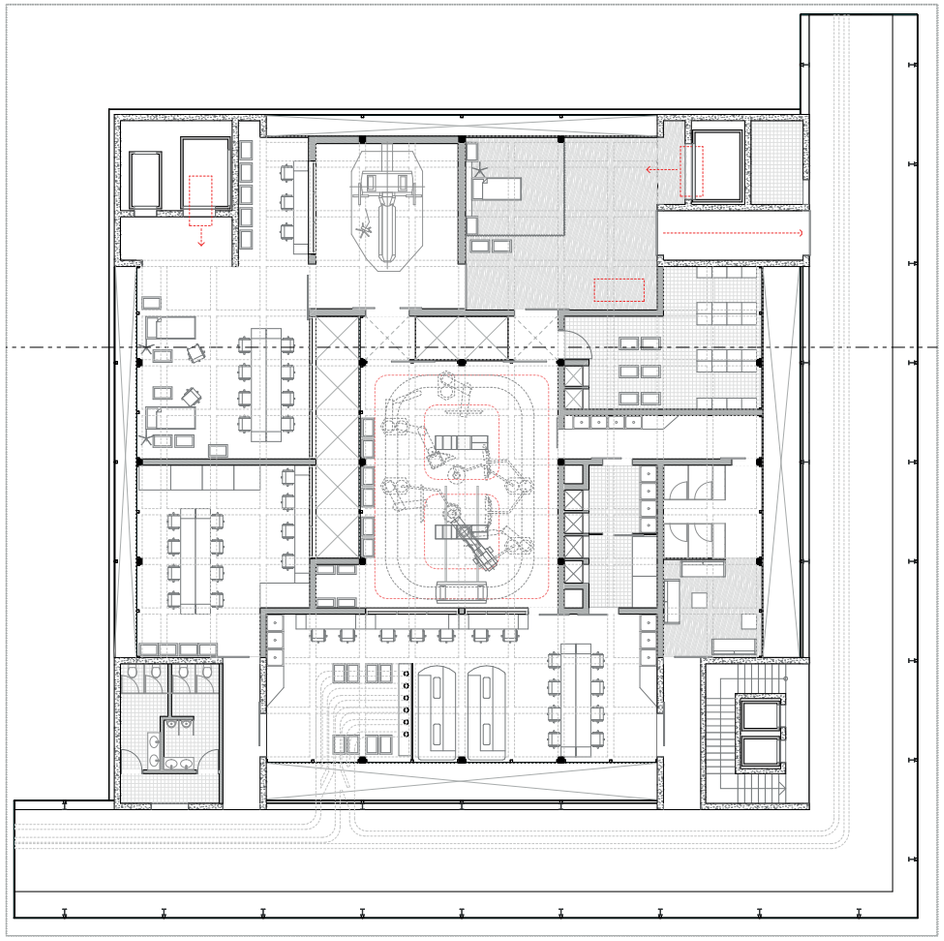


Figure - 83 First floor plan for the threapy unit

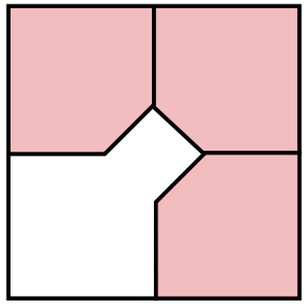
Image - 38 Render showing the ground floor of Regenerative module - surgical unit

The patient module

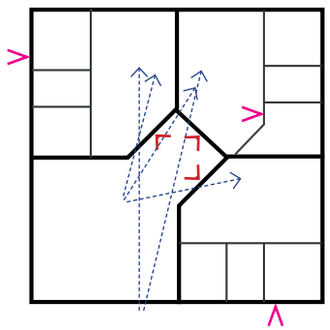
The patient module represents the smallest functional unit within the hospital, designed to create a comfortable and healing environment. Each module consists of three patient rooms, each accompanied by a dedicated companion space, and a centrally located common area for meetings, consultations, and guest visits. The module follows a 12m × 12m grid, divided into four parts, three designated for patient rooms and the fourth serving as a shared space that also connects the rooms to the corridors.

This layout ensures that the module can be accessed from one or two sides, allowing the remaining sides to remain open, integrating the patient rooms with the surrounding natural environment. Such an arrangement provides a clear line of sight from the corridors to the patient rooms and monitoring areas, ensuring smooth and efficient hospital operations. The companion spaces have separate entrances directly connected to the corridors, maintaining patient privacy while offering companions a place to rest without disturbing the patient.

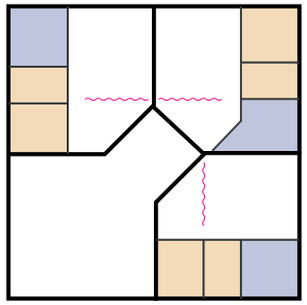
The interior of the patient room is thoughtfully designed to enhance comfort and well-being. A sloping false ceiling gives the impression of a cozy, home-like space, reducing the clinical feel often associated with hospitals. Additionally, each room features a spherical skylight, bringing in abundant reflected natural light and allowing patients to gaze at the sky, promoting a sense of calm and connection to nature. The warm wooden interior further enhances the homely atmosphere, making the patient experience more comfortable and restorative.



Dividing the module in 4 sections, 3 rooms, 1 common space

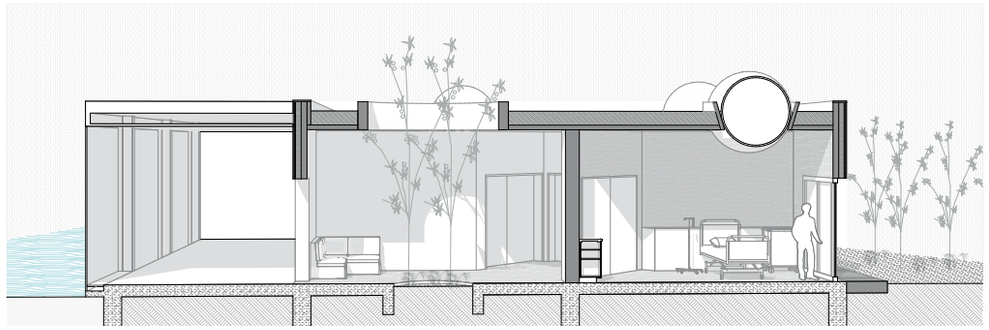


Access points and Visibility line from corridor and the common space for the Staff



Spatial scheme of the module

Figure - 84 Schematic diagrams of arrangement of the patient rooms



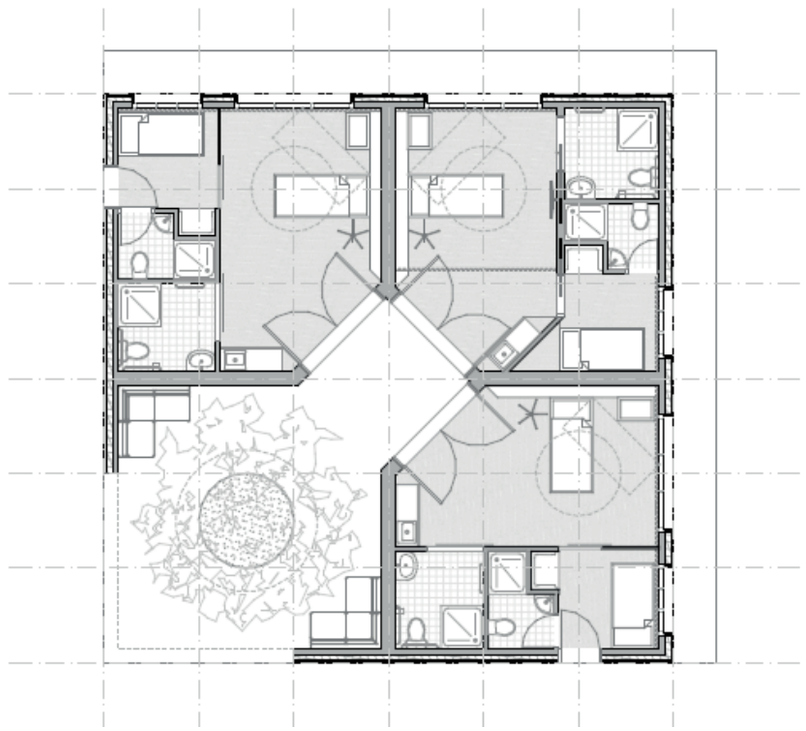


Figure - 85 (above) Section of the patient module | Figure - 86 (below) Floor plan of the patient module

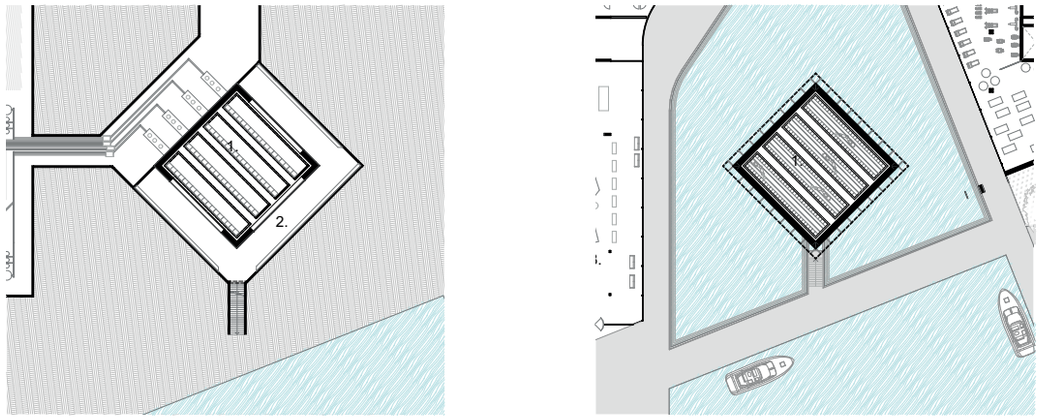
Image - 39 Interior render, highlighting the abundance of natural light and openess of the module to the outside world and warm interiors

The Bio Repository

The bio repository is one of the most important spaces for regenerative medicine to function and, therefore, becomes a key element of the regenerative hospital. It serves as a storage facility for biological matter collected from patients and donors for current or future use. Acting as a vault, it preserves these materials at extremely low temperatures using cryopreservation techniques.
Traditionally, these spaces have been limited to very few treatments, but with advancements in human regeneration, storing stem cells and genetic material has become crucial. This requires a large storage facility that functions as the central hub, maintaining the supply chain and ensuring a steady flow of biological materials.
For the general public, it is similar to reserving a locker in a bank, but instead of valuables, they are storing their genes and stem cells for future medical use and to support research in regenerative medicine.
Typically, these spaces are hidden within hospitals due to security concerns. However, the future regenerative hospital envisions the bio repository as a way to connect with people, making medical advancements more transparent and showing them how their biological matter is handled after submission. This facility not only serves as the backbone of regenerative medicine but also acts as an iconic element of the hospital, breaking the traditional barriers of secrecy in medical environments.

The bio repository is strategically located along the central spine at the junction where it meets the Spree River, making it highly visible from all sides, including from the river, trains, and the emerging Europacity, establishing itself as a landmark within the urban context. As part of the main public corridor, the repository features a public gallery where visitors can observe its operations. Access to the gallery is provided by a staircase designed to give the impression of diving into water, piquing curiosity about what happens beneath the surface.

The repository is placed within the water body, emphasizing its secure and protected nature, with limited access points. All technical operations, including the handling and processing of biological materials, take place at the underground level, connected to a dispatch area to ensure uninterrupted and secure functionality. Most of the internal operations are automated, requiring minimal human intervention.



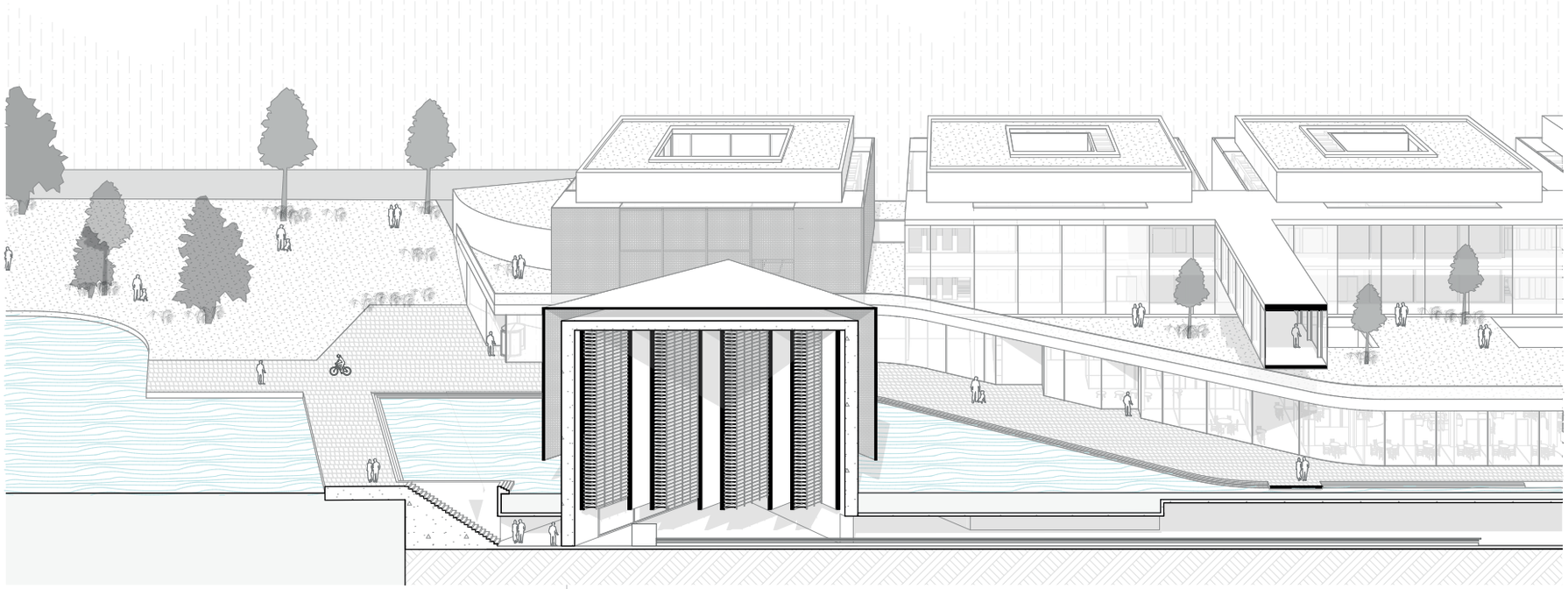
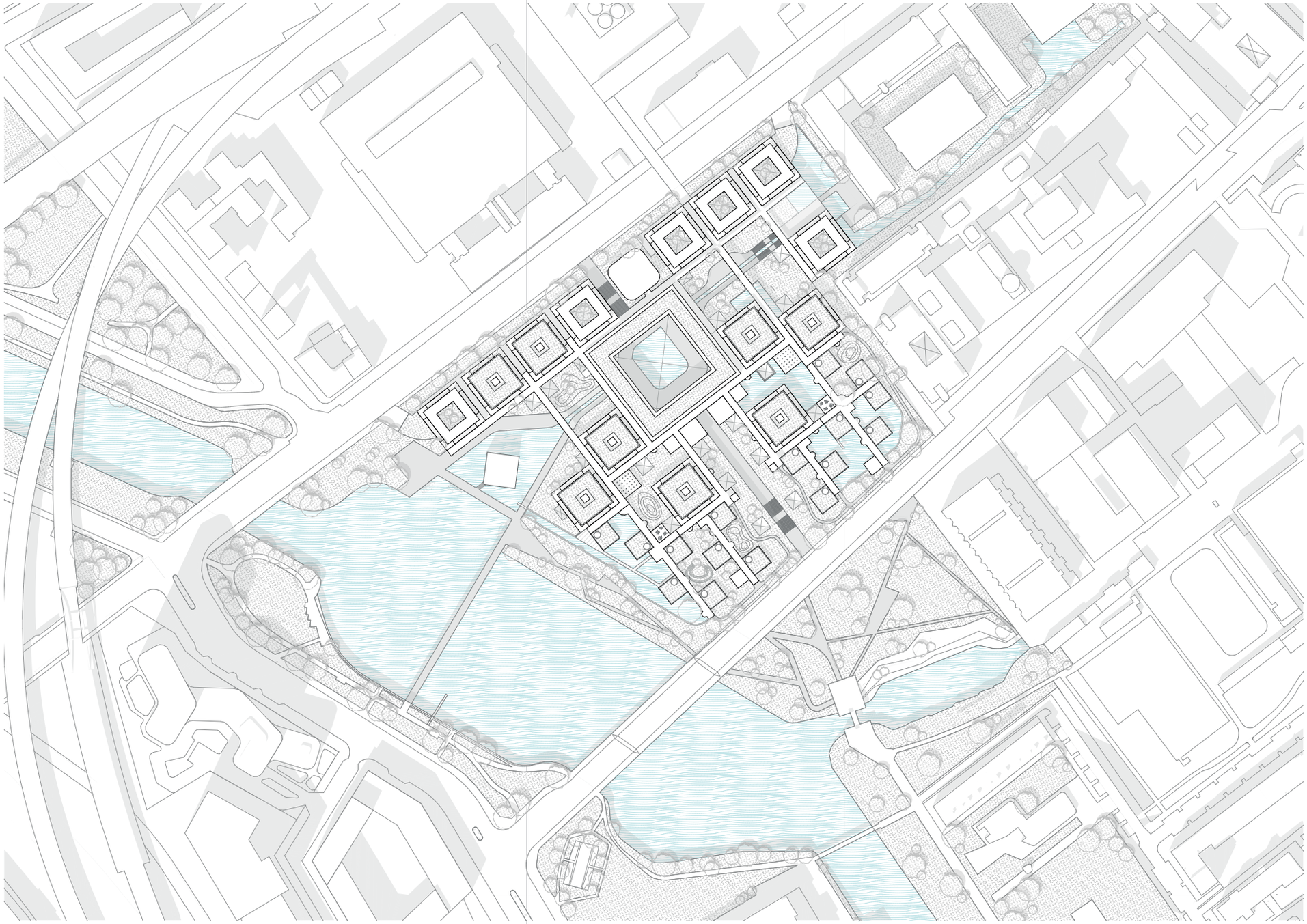


Figure - 87 (above) Floor plans of the Bio repository | Figure - 88 (below) Section highlightinh the public and technical sides of the Bio repositiry

Image - 40 Render of the central spine opening up to the main element of the hospital, Bio repository

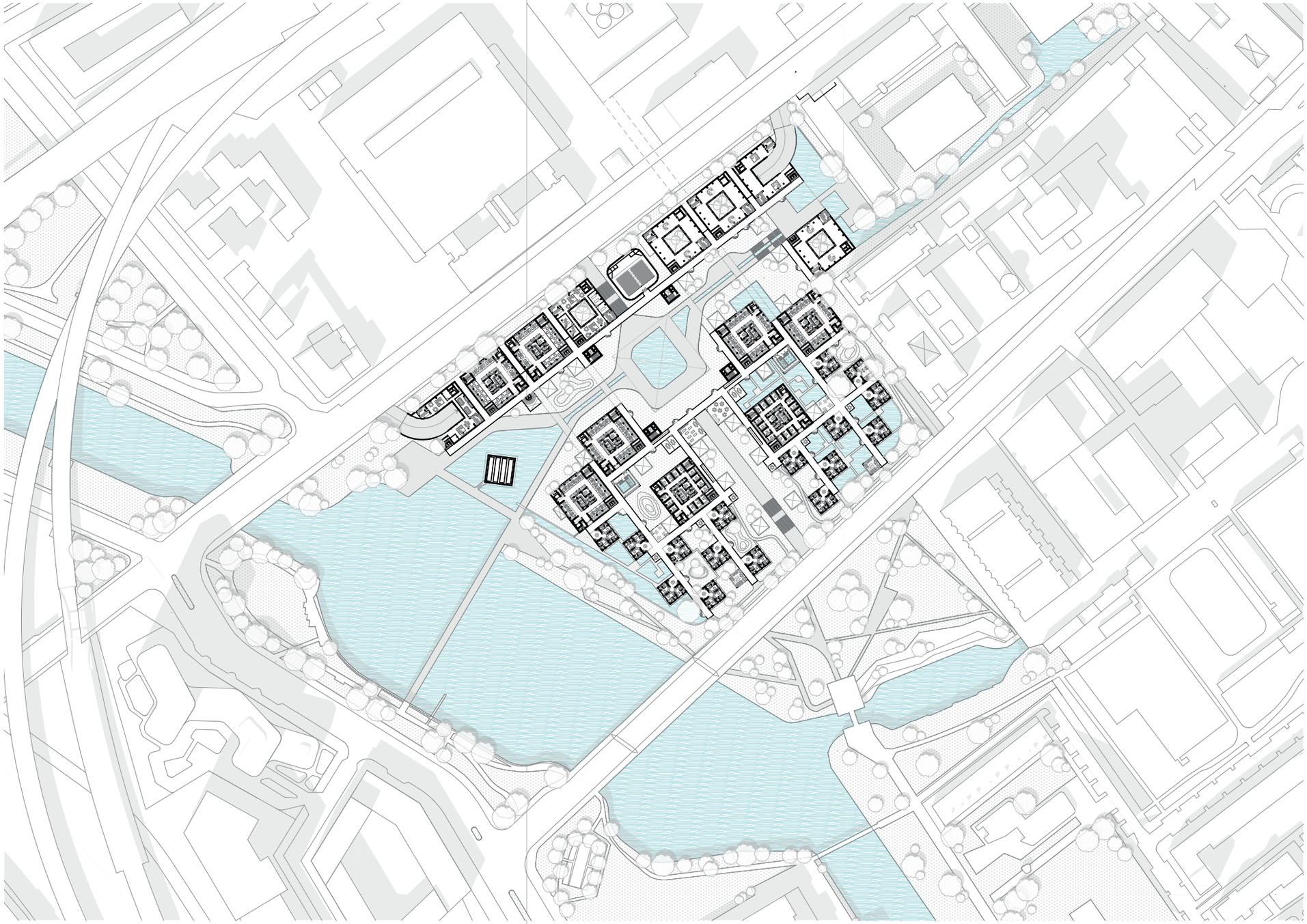
Site plan

Public corridor(main spine),
Spaces for public and science interaction
Technical support spaces



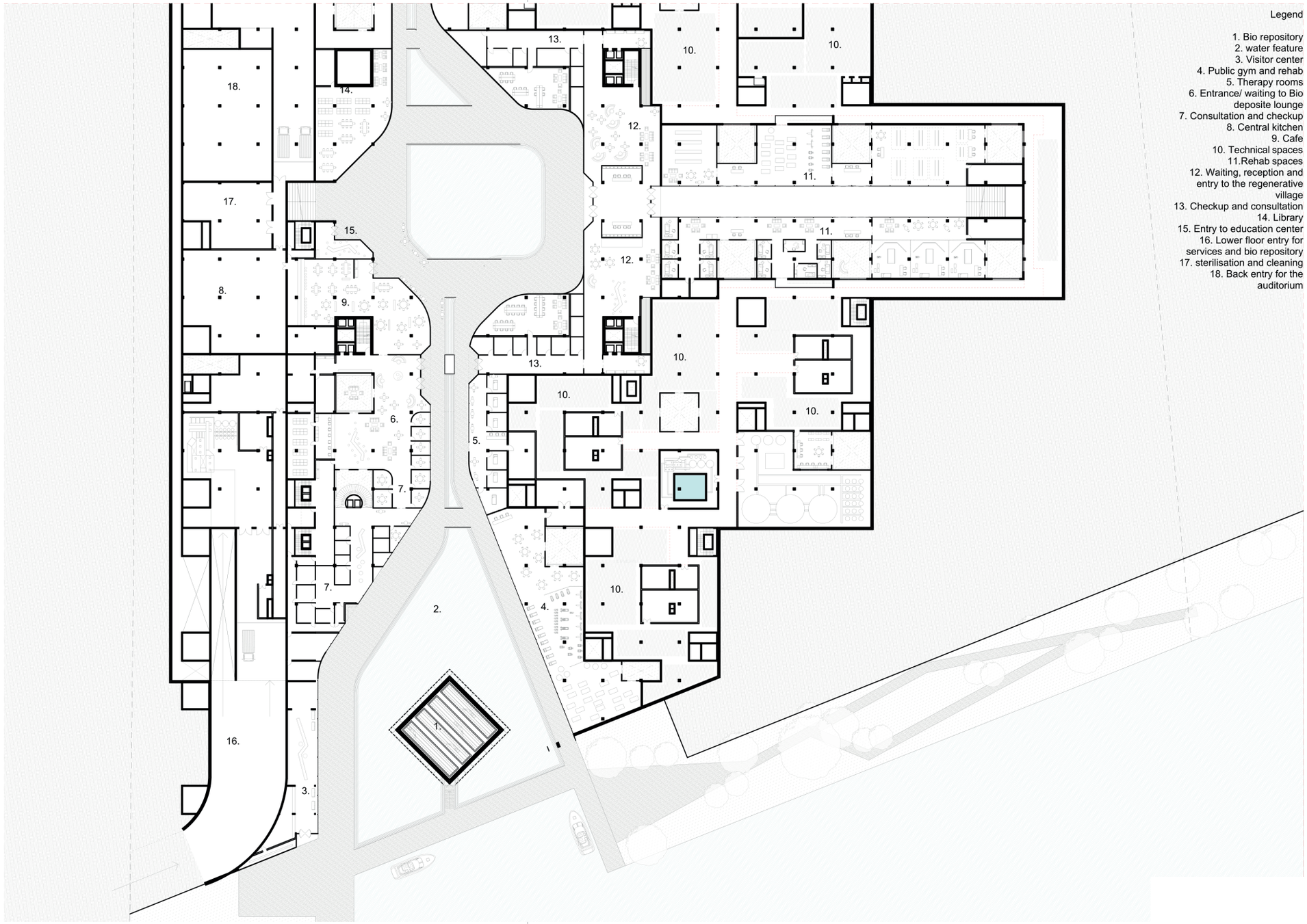
Urban integration plan

Public corridor(main spine),
Spaces for public and science interaction
Technical support spaces



Lower Ground floor

Public corridor(main spine),
Spaces for public and science interaction
Technical support spaces

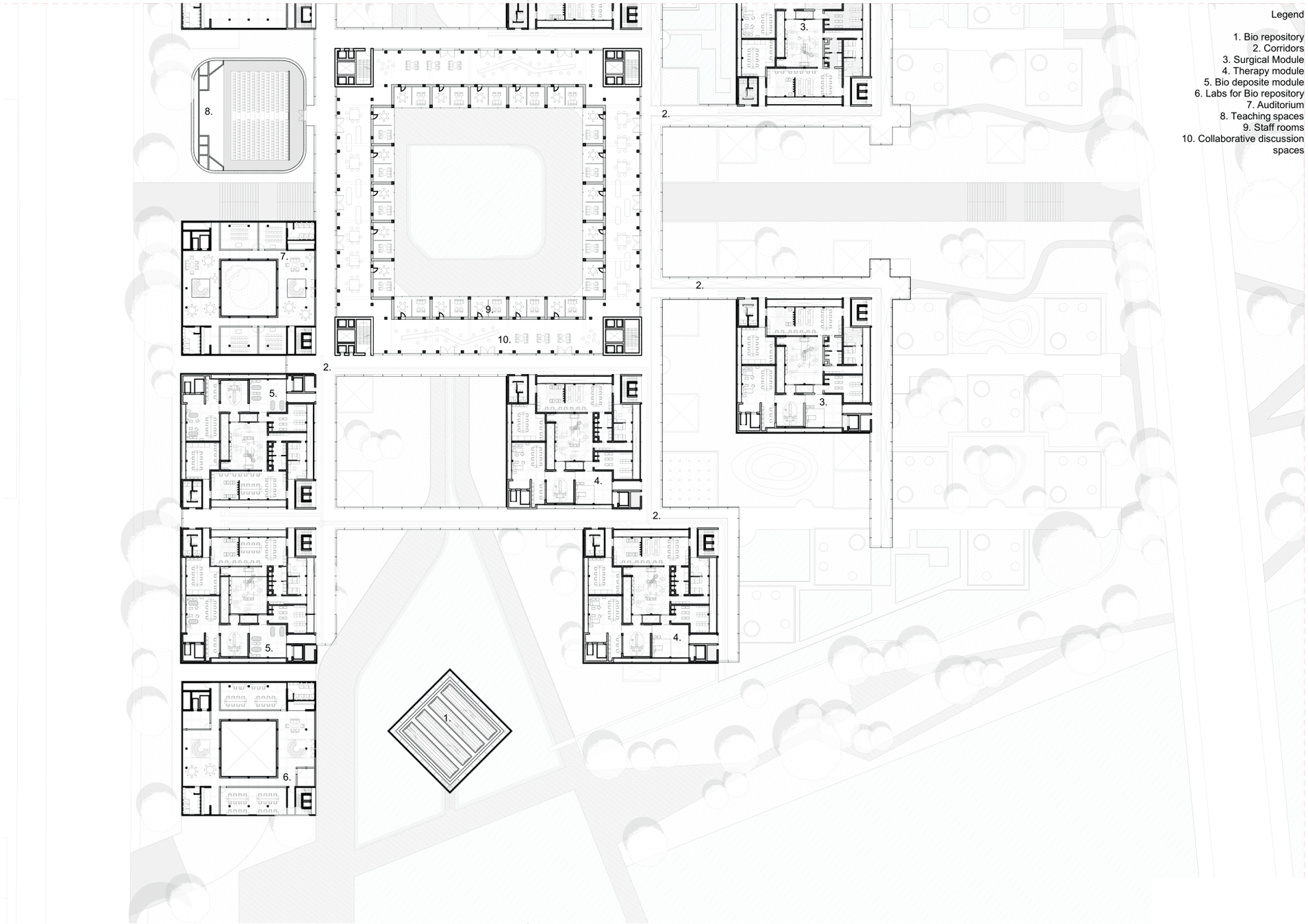


Upper Ground floor

Public corridor(main spine),
Spaces for public and science interaction
Technical support spaces

First floor

Public corridor(main spine),
Spaces for public and science interaction
Technical support spaces



Technical concept

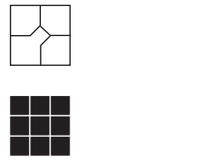
The project incorporates four distinct structural systems, each utilizing different materials that best align with the scale and function of its respective module. The main objective is to ensure that these structural systems do not visually separate the modules but instead maintain a cohesive aesthetic while complementing their functional requirements.

The smallest module, dedicated to patient rooms, follows a compact 12m × 12m layout. Its primary structural system consists of 350mm thick CLT (Cross-Laminated Timber) walls, serving as the main load-bearing elements, topped with a CLT slab. This choice of material provides a warm and natural ambiance, reinforcing the healing environment of the patient spaces.

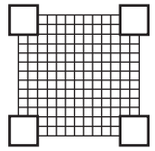
The medium-sized regenerative module, measuring 28m × 28m, houses the core medical functions of the hospital. Its structure comprises a CLT beam and column grid, with columns spaced 2m apart to create a rhythmic and efficient framework. This system is further supported by a 6m × 6m concrete core, which accommodates vertical transportation elements such as lifts and staircases, along with essential core areas like washrooms. Corridors for circulation are structured using independent white steel frames, which, in some instances, are anchored to the main modules to ensure stability.

The largest module is a striking ring-shaped structure that spans over the central spine and open space of the hospital. This module measures 64m × 64m, featuring a 40m × 40m cutout at its center, giving it a distinct floating ring-like form. Given its extensive span, a steel truss system is employed to bridge the distance between four 8m × 8m concrete cores, which house the vertical circulation shafts connecting various sections of the hospital for different users.

These distinct structural systems have been carefully selected and adapted to ensure a sleek and cohesive aesthetic across all modules while also providing structural efficiency and functionality suited to their respective scales.

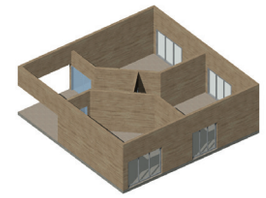


Patient module

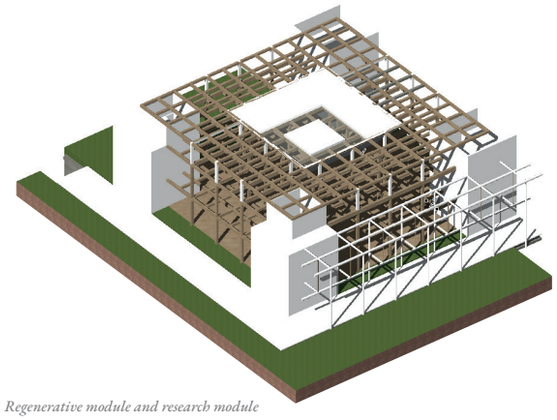


Regenerative module and research module

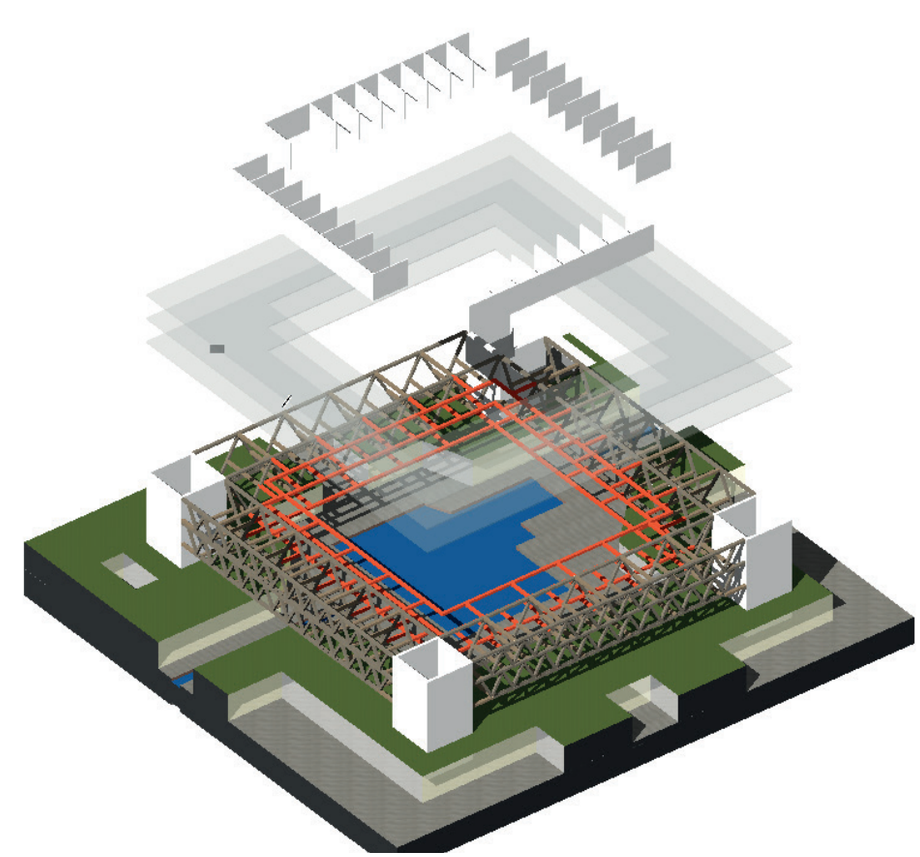
Figure - 89 Structural schematics of all three types based on the scale of the module



Patient module



Regenerative module and research module



The collaborative ring

Figure - 90 Axo of all three types based on the scale of the module - showing the structural elements of it

Detials

The project details are meticulously designed to reinforce the concept of solid modules contrasted against sleek, nearly invisible corridors. To achieve this, glass is used extensively for the corridor enclosures, creating a sense of lightness and transparency. The roof junction detail is executed by extending the glass to its uppermost edge, leaving only a minimal white fascia strip visible. A similar approach is applied at the base, where the glass is seamlessly integrated with the ground level, giving the impression that it grows naturally from the earth to the sky. (figure - 91)

The corridors are made visually minimal by using a combination of glass and slim steel members for structural support. A specialized framework is developed by combining steel I-sections for structural integrity with a lightweight aluminum frame to hold the glass panels in place. This delicate balance ensures that the corridors appear as thin, floating glass tubes weaving through the campus, visually wrapping around the solid modules and holding them in place.

At the junctions where corridors connect to the modules, specialized detailing allows for the natural intake and outtake of air, ensuring a continuous flow of fresh air throughout the campus. (figure - 93)This design makes the system highly efficient in utilizing natural ventilation, reducing reliance on mechanical systems.

The modules themselves remain as solid blocks, with an emphasis on maximizing the use of skylights to enhance interior lighting and create dynamic spatial experiences. The patient modules feature a particularly innovative skylight detail, using hollow glass spheres instead of conventional glass domes or flat skylights. These spheres diffuse light evenly while still offering a clear view of the sky. At their junctions, the spheres incorporate internal lighting, creating a striking visual effect at night—when illuminated, they appear as glowing orbs, giving the patient rooms a unique identity from the outside while maintaining a soft, diffused lighting ambiance within. (figure - 94)

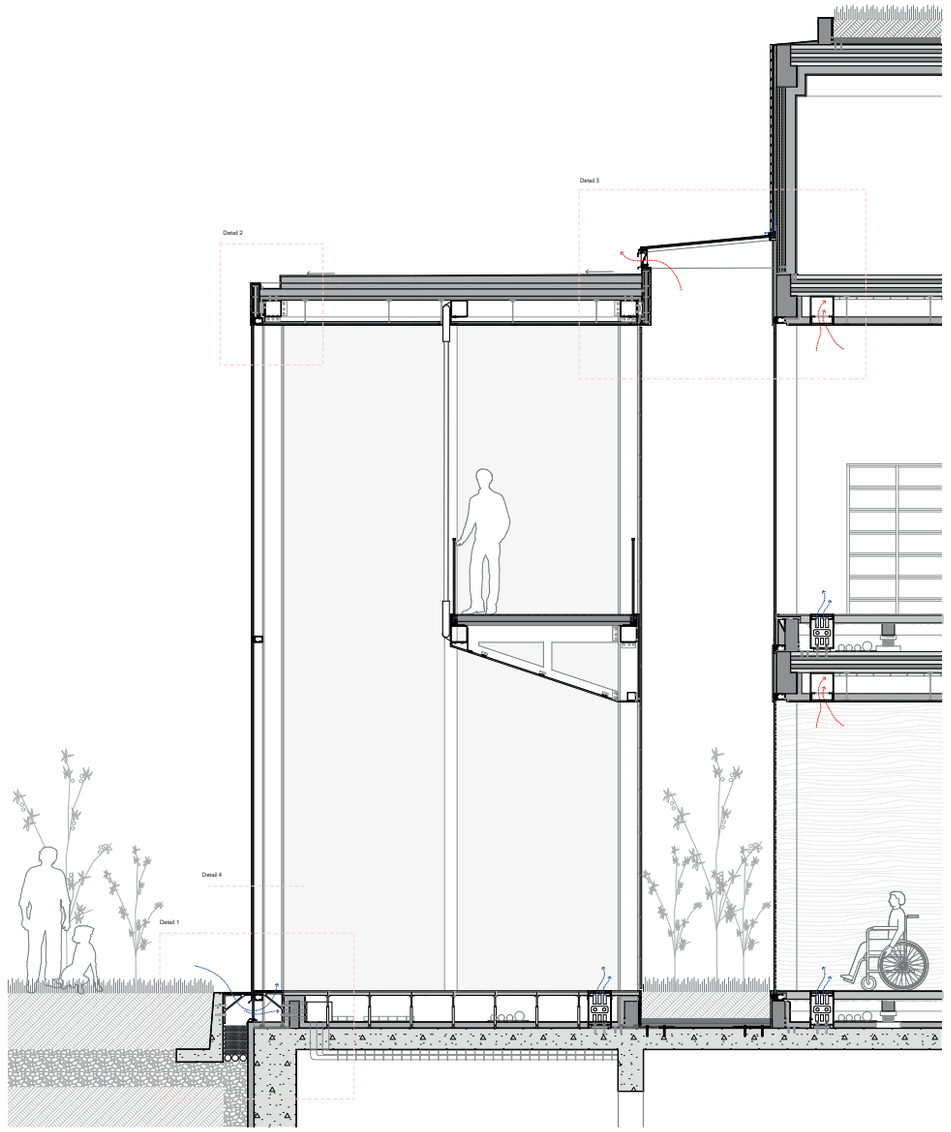
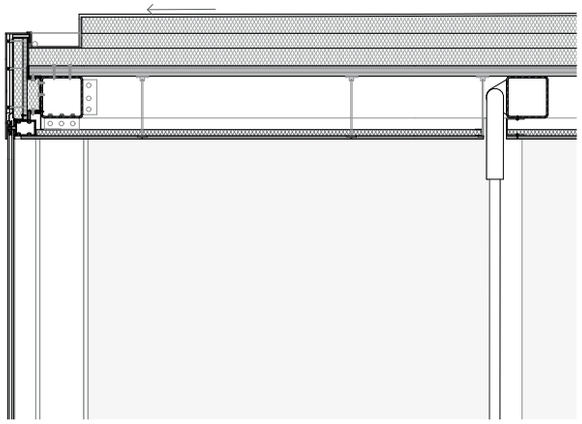
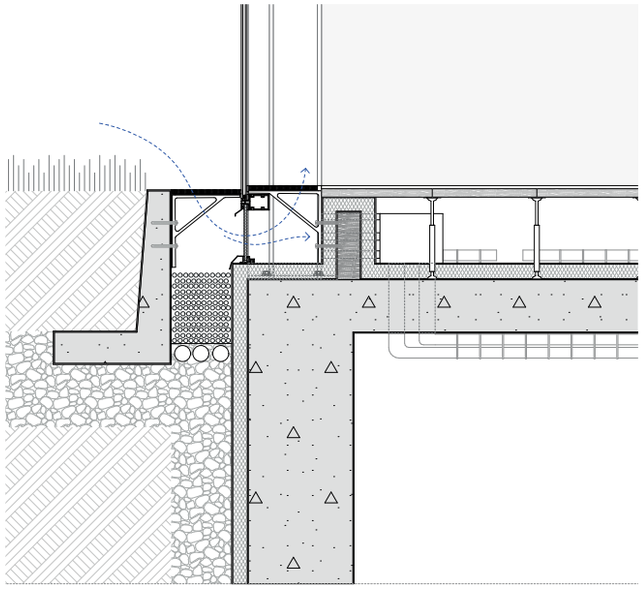


Figure - 91 Wall section of corridor and regenerative module connection



Detail 2
Scale - 1:20

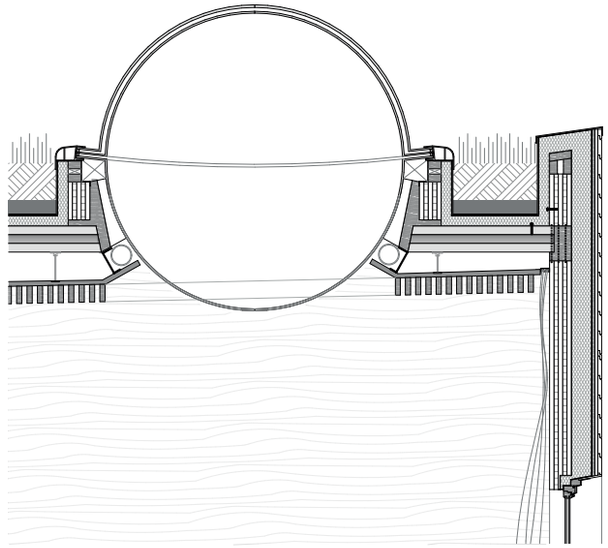
1. 250x250 mm Steel box profile beam
2. Suspended ceiling
3. Insulation
4. Water resistant roofing sheet
5. 50mm Dia steel cords
6. Mounting plate
7. Double glazed insulated curtain wall
8. Aluminium frame curtain wall
9. Facia board
10. I beam column



Detail 1
Scale - 1:20

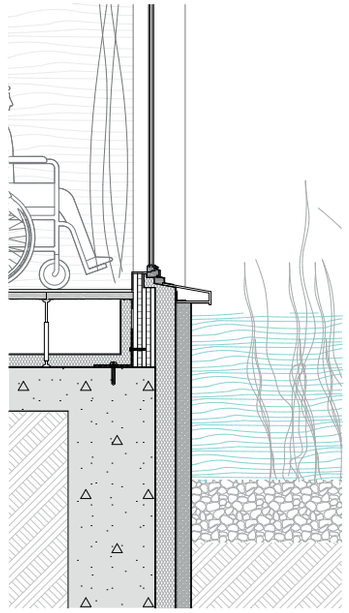
1. Concrete slab
2. Raised floor system
3. Rain water basin
4. External grating
5. Lower ventilation operable damper
6. Basement concrete retaining wall
7. Floor air intake
8. HEPA filters
9. Insulation
10. Vapour and moisture resistant membrane
11. Drain pipes
12. Aluminium profile with thermal breaker
14. Extrior corridor facade, double glazed insulated curtain wall with low iron glass

Figure - 92 (above) Detail of Corridor roof | Figure - 93 (below) Detail of corridor floor slab junction



Detail 1
Scale - 1:20

1. Concrete slab
2. Glt slab
3. CLt load bearing walls
4.Insulation
5. Water proof and moisture membrane
6. Basement concrete retaining wall
7. External wooden cladding, white colour finish
8. Aluminium coping
9. Sperical glass skylight with attached lights to increase the glow and throw of light
10. Sloping false ceiling
11. Aluminium casing to hold the skylight
12.Aluminiun window frame, power coated white
14. Root barrier
15. Insulation
16. Water proof membrane
17. 200mm soil



Detail 3
Scale - 1:20

1. Concrete slab
2. Concrete wall
3. Insulation
4. Stone pitching
5. Gravel
6.Compacted soil
7. Aluminium sill profile to stop water from over flashing
8. Raised floors for services
9. Alumium window frame, powder coated white
10. Vapour and moisture resistant membrane
11. Double glased insulated windows

Figure - 94 (above) Roof details of patient module | Figure - 95 (below) Floor junction details of patient module

Material pallet

The materials of the project are selected with its sole purpose in mind: to give an identity to human regeneration as a highly advanced act of medicine, to define the space it houses as one of extreme innovation and discovery, while maintaining a human-friendly environment—making patients feel at home while receiving treatment. The idea of materiality revolves around creating spaces that showcase innovation while also presenting a soft and homely side.

In order to achieve this, the exteriors and technical/critical spaces of the hospital follow a color theme of whites and glassy materials, emphasizing the groundbreaking innovation and research aspect of the project. Clean white surfaces and sharp details are seen as a symbol of innovation and boldness. On the other hand, the interiors are designed with earthy tones, using wood as the primary material. This warm, wooden interior helps patients feel as if they are inside their homes, fostering a sense of comfort and normalcy. This directly influences recovery rates from severe conditions. The wood, supported by reflected natural light, adds an extra touch of warmth and tranquility.

Inside the modules

Outside the modules

warm interiors, difused light, wood texture

Glass, white, direct light

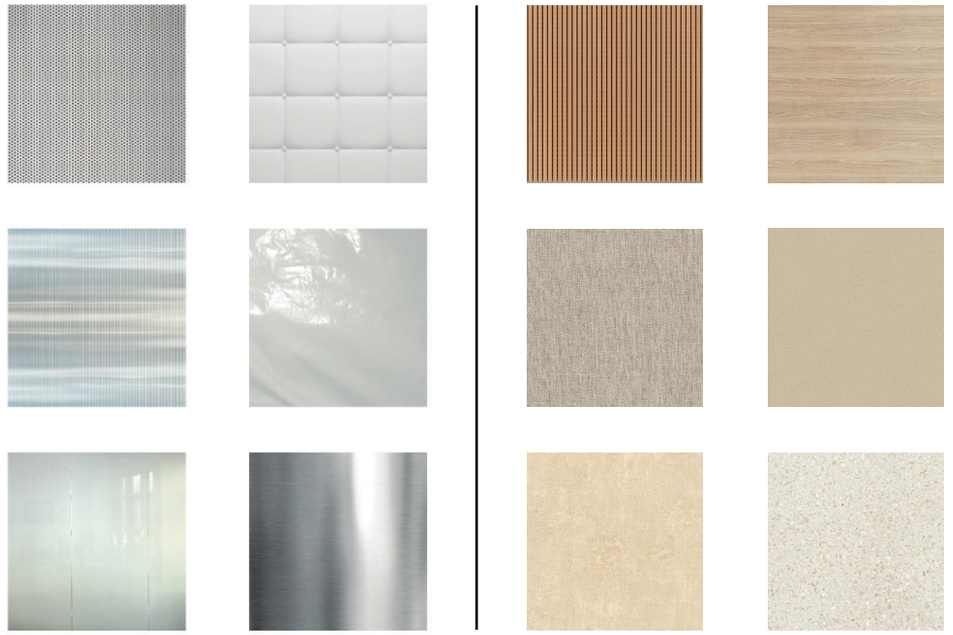


Image - 41 (above) Two worlds inside and outside material and ambience comparision | Image - 42 (below) Material pallets of outside (left) and inside (right)

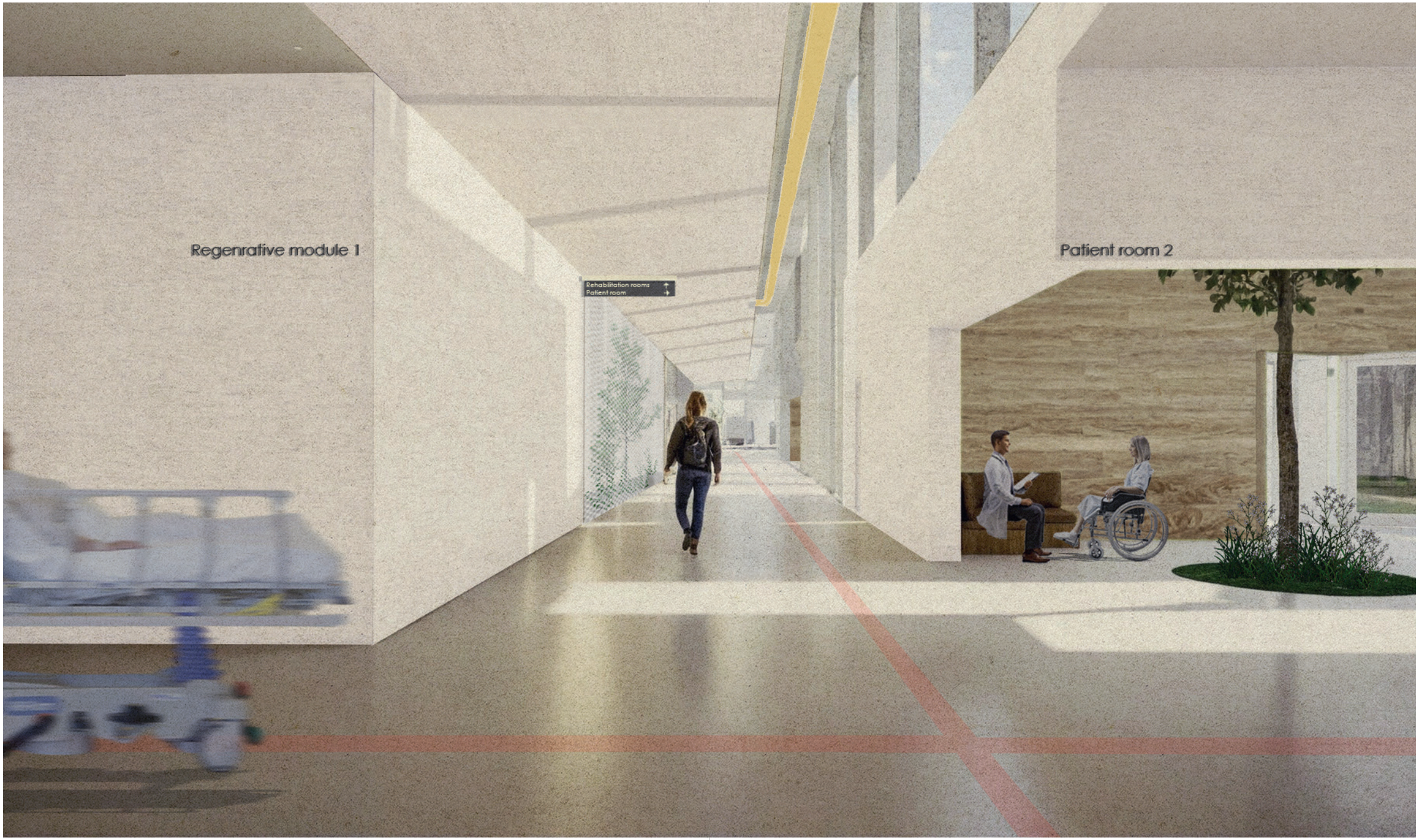


Image - 43 View of a corridor showing the junction of regenerative module on left and patient module on right with Yellow pneumatic tube above

Facade - elevation

Wanting to be a light and clean object within the massive cityscape, the materials and façade appearance play a crucial role. The concept revolves around creating transparent looking corridors that wrap around solid white blocks.

With multiple modules placed together, there is also a concern for privacy at the ground level, particularly in the patient hub, which will house most patients for a minimum of 3 - 4 days. The challenge is to ensure a clear view of nature from the inside while blocking the view from outside, maintaining privacy and reinforcing the modules' solid block identity.

The building is clad in a seamless anodized expanded aluminum mesh, with windows subtly visible behind it. The result is an elegant, light, and white succession of surfaces, uninterrupted by other elements, a semi-transparent "dress" for the hospital modules. This allows light to become an additional dimension within the regenerative module, changing throughout the day.

By using this seamless mesh, the geometry of the modules is highlighted, enhancing the structure while demonstrating sleekness, strength, and innovation. At night, the modules emit a soft glow from within, with light filtering through the gaps in the mesh, accentuating the volumes inside and giving the modules an even lighter appearance.

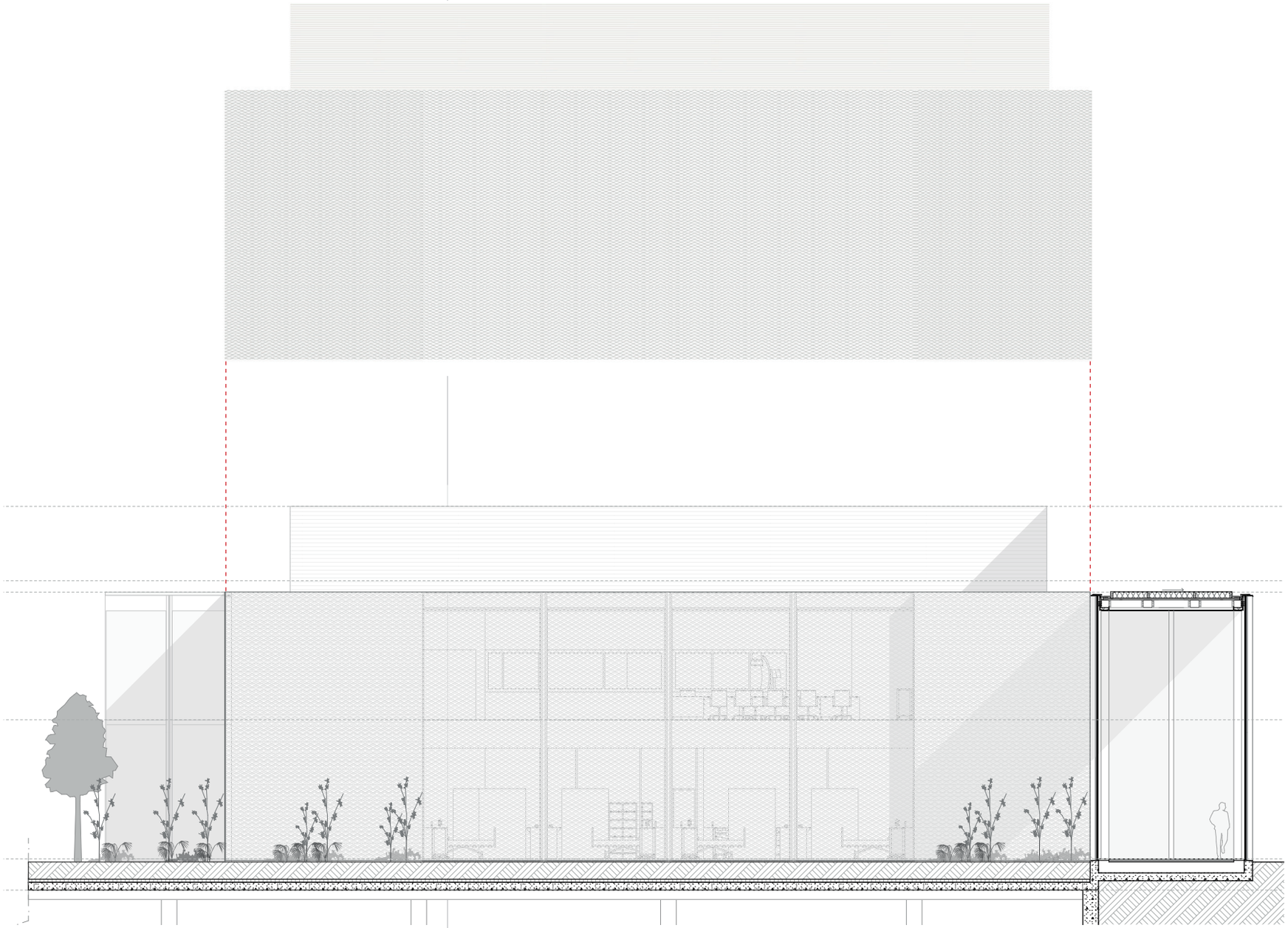


Figure - 96 Elevation of the main Regenerative module

Image - 44 View of the Hospital from spree river highlighting the solidness of the modules with transparent corriodors and the bio repository

Natural light

With the project's concept of relying on nature and maximizing the use of natural elements, be it air for cooling or light, its reliance on external energy sources is significantly reduced, leading the building towards a greener and more sustainable future.

This becomes increasingly important, as natural light plays a crucial role in the healing process. The human connection to natural light is essential for multiple reasons. It not only reduces stress but also provides a sense of being outside rather than enclosed within a space. It fosters a feeling of openness and freedom. Additionally, reflected light helps create a homely environment within the hospital modules. Natural light has many health benitfits as well, leading to a better and natural recovery.

To align with this, the project focuses on maximizing the use of natural light within the built structures. Since the design concept revolves around creating solid-looking blocks from the outside and, given the scale of the larger blocks, it becomes challenging to bring natural light into spaces near the center of each module. To address this, multiple cutouts, skylights, and light wells have been incorporated to direct natural light deep into the center of each block, even reaching the lowest levels.

As seen in figure - 97, a study was conducted on various types of openings to analyze the kind of light entering a space and how the space responds to it. This study is further supported by multiple examples from Tadao Ando's projects, which create mesmerizing and pleasant spaces by masterfully playing with natural light. In a similar manner, different types of cutouts, openings, and skylights are strategically used throughout the project, depending on the function of each module, the light requirements, and the intended atmosphere of the space.

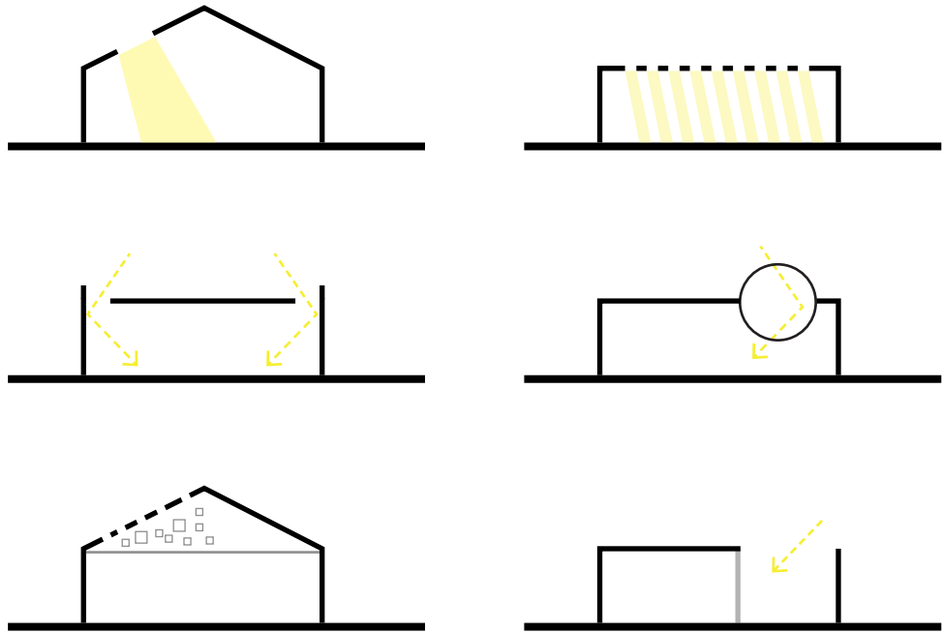


Figure - 97 Schematic sections of different roof cutouts/ skylights used in different spaces to maximise the use of natural light

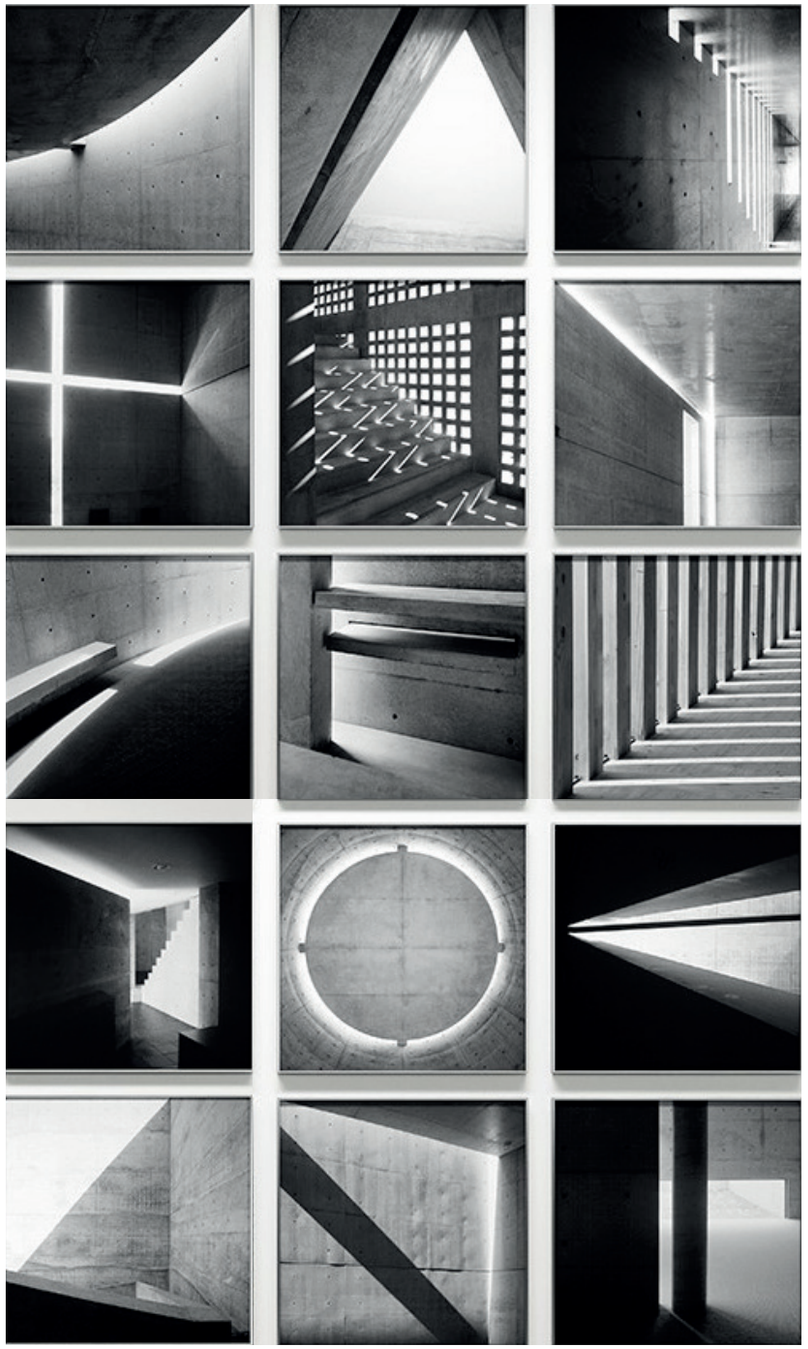
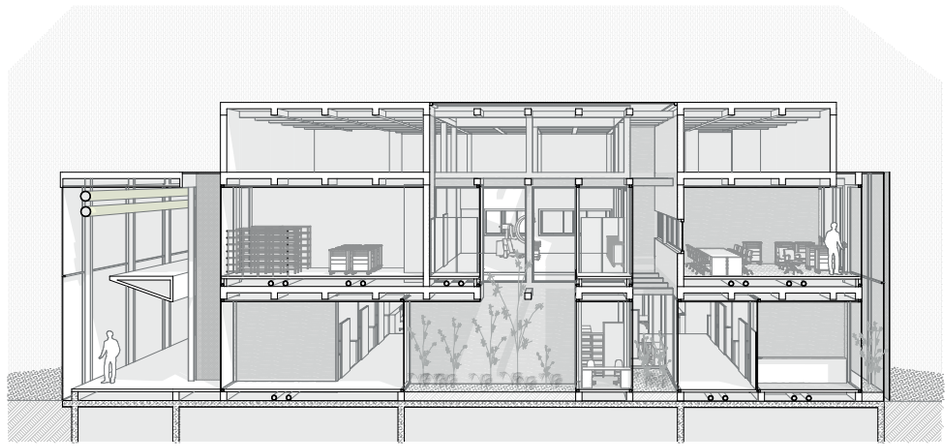
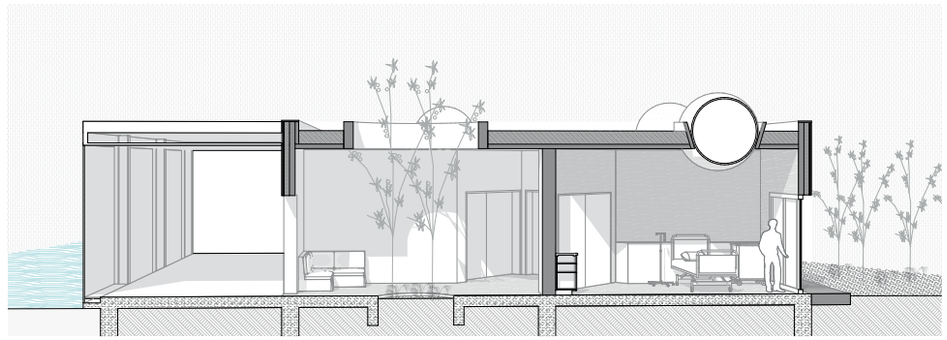


Image - 45 Reference image of how the skylight will create a play of shadows in differenct spaces taken from Tadao Andos work



Regenerative module



Patient module

Each type of module has its unique way of allowing natural light inside the built space. Regarding the main regenerative module, the primary concern was to carry light to the lower level, particularly in the central space, as it connects to some patient areas and staff zones. This also highlights indoor circulation and multiple technical spaces on the first floor. The key highlight of this approach is that it helps create a treatment space that operates using natural light.

As seen in figure - 98, the regenerative module incorporates a light well that not only brings in natural light but also supports natural ventilation and creates small green pockets in the center of the module, effectively bringing the outdoors inside.

On the other hand, the patient module features a unique and iconic skylight shaped in a hollow spherical form. This design allows an abundance of diffused natural light to enter the module, helping to create a pleasant environment even when the main curtains are closed for privacy. Additionally, it serves as a celestial window, enabling patients to gaze at the sky without straining their bodies to sit up or make sudden movements to look out of a window.

Figure - 98 Section of regenerative and patient module highlight the skylights and play of shadows

Image - 46 Skylights an light wells providing ambient lightings in the interior of regenerative module (clinical floor)

Sustainability Concept

As hospitals are considered one of the buildings that are big in size, consumes a lot of energy and also preoduces a lot of waste and consumes the most amount of water.
As the projects idea that the healthcare moves to regenration the concept of the hospital sustainability also moves a step forward to creating a regenerative architecture.

The regenrative architecture
The concept of regenerative architecture works on few main parameters as follows-
- Restoring and Enhancing Natural Ecosystems
- Energy positive buildings
- Closed loop water and energy system
- Human health and well being
- Relience and Adaptability

Restoring and Enhancing Natural Ecosystems
The excavated soil from the site is repurposed for landscaping and creating green terraces. The horizontal layout and segregated modules allow for the formation of green and blue patches, fostering a natural ecosystem that reconnects humans with nature. This design promotes a dialogue between patients and their environment, aiding in smooth recovery. Placing patient spaces on lower levels, contrary to traditional hospital designs, strengthens this bond with nature.
The inclusion of water bodies and green areas creates natural buffers from external noise and acts as temperature regulators. These features contribute to human well-being by offering psychological support in stressful situations. The open layout and urban integration of the hospital further encourage healthy community interactions and social engagement. The water bodies also function by capturing the rainwater and acting as water purification ponds from the grey watter collected from hospital reusing it for purposes apart from consumption and treatment.

Integration with the City and Accessibility
The hospital's design embraces its role as an integral part of the city, blending into daily urban life. Located in Nordhaven, the site is easily accessible through various transport options, including U-Bahn and S-Bahn connections, as well as the planned S-Bf Perleberger Brücke station. These links reduce dependence on cars, significantly lowering the carbon footprint of visitors and staff traveling to the hospital.
Sustainability and Energy Efficiency
The proposed hospital maximizes natural light through open planning, skylights, and light wells. Corridors connected to green spaces bring in fresh air, which is filtered and dehumidified via HEPA systems to ensure clean air in critical areas. Waste heat from cooling the Bio Repository is reused to warm usable spaces, while a ground-source heat pump and solar panels provide additional energy, reducing reliance on the electrical grid.
The horizontal layout minimizes dependence on vertical transportation, improving connectivity and fostering a collaborative environment by placing all key functions at the same level.

Construction and Adaptability
The hospital employs Cross-Laminated Timber (CLT) construction for modules, supported by solid underground levels. This approach reduces embodied carbon while maintaining structural integrity. The decentralized modular design also enables partial repurposing of the hospital for alternative functions without disrupting operations, a flexibility that traditional centralized hospitals lack.

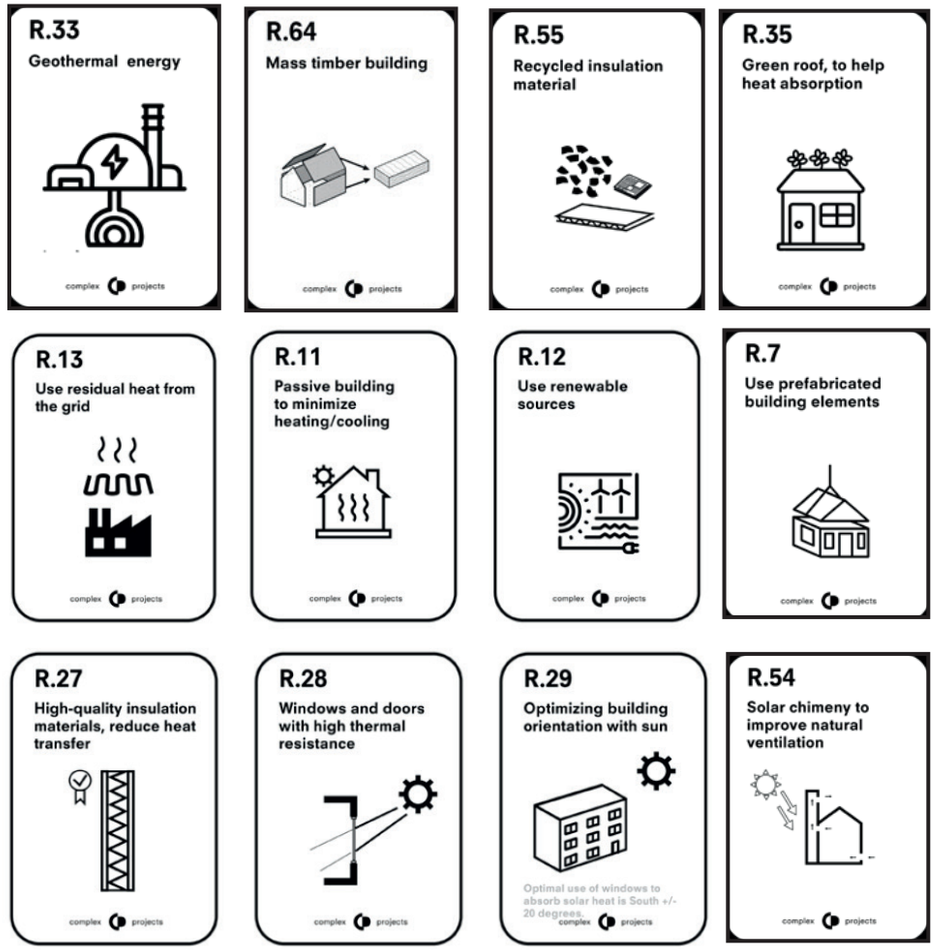


Figure - 99 Few Sustainable elements used in the project, the diagrams are taken from the Complex projects studio group work of the group - Sustainability

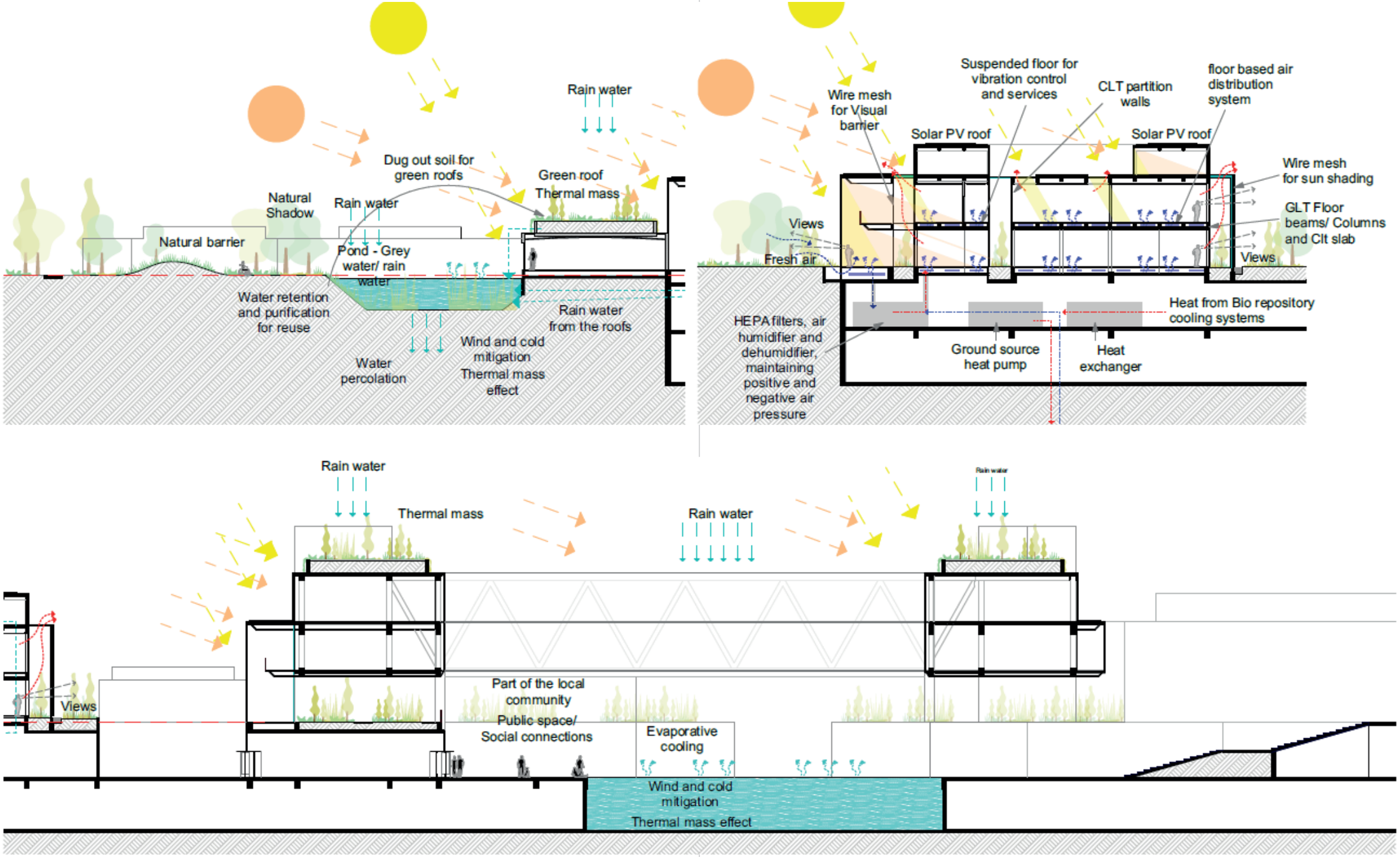
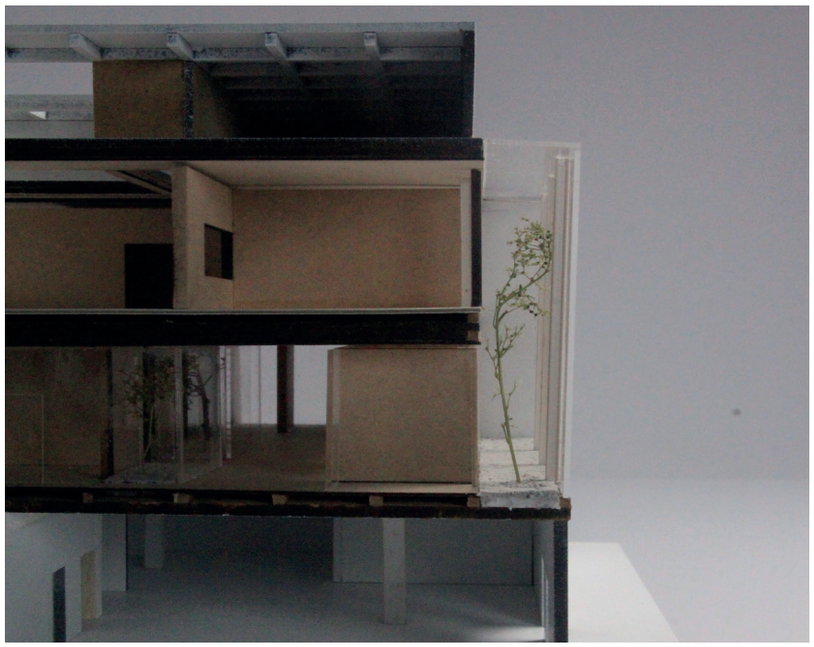
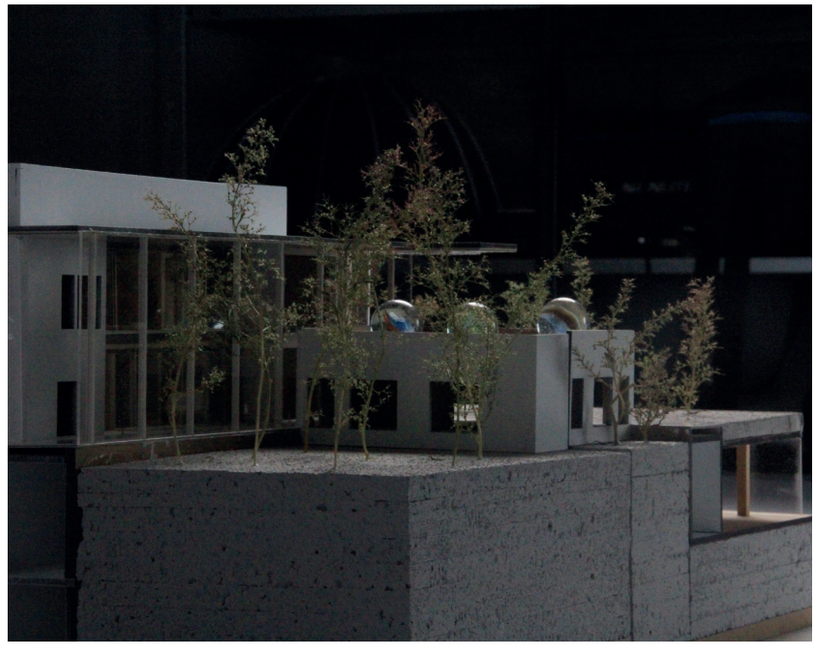


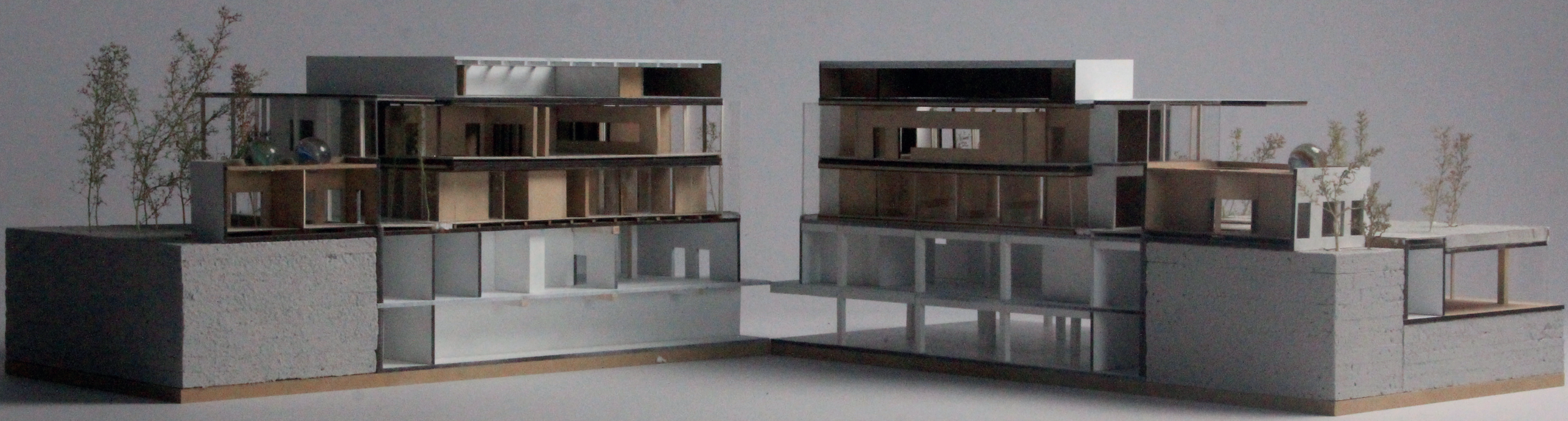
Figure - 100 Sections showing the sustainable strategies of the project and how they function to keep the building functional in cold and summer times

Physical Model

Scale 1:100 - Sectional

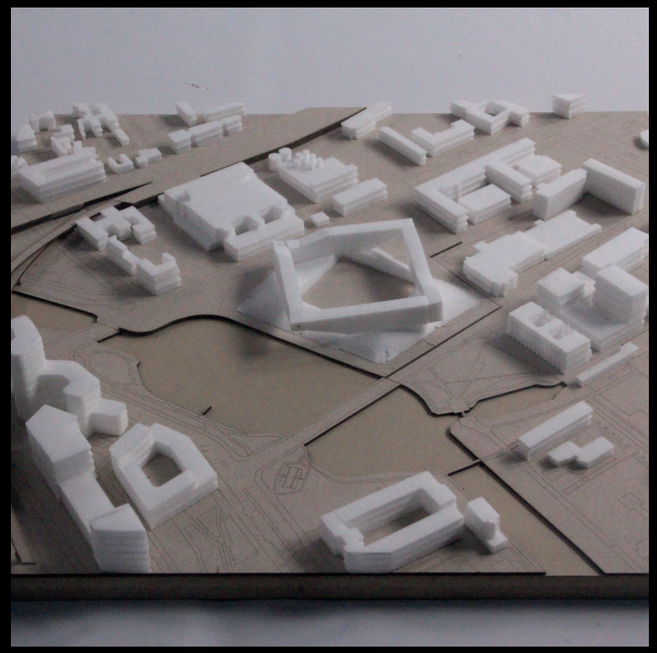






Appendix

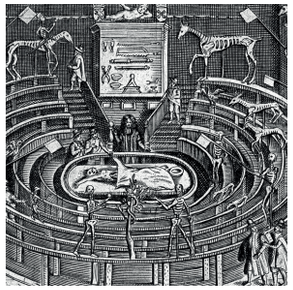
Supporting material



Evolution of OT

General open setting

pre-mordern



Theatre setting

1937

Centralised setting

1955

Cleanroom setting

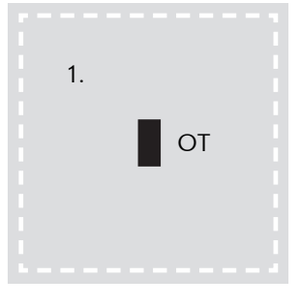
1966

Hybrid setting

2010 - current

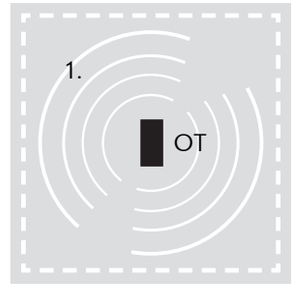
AI and robotic based setting

current - future



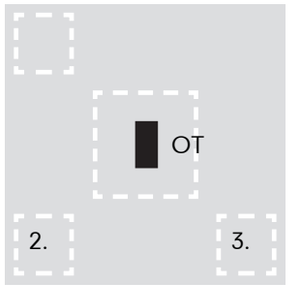
Area -

1. Common space for other procedures and waiting



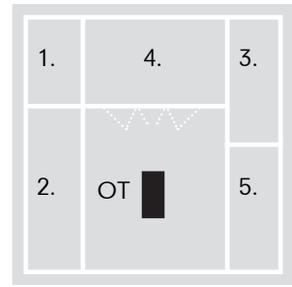
Area -

1. Seating for viewers



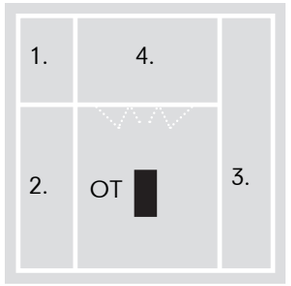
Area - 50

1. Diagnostic space
2. Pre-op preparation
3. Storage



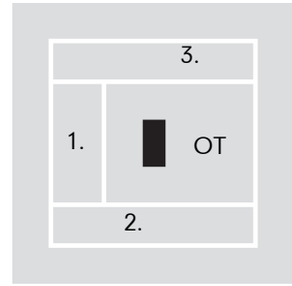
Area - 200

1. Anesthesia and equipment
2. Pre-Op space
3. Cleaning space and storage
4. Diagnostic space (flexible)
5. Control room and data center



Area - 150

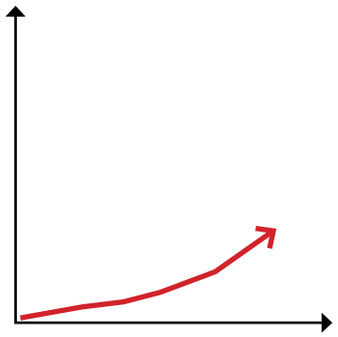
1. Anesthesia and equipment
2. Pre-Op space
3. Cleaning space and storage
4. Diagnostic space (flexible)



Area - 100

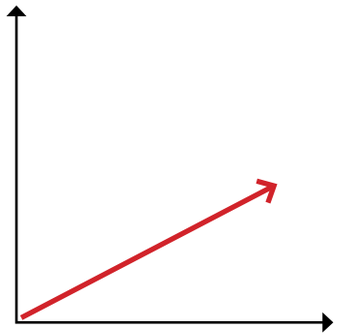
1. Anesthesia and equipment
2. Pre-Op space
3. Cleaning space and storage

Evolution of OT



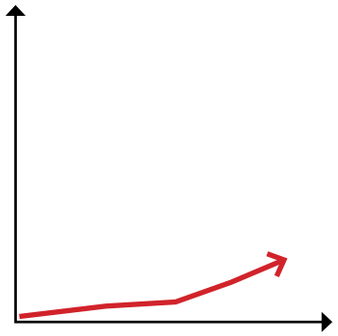
Multifunctionality

Surgical setting is becoming more multifunctional accomodating multiple functions working in collaboration



Area

Area of surgical setting is increasing with time



Flexible layout

With time the layout which used to be very strict is becoming more flexible, being used for differenet programs

Case studies

Center for surgical medicine

Architect - Heinle, Wischer und Partner
Location - Dusseldorf, Germany
Completion - 2011
Client - University hospital Dusseldorf
Area - 20,632 sqm
Capacity - 316 beds

Cancer center at Guy's

Architect - Rogers Stirk Harbour + Partners with Stantec
Location - London, UK
Completion - 2016
Client - Guy's & St. Thomas' NHS foundation trust
Area - 20,000 sqm

Zaans medical center

Architect - Heinle, Wischer und Partner
Location - Dusseldorf, Germany
Completion - 2011
Client - University hospital Dusseldorf
Area - 20,632 sqm
Capacity - 316 beds

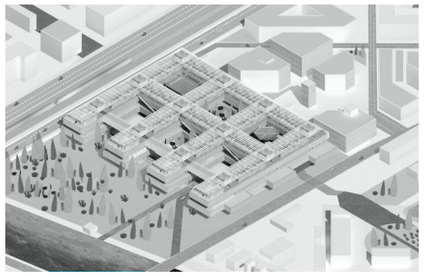
Ulm Surgical Center

Architect - KSP Jürgen Engel Architekten
Location - Ulm, Germany
Completion - 2012
Client - Universitätsklinikum Ulm
Area - 68,500 sqm
Capacity - 235 beds

Sanford Consortium for Regenerative Medicine

Ray and Dagmar Dolby Regeneration Medicine Building

+

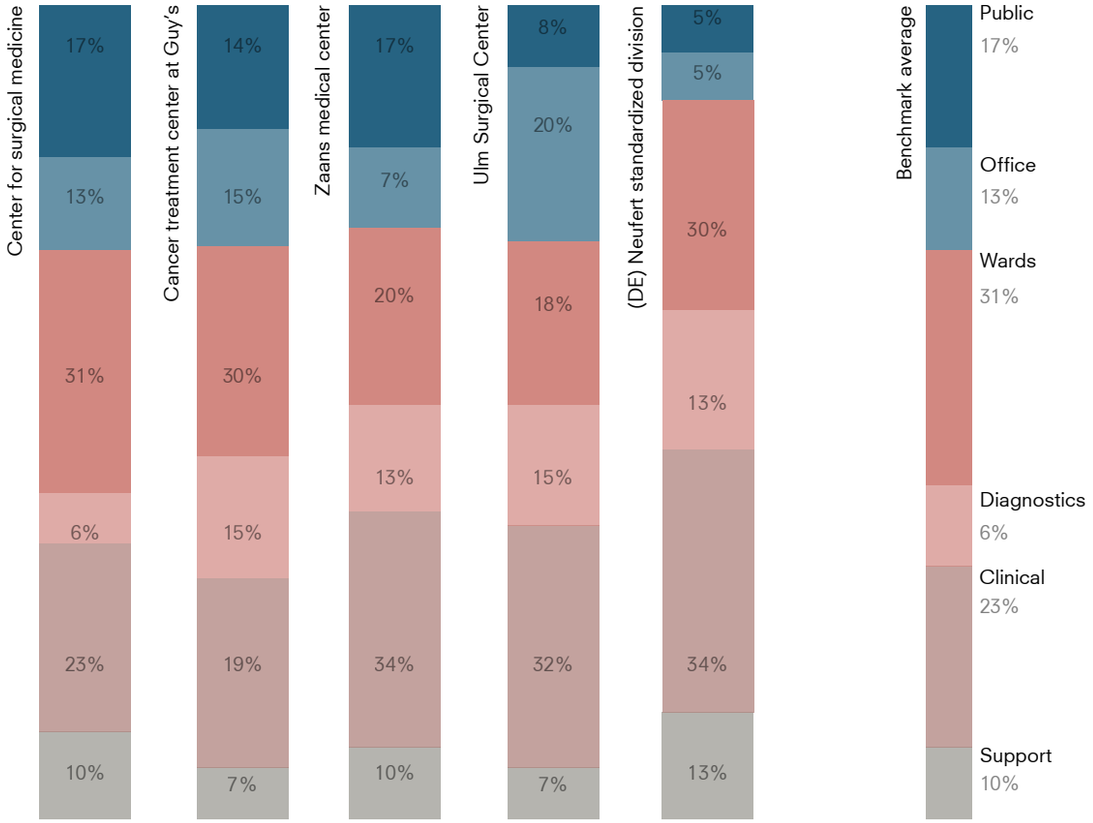


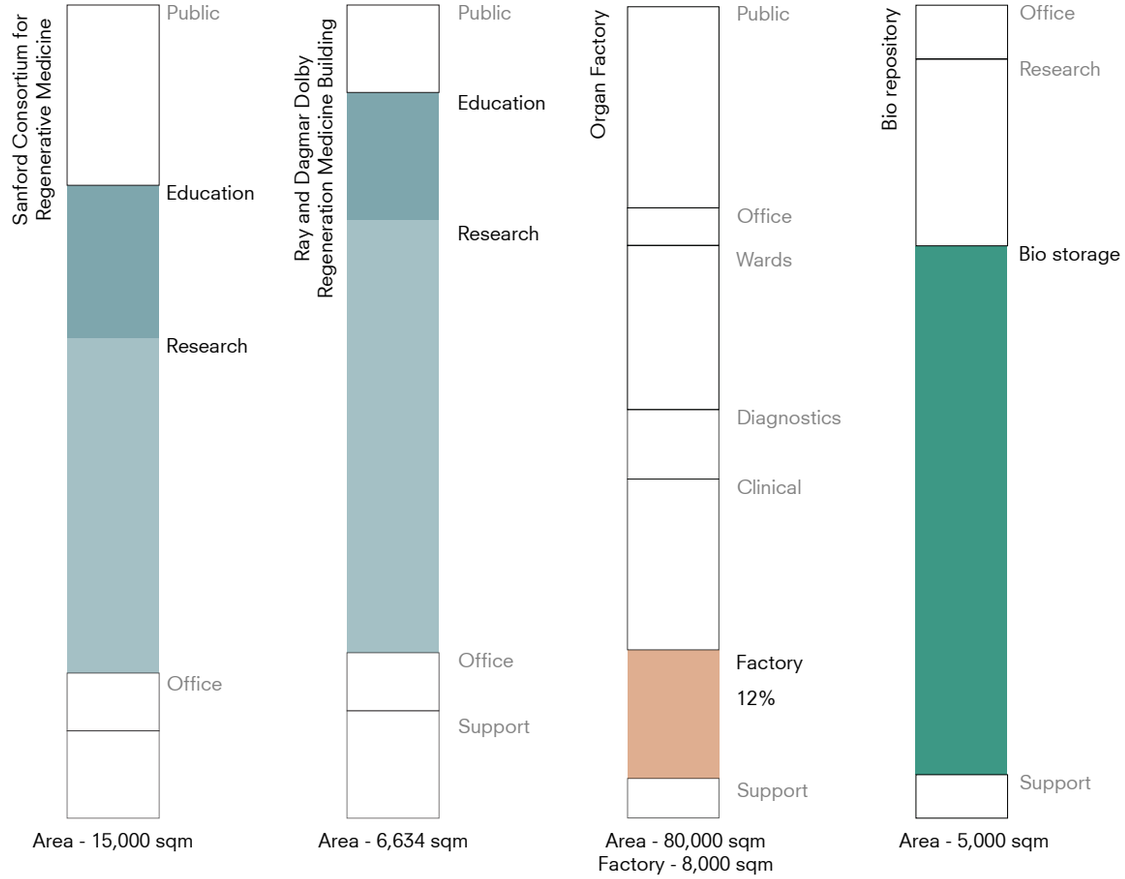
Organ factory, (CP student project)

+

Production

Production


Center for surgical medicine
17%
13%
31%
6%
23%
10%
Cancer treatment center at Guy's
14%
15%
30%
15%
19%
7%
Zaans medical center
17%
7%
20%
13%
34%
10%
Ulm Surgical Center
8%
20%
18%
15%
32%
7%
(DE) Neufert standardized division
5%
5%
30%
13%
34%
13%
Benchmark average
Public
17%
Office
13%
Wards
31%
Diagnostics
6%
Clinical
23%
Support
10%


Sanford Consortium for Regenerative Medicine
Public
Education
Research
Office
Area - 15,000 sqm
Ray and Dagmar Dolby Regeneration Medicine Building
Public
Education
Research
Office
Support
Area - 6,634 sqm
Organ Factory
Public
Office
Wards
Diagnostics
Clinical
Factory
12%
Support
Area - 80,000 sqm
Factory - 8,000 sqm
Bio repository
Office
Research
Bio storage
Support
Area - 5,000 sqm

Special thanks to all my mentors for guiding me through, my studio mates, Santje, Helena, Lena, Rik, Joep, Sumeet and my brother Harin for indulging in highly informative brain storming sessions and to my mentors who pushed me to keep going deeper and deeper in the field of healthcare architecture.