



# 2012 IFHE Congress in Norway

22nd Congress of International  
Federation of Hospital Engineering (IFHE)



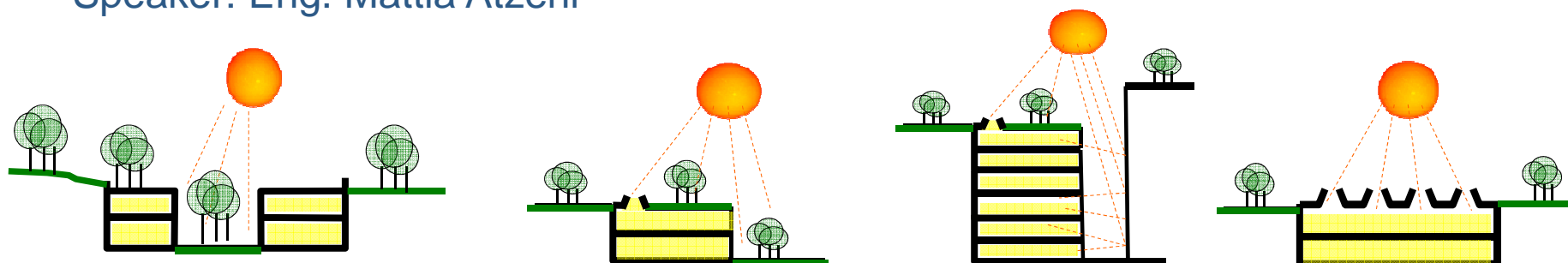
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## Natural Light - The Hypogeum Hospital Spaces

Speaker: Eng. Mattia Atzeni



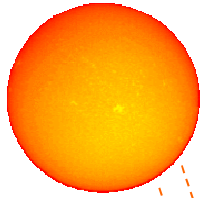


# Abstract

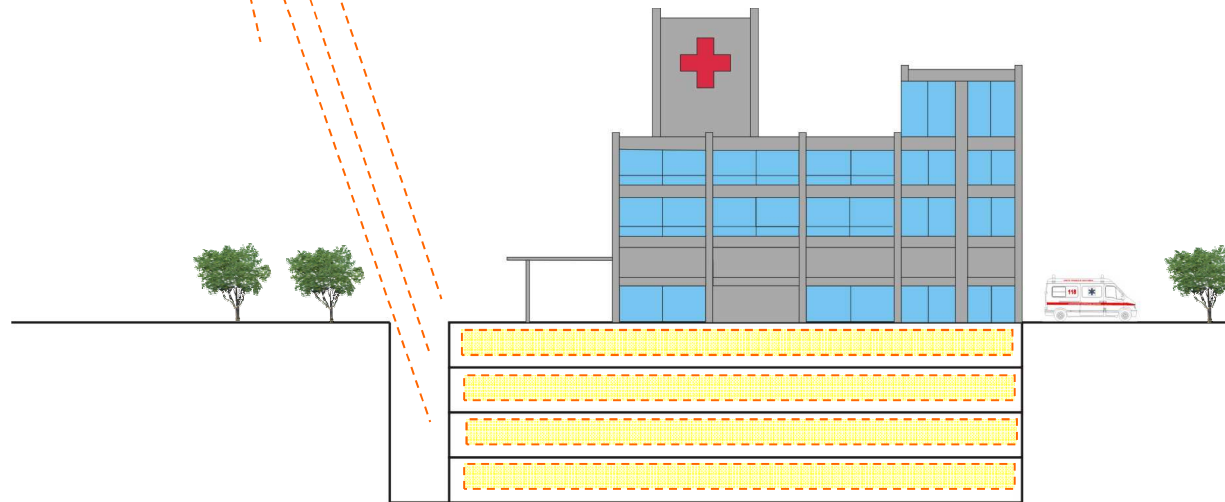
## Natural Light - The Hypogeum Hospital Spaces



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Humanization is a subject of study on which people are placing a lot of attention for a better hospital design. The construction of spaces more comfortable is a goal of many designers and natural light is the biggest player.



Aim of the study is to investigate the matter of natural light in health care facilities, with special attention to the underground rooms of the hospitals. The goal was to give guidance on how to design with natural light, to illuminate those hospitals that live only with artificial light. The study was developed analyzing natural lighting systems used in six hospitals designed and built in Spain.



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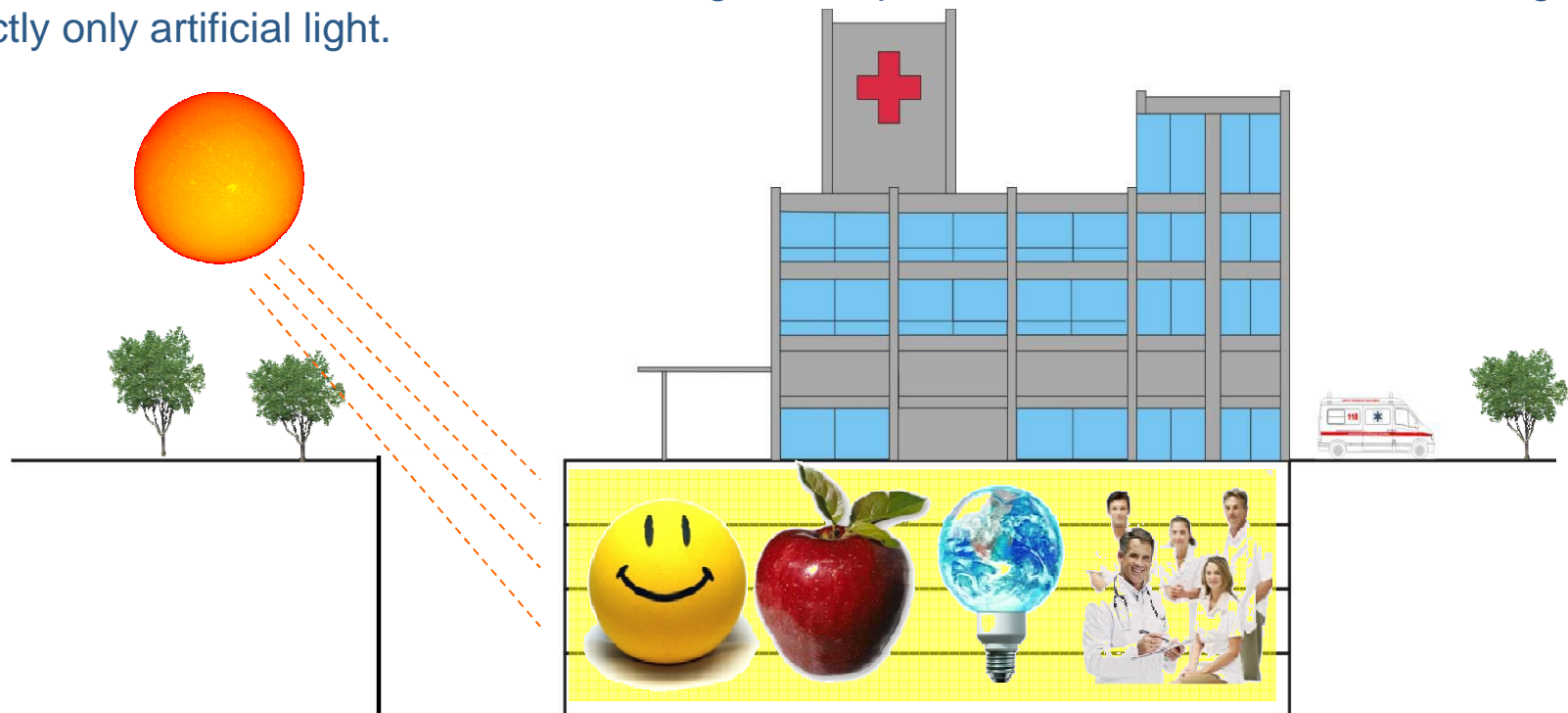
# Abstract

## Natural Light - The Hypogeum Hospital Spaces



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Architecture healthcare design with natural light is essential. Able to illuminate the possible spaces of the hospital in a natural way, avoiding the artificial light which is cold and uncomfortable, as much as possible, it is an objective that the designer must ask. This way of designing the space dedicated to health care and certainly brings many advantages: visual comfort, positive moods, warmer environment, domestication of space, saving on energy costs. Greater attention has to be asked in the underground spaces of healthcare facilities, living spaces strictly only artificial light.



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# Natural Light

## Natural Light - The Hypogeum Hospital Spaces



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In architecture, the light works on three levels. At the material level, the light is a formal element of the spread of light. Aesthetically, however, relates to a refined sense of space that can be influenced by the composition and color of shadow.

On an emotional level, finally, the sensations are caused by effects of light targeted and sought. During different periods, each architectural style has paid a relationship with the natural light and the consequent creation of architectural solutions

Over the centuries, the perception of light and its cultural significance fluctuated regularly between emotional and a rational interpretation. Light in the home made his entrance with a diffuse light, through the use of transparent glass plate continues, the inside of the external environment became appendix.



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# Natural Light: positive effects

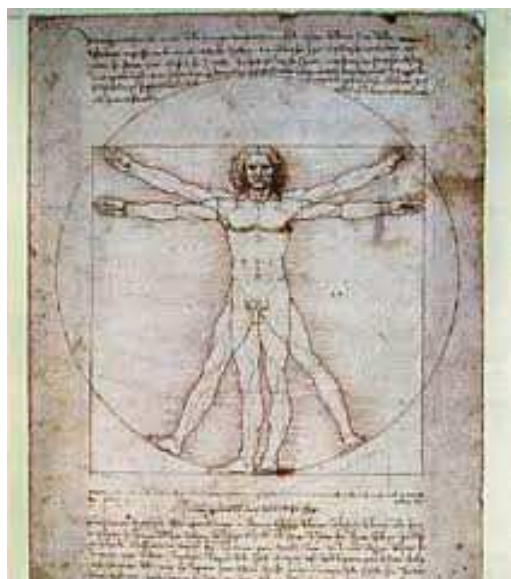
## Natural Light - The Hypogeum Hospital Spaces



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The Natural Light has positive effects on:

MAN



ENVIRONMENT



COST



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# Natural Light: positive effects on MAN

Natural Light - The Hypogeum Hospital Spaces

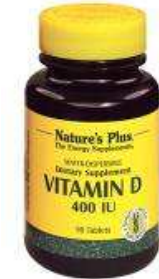
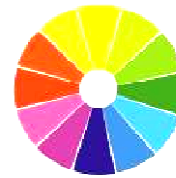


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- **FOR THE PHYSIOLOGICAL FACTOR:** Formation of Vitamin D from Provitamin

- **VISUAL QUALITY:** High Vield Colour

Production of Melatonin



- **ANTIBACTERIAL** It is a good bactericide



- **THERAPEUTIC** : Tuberculosis, Anemia, Rickets...



- **PSYCHOPHYSICAL BENEFITS** : Regulation of Circadian Rhythms



Decrease eyestrain thanks to the vision towards the outside



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# Natural Light: positive effects on the ENVIRONMENT

Natural Light - The Hypogeum Hospital Spaces



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The natural light is a very important renewable source and so it looks like the best of the world clean energy.

RENEWABLE SOURCE



CLEAN ENERGY



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# Natural Light: positive effects on COST

Natural Light - The Hypogeum Hospital Spaces



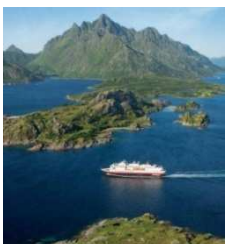
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MAN

ENVIROMENT

COST

TOTALLY FREE RESOURCE



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## Working Methodology

Natural Light - The Hypogeum Hospital Spaces



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### GENERAL ANALYSIS ON THE MARKET OF NEW TECHNOLOGIES FOR THE TRANSPORTATION OF NATURAL LIGHT IN HYPOGEUM SPACES



### CASES STUDY ANALYSIS OF SIX SPANISH HOSPITAL PLANNED ARCHITECT ALBERT DE PINEDA ALVAREZ , PINEARQ STUDIO IN BARCELONA

Hospital Quiron, Madrid

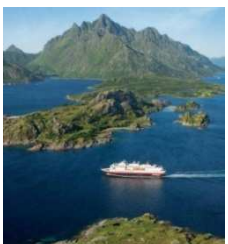
Hospital Baix Llobregat

Hospital Santa Caterina

Hospital Denia

Hospital Quiron, Bcn

Hospital Mare Bcn



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# New Technologies: transportation of natural light

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## The heliostats:

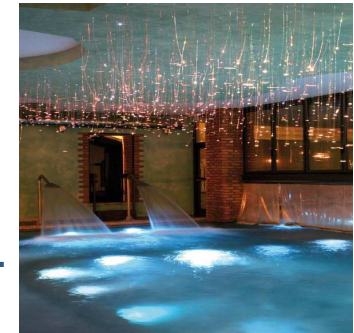
The heliostats are devices able to follow the path of the sun rotating around one or two axes.

Their movement is driven by automatic processes.



## The fibers optics:

The fiber optic elements are cylindrical glass or plastic in the field. Their most valuable is the ability to carry light from a distance, even in places not easily accessible, with a footprint of very small space.



## The light pipes:

The light pipes are complex systems, based on multiple specular reflections and / or diffuse solar radiation.



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# Overview Cases of Study

Natural Light - The Hypogeum Hospital Spaces



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**Quiron Hospital, Madrid**



**St. Catherine Hospital, Girona**



**Hospital Sant Joan Despi,  
Baix Llobregat**



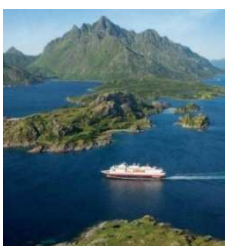
**Denia Hospital, Alicante**



**Quiron Hospital, Barcelona**



**The Sea Hospital, Barcelona**



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# Case of Study: St. Catherine Hospital , Girona

Natural Light - The Hypogeum Hospital Spaces



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## St. Catherine Hospital



Address: Av. doctor Castany S/N; Salt(Girona)

Gross floor area: 27.387 m2

Beds: 222

The new Hospital of St. Catherine is located in the town of Salt, near Girona, in Catalonia (Spain).

The hospital is characterised by low height pavilions in the inner part of the park to try to maintain a feeling of low density and also a relationship between trees and the green building hospital.



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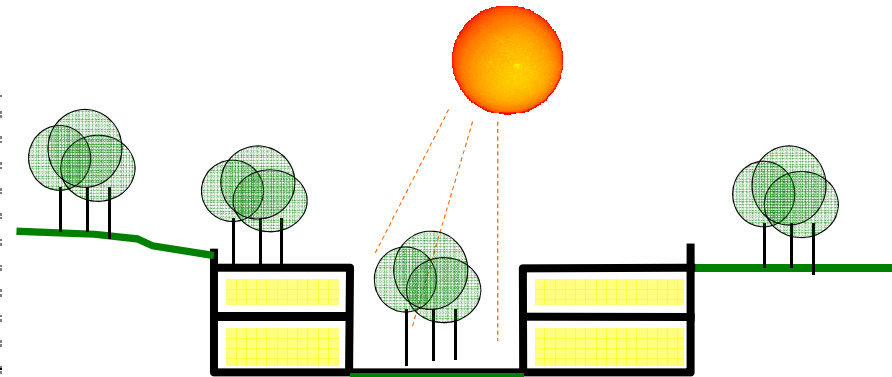
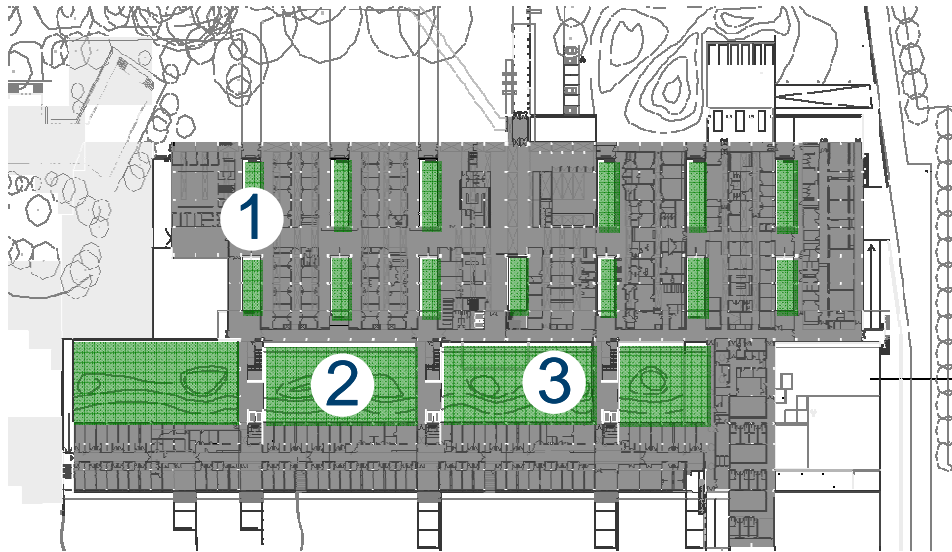


# Case of Study: St. Catherine Hospital , Girona

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Illumination with central patio



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# Case of Study: Quiron Hospital , Madrid

Natural Light - The Hypogeum Hospital Spaces



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## Quiron Hospital, Madrid



Address: Pozuelo de Alarcón, Madrid

Gross floor area : 68.065 m<sup>2</sup>

Beds: 191

The new hospital is located in Quiron Madrid in the province of Madrid Pozuelo Alarcon. The analysis of the structure of the urban population and its characteristic appearance, lead the architect to choose for a building that fits the area open to light and landscape, away from building too high or too big, since it would undermine the balance between buildings and the landscape. It is made of the building into a field with its axis in the direction North-East, South-East, aligning the road turned, in the south facade are made of inpatient units.



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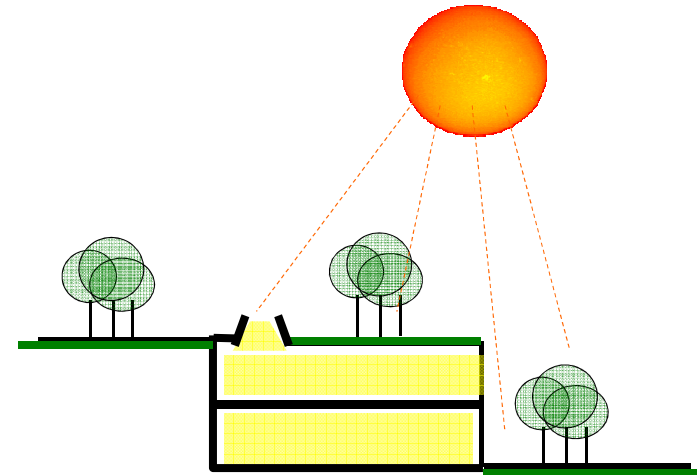
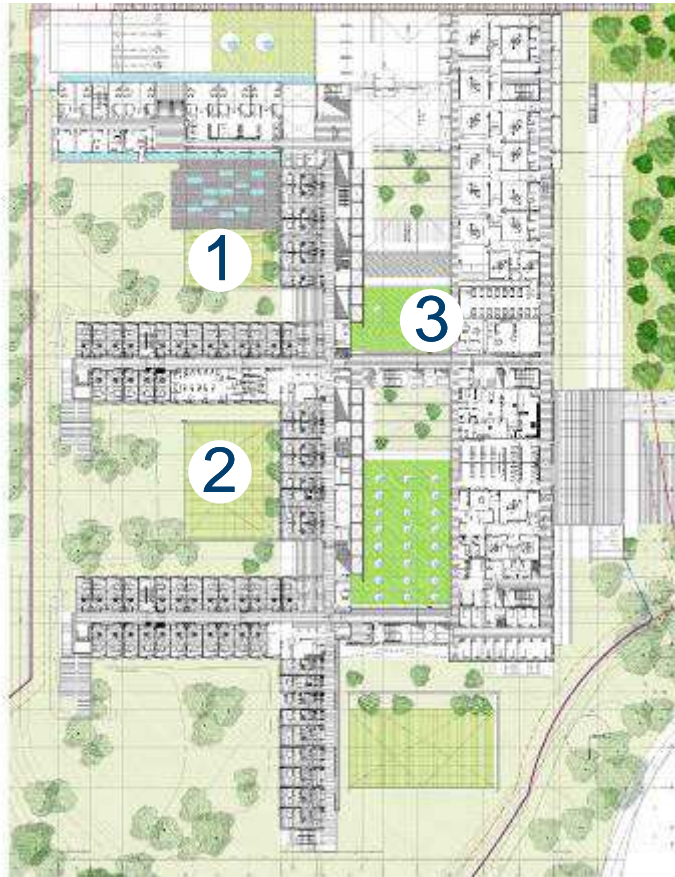


# Case of Study: Quiron Hospital , Madrid

Natural Light - The Hypogeum Hospital Spaces



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System with a patio and skylight



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# Case of Study: Denia Hospital , Alicante

Natural Light - The Hypogeum Hospital Spaces



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## Denia Hospital, Alicante



Adress: Denia, Alicante

Gross floor area : 45.900 m2

Beds: 160

The project is located on a plot of 72,000 m2 on the outskirts of the town of Denia (Spain). The hospital has a total area of 38,367 m2. The building is on three levels above ground and two underground. In the basement there is parking for staff. On the ground floor there is access to the hospital: main entrance, access to external services, emergency, rehabilitation, radiation and direction.



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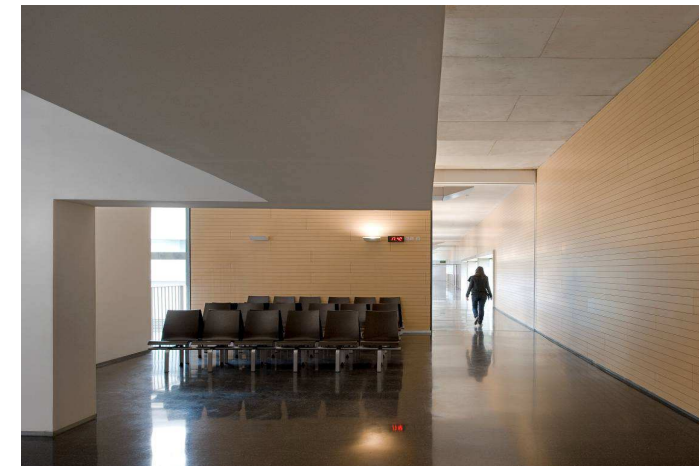


# Case of Study: Denia Hospital , Alicante

Natural Light - The Hypogeum Hospital Spaces



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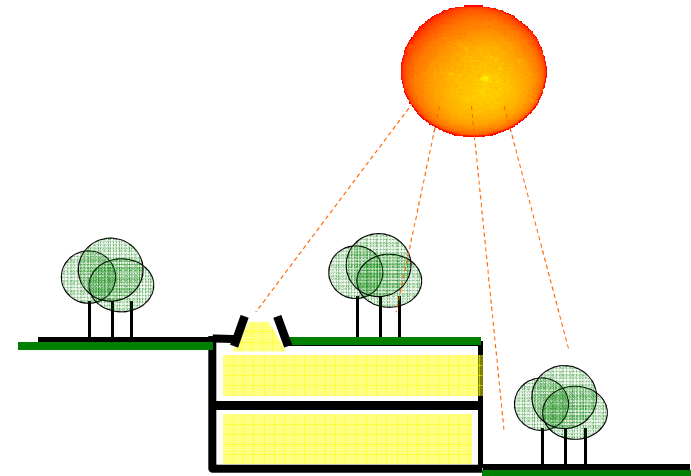


# Case of Study: Denia Hospital , Alicante

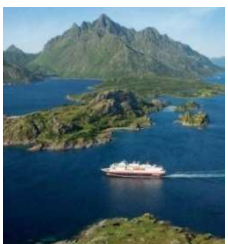
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System with a patio and skylight



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# Case of Study: The Sea Hospital , Barcelona

Natural Light - The Hypogeum Hospital Spaces



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## The Sea Hospital



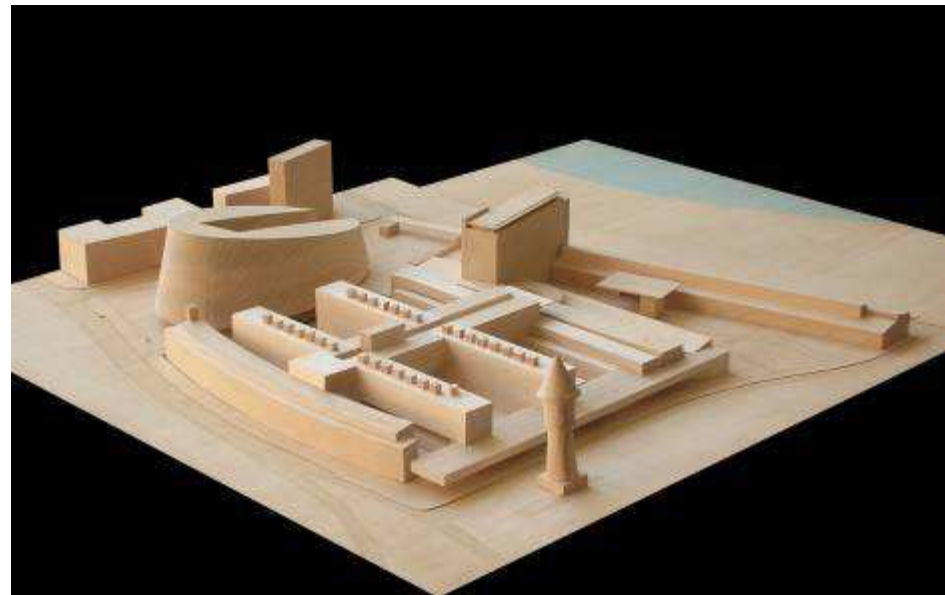
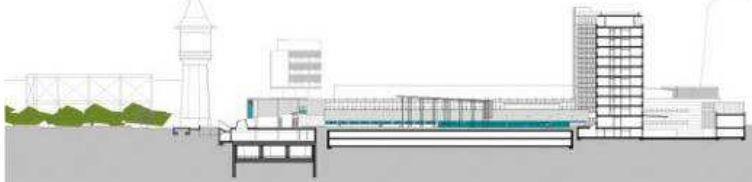
Adress: Passeig Maritim, Barcellona

Gross floor area: 57.581 m<sup>2</sup>

Exstension: 76.571 m<sup>2</sup>

Bads: 532

The Hospital del Mar is located in Barcelona and integrates into the sea in front of the city.



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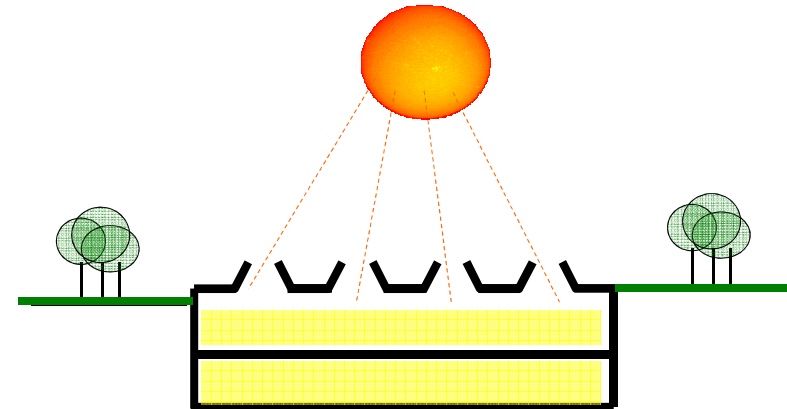


# Case of Study: The Sea Hospital , Barcelona

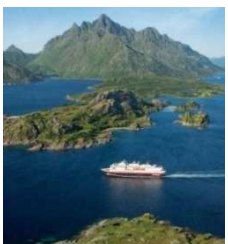
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System skylight



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# Case of Study: Hospital Sant Joan Despi, Baix Llobregat

Natural Light - The Hypogeum Hospital Spaces



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## Hospital Sant Joan Despi



Adress: Baix Llobregat

Gross Floor Area: 45.725,78 m<sup>2</sup>

Bads: 310



Hospital Sant Joan Despi Doctor Moises Broggi is a building located in the Baix Llobregat in Catalonia, Spain. Adapting to the place, the external environment in which the building is located is the motivations of the design solution developed for such construction.



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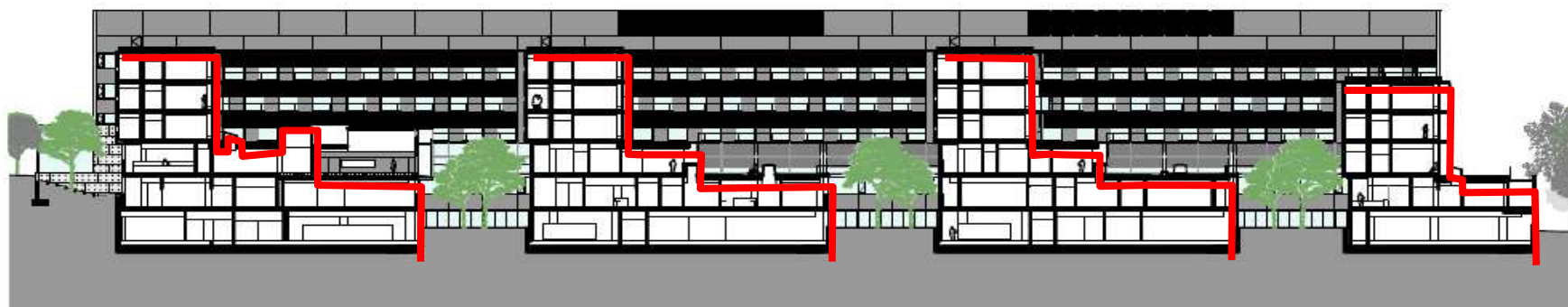


# Case of Study: Hospital Sant Joan Despi, Baix Llobregat

Natural Light - The Hypogeum Hospital Spaces



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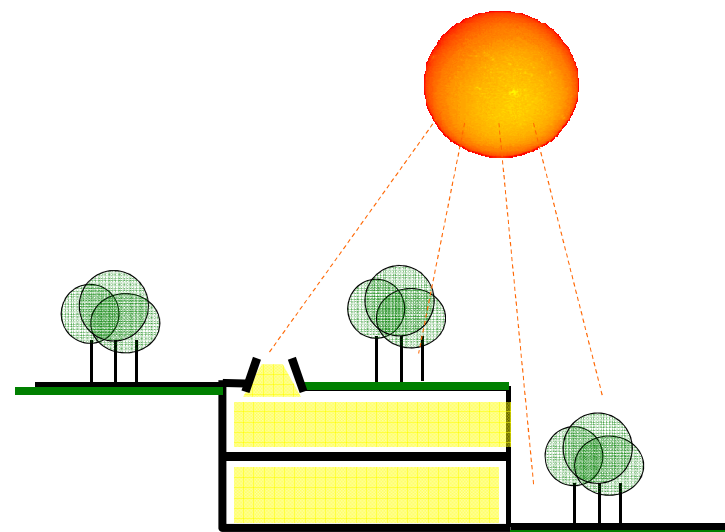
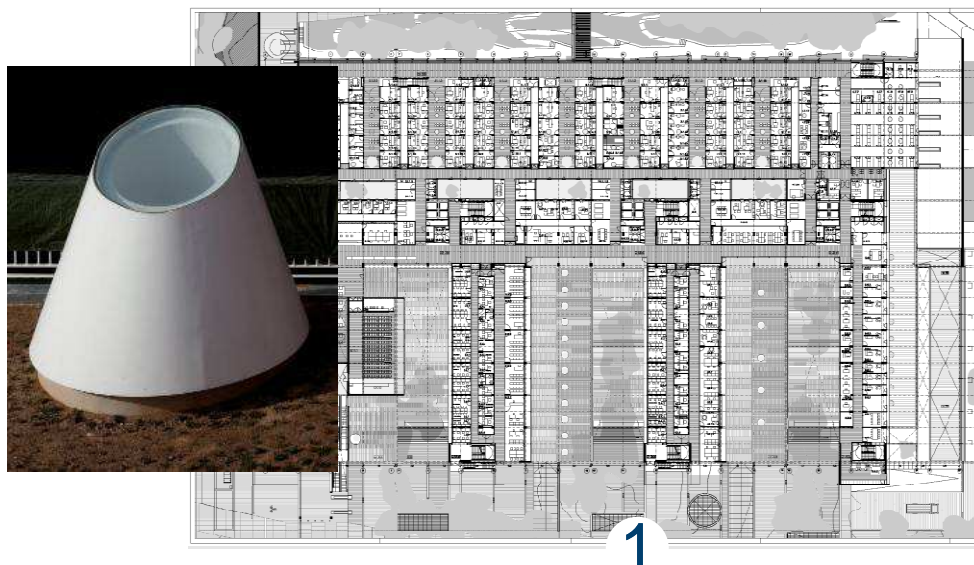


# Case of Study: Hospital Sant Joan Despi, Baix Llobregat

Natural Light - The Hypogeum Hospital Spaces



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## System with a patio and skylight

The underground areas of the hospital are lit with large skylights in the conical section, and in so illuminating the underground spaces of course. Even in this case study, the design philosophy of the Spanish architect Albert Alvarez de Pineda is reflected perfectly in this project, where the natural light and the visual and psychological comfortable to characterise all areas of the hospital including those underground. The skylights and patios used are shown in the images and construct all of the details that follow.



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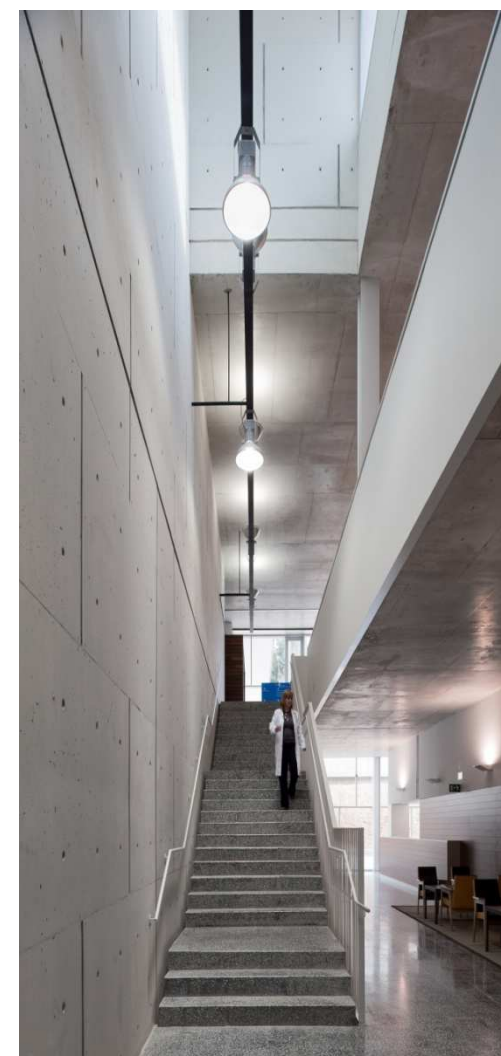
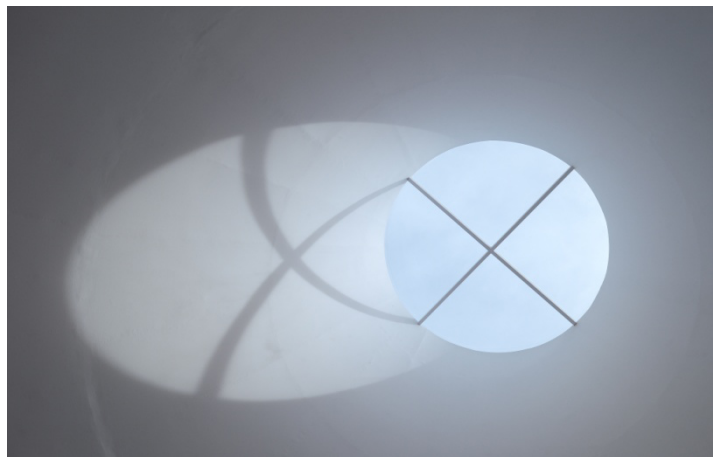


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# Case of Study: Quiron Hospital, Barcelona

Natural Light - The Hypogeum Hospital Spaces



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## Quiron Hospital

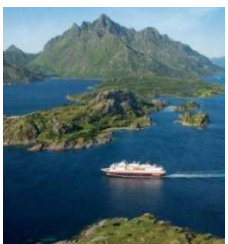


Address: Barcellona

Gloos floor area: 57.775 m2

Bads: 177

The Quiron Hospital in Barcelona is located in the district of Gracia, in the highest part of the Catalan city. It has a lot size of 7,000 m2. The hospital is divided by intensive care: the levels are completely off the ground in the shape of an "L" and the six dedicated inpatient unit. The plants that are located between the input level inpatient and outpatient clinics have been devoted to the external exams special, intensive care and day hospital. The two levels immediately below the Hall have been allocated to social services such as an emergency room, diagnostic imaging, surgical unit, the lock midwife, sterilizing and laboratories. Due to the steep slope of the land and its topography, courts have been designed well defined so that it is possible the arrival at all levels of natural light. In the lower floors are general logistics services and plants destined for parking.



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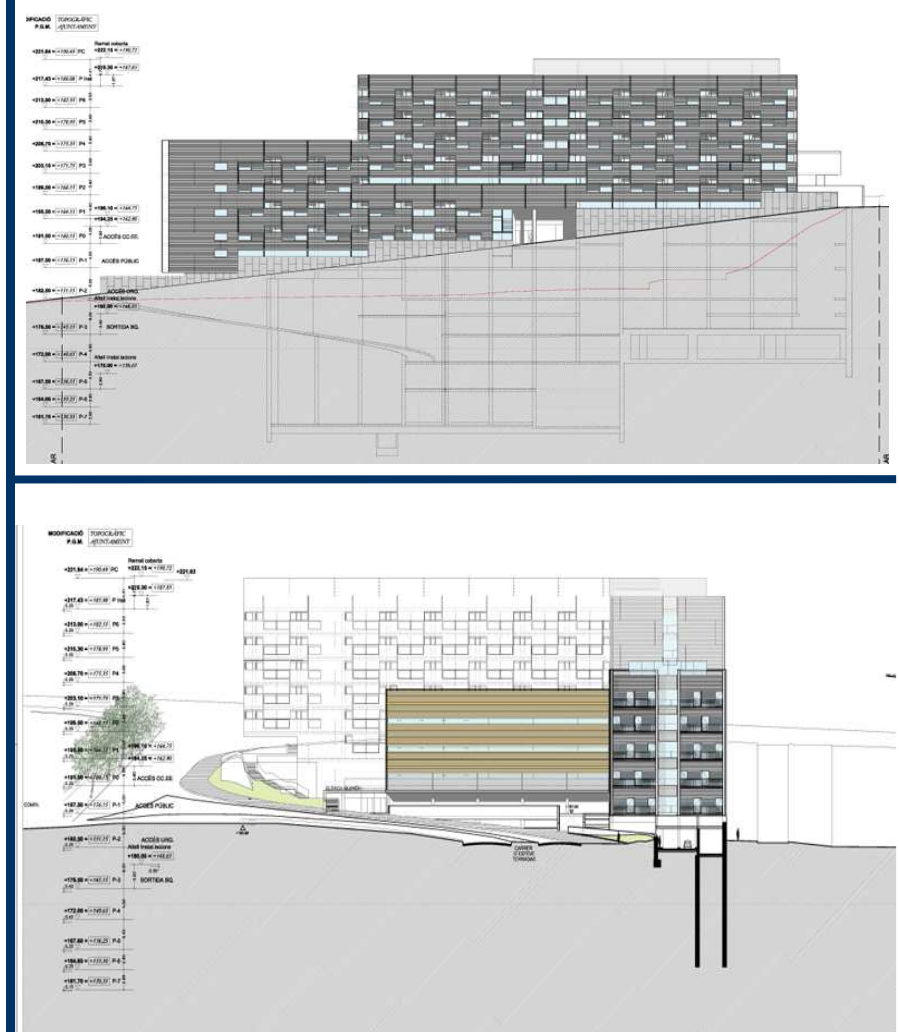
# Case of Study: Quiron Hospital , Barcelona

Natural Light - The Hypogeum Hospital Spaces



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Quiron Hospital in Barcelona is perhaps the best example of how the architect can see how great the ability of skill and architecture to illuminate spaces underground. The hospital has seven levels underground, and all natural lighting through the use of deep basement well and skylights details but at the same time of great simplicity. All this leads to a perfect lighting in all underground sites, thereby ensuring a high level of visual comfort, and reach an optimal psychological state of general approval.



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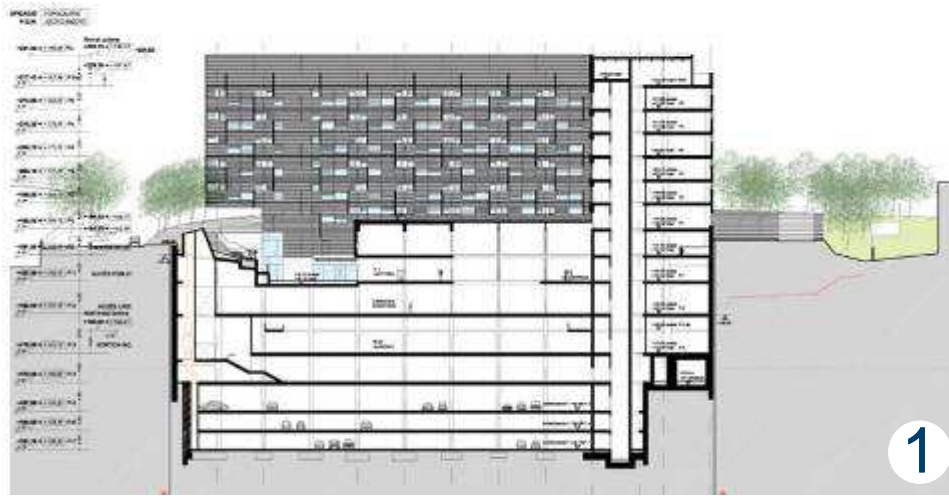


# Case of Study: Quiron Hospital, Barcelona

## Natural Light - The Hypogeum Hospital Spaces



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Some very representative section, in the number one is possible to note how the cone bearer of light has been divided into two parts, one to illuminate hypogeum spaces and the other for the exhaust gases of the parking lots.



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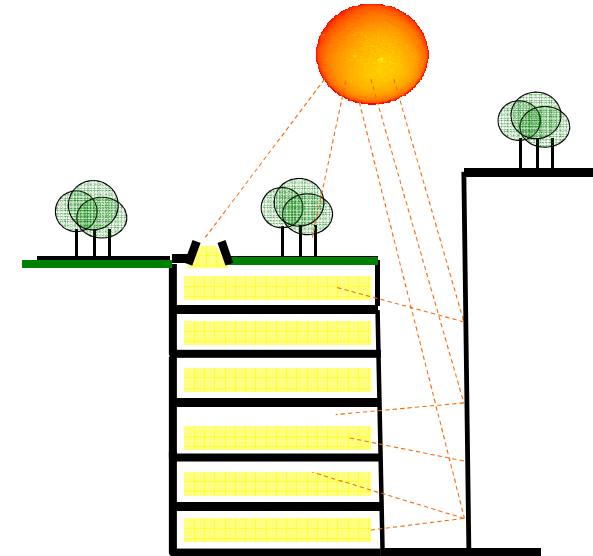
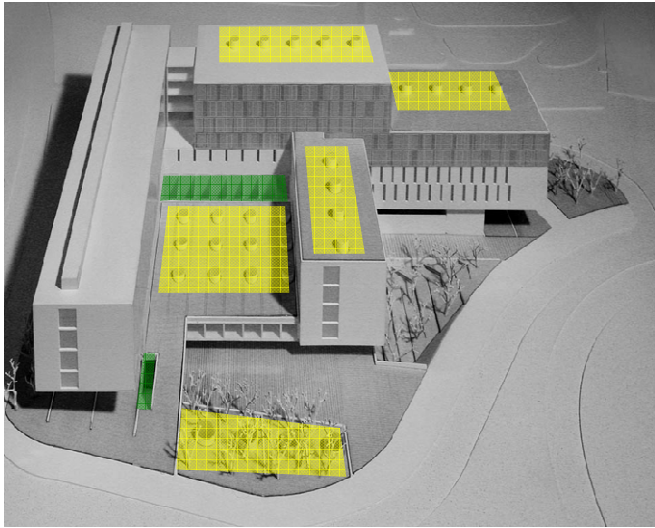


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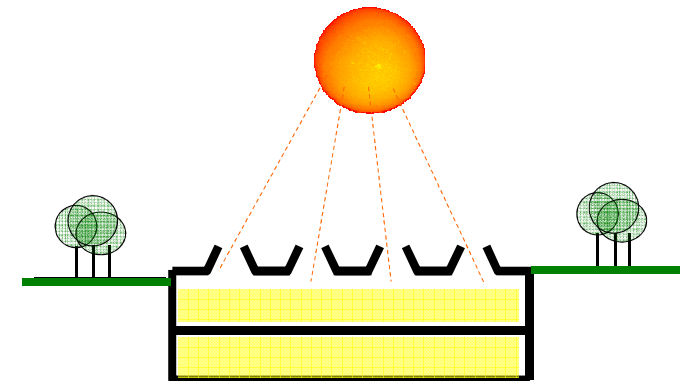
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Bocca di lupo+lucernario ???



Lucernari in serie ???



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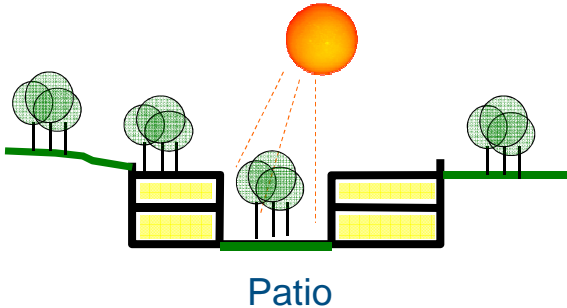

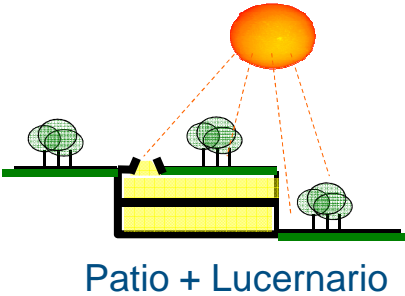


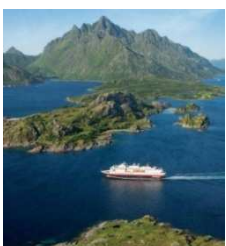
# The Matrix of Hospitals

Natural Light - The Hypogeum Hospital Spaces



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Hospitals	System Natural Light	Features
<b>St. Catherine Hospital</b> 	 <p>Patio</p>	Very Good illumination Internal-External View Green over View Psycho-physical Wellness Energy saving
<b>Quiron Hospital, Madrid</b> 	 <p>Patio + Lucernario</p>	Very Good illumination Green over View Psycho-physical Wellness



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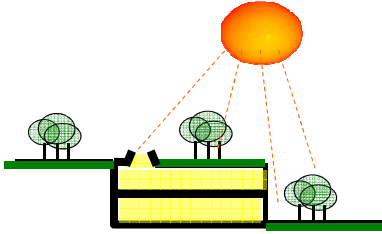

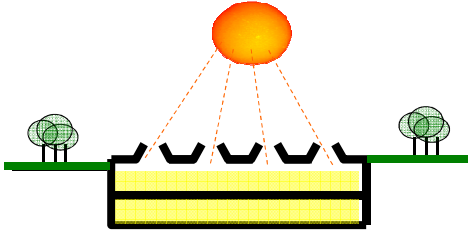


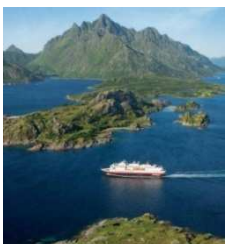
# The Matrix of Hospitals

Natural Light - The Hypogeum Hospital Spaces



IFHE CONGRESS 2012

Hospitals	System Natural Light	Features
<p><b>Denia Hospital, Alicante</b></p> 	 <p>Patio + Lucernario</p>	<p>Very Good illumination Green over View Psycho-physical Wellness</p>
<p><b>The Sea Hospital</b></p> 	 <p>Lucernari</p>	<p>Good illumination Internal-Exsternal View Green over View Psycho-physical Wellness Energy saving</p>



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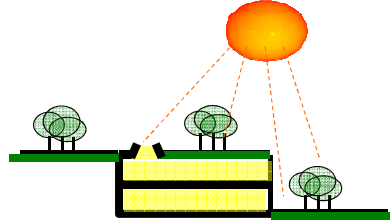

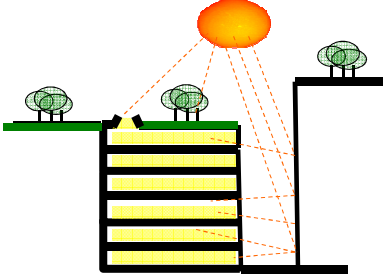


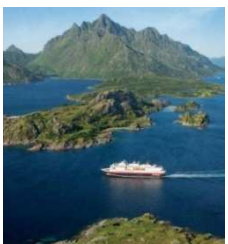
# The Matrix of Hospitals

Natural Light - The Hypogeum Hospital Spaces



IFHE CONGRESS 2012

Hospitals	System Natural Light	Features
<b>Hospital Sant Joan Despi</b> 	 Patio + Lucernario	Very Good illumination Green over View Psycho-physical Wellness
<b>Quiron Hospital , Bcn</b> 	 Bocca di lupo + lucernario	Very Good illumination Green over View Psycho-physical Wellness Very deep hypogeous spaces



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# Design Guidelines

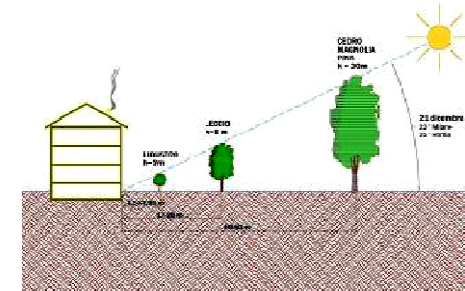
Natural Light - The Hypogeum Hospital Spaces



IFHE CONGRESS 2012

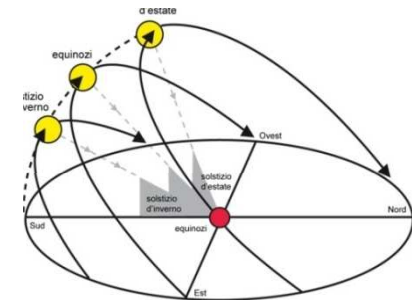
## STUDY THE AREA OF PROJECT:

Views and accessibility potential  
Openings to natural or artificial green spaces that surround and complement the building.



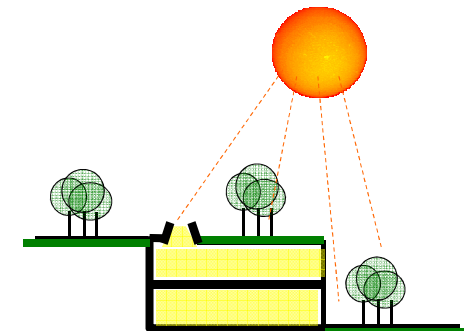
## STUDY ORIENTATION:

With the aim to correctly load different areas of the hospital, always directing openings to underground buildings the sunniest areas, observing the sun's east-west line.



## ARCHITECTURAL:

Characterized by open spaces with high levels  
Lighting data by the presence  
patios and skylights, large diameter, inclined planes also  
generate the existing terrain.



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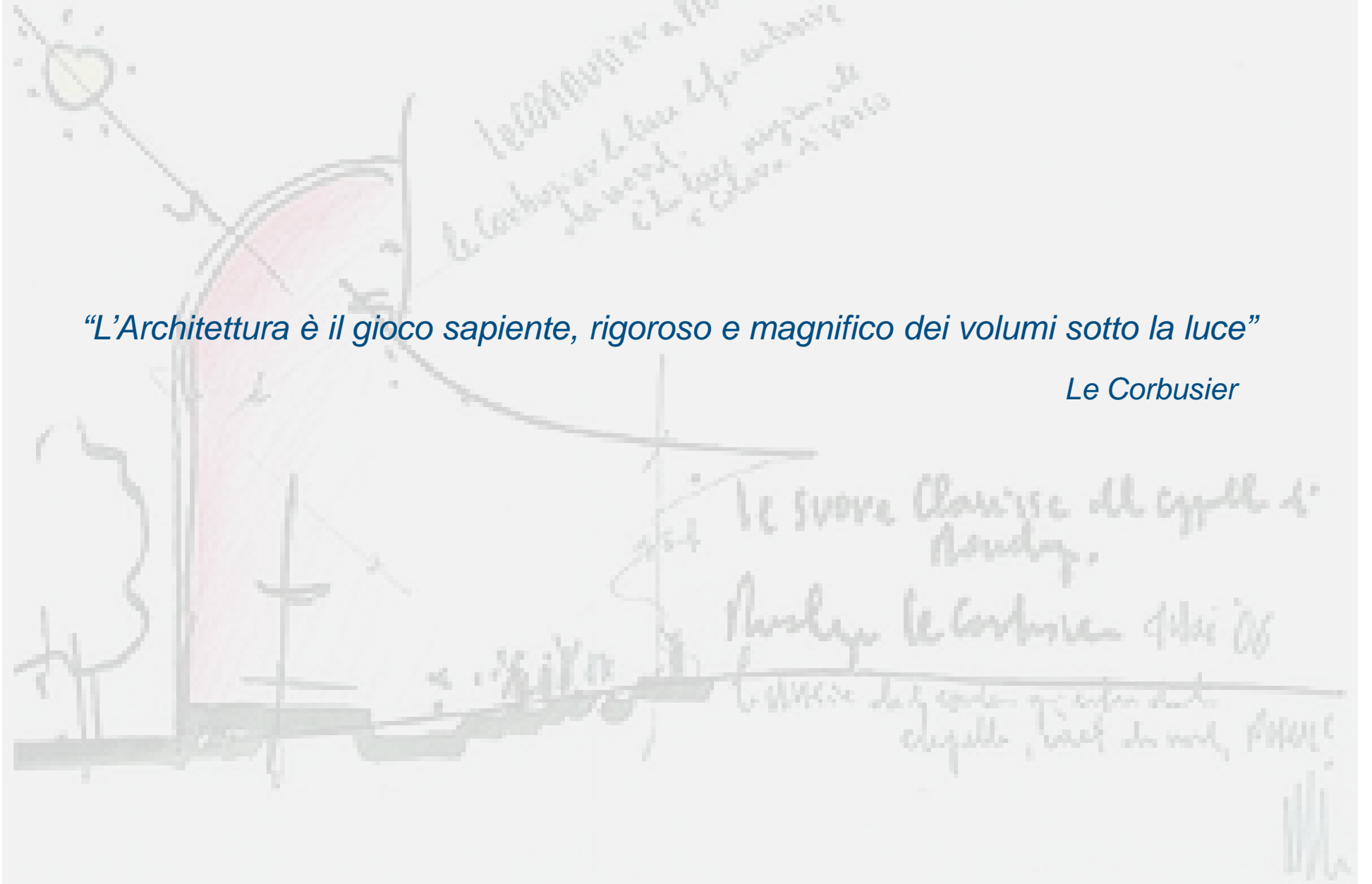


# Conclusions:

The analysis of the Architect Albert de Pineda projects can definitely help to get light in those spaces that live underground the hospitals and in which normally there is only artificial light. Most often in these environments there are the imaging or diagnostic laboratories. With the solutions undertaken in the projects just analysed, it is possible to use those spaces for different uses in a really humanized environment..



*Sagrada Família, Antonio Gaudí Barcelona*



“L'Architettura è il gioco sapiente, rigoroso e magnifico dei volumi sotto la luce”

Le Corbusier