

Urban Angiogenesis I BIO Smart City 3.0

Knafo Klimor Architects
Prof. Ronit Satchi-Fainaro, Ph.D.

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Knafo Klimor Architects I www.kkarc.com

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LifeObject I Israel Pavilion
Venice Biennale 2016 I 15th International Architecture Exhibition



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Knafo Klimor Architects I www.kkarc.com
Prof. Ronit Satchi-Fainaro, Ph.D. I www.medicine.mytau.org/satchi-fainaro

Knafo Klimor Architects: Tagit Klimor, David Knafo, Or Regev, Uri Hallel, Arie Hayun & Heba Saleh

Cancer Angiogenesis and Nanomedicine Laboratory, Sackler Faculty of Medicine, Tel-Aviv University: Prof. Ronit Satchi-Fainaro, in collaboration with Galia Tiram.

Eng. Yacov Biofcic, ER&D - Engineering, Research & Development , Mechanical & Electrical implementation

Editor & texts: Tagit Klimor

BioText: Prof. Ronit Satchi-Fainaro, Ph.D.

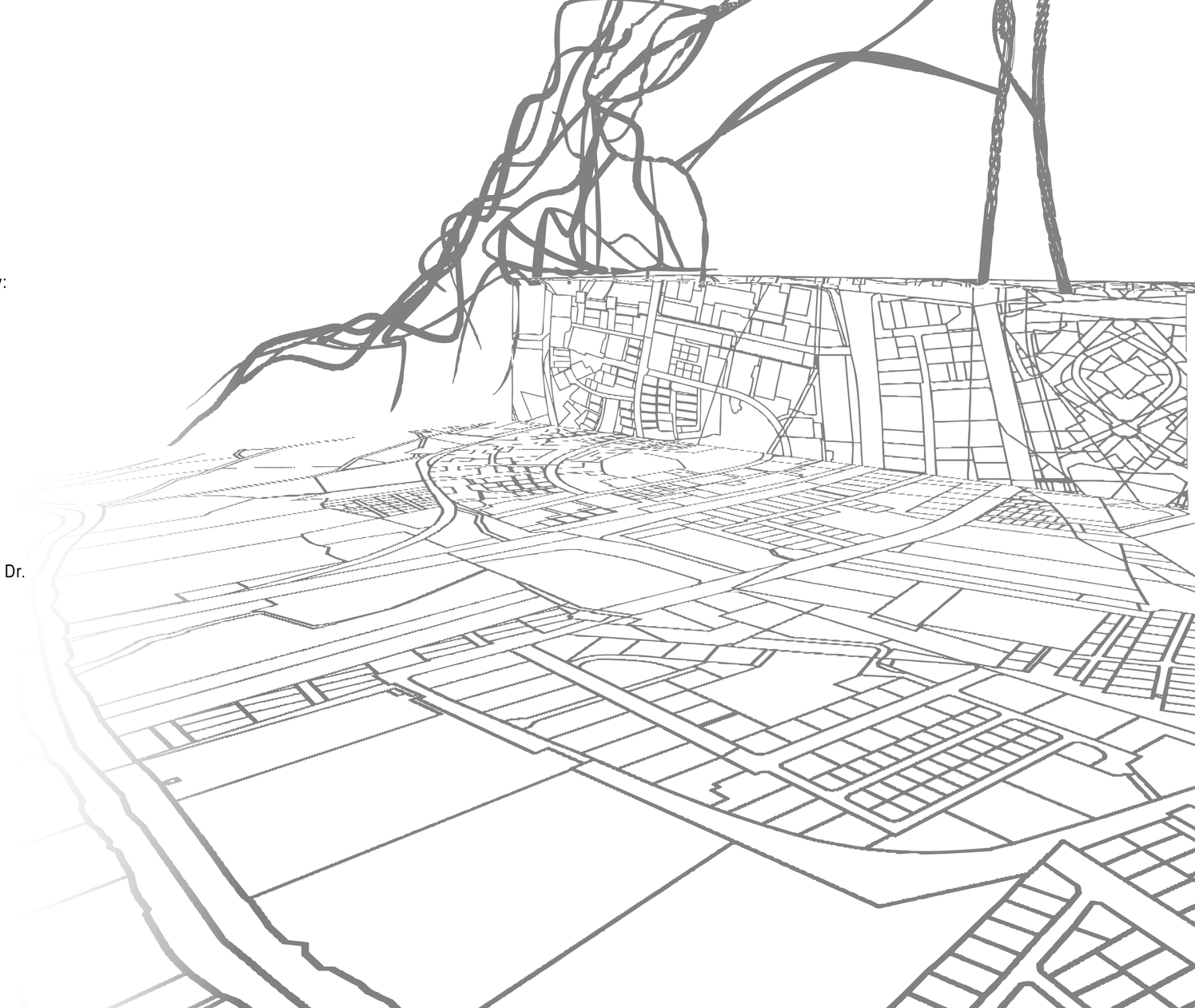
language editor: Carly Golodets, Ph.D.

LifeObject: Israel Pavilion at La Biennale di Venezia 2016
Curatorial team: Architect Bnaya Bauer, Architect Arielle Blonder, Architect Noy Lazarovich, scientist Dr. Ido Bachelet and curator Dr. Yael Eylat Van-Essen

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'Look deep into nature,

and then you will understand everything better.'

Albert Einstein

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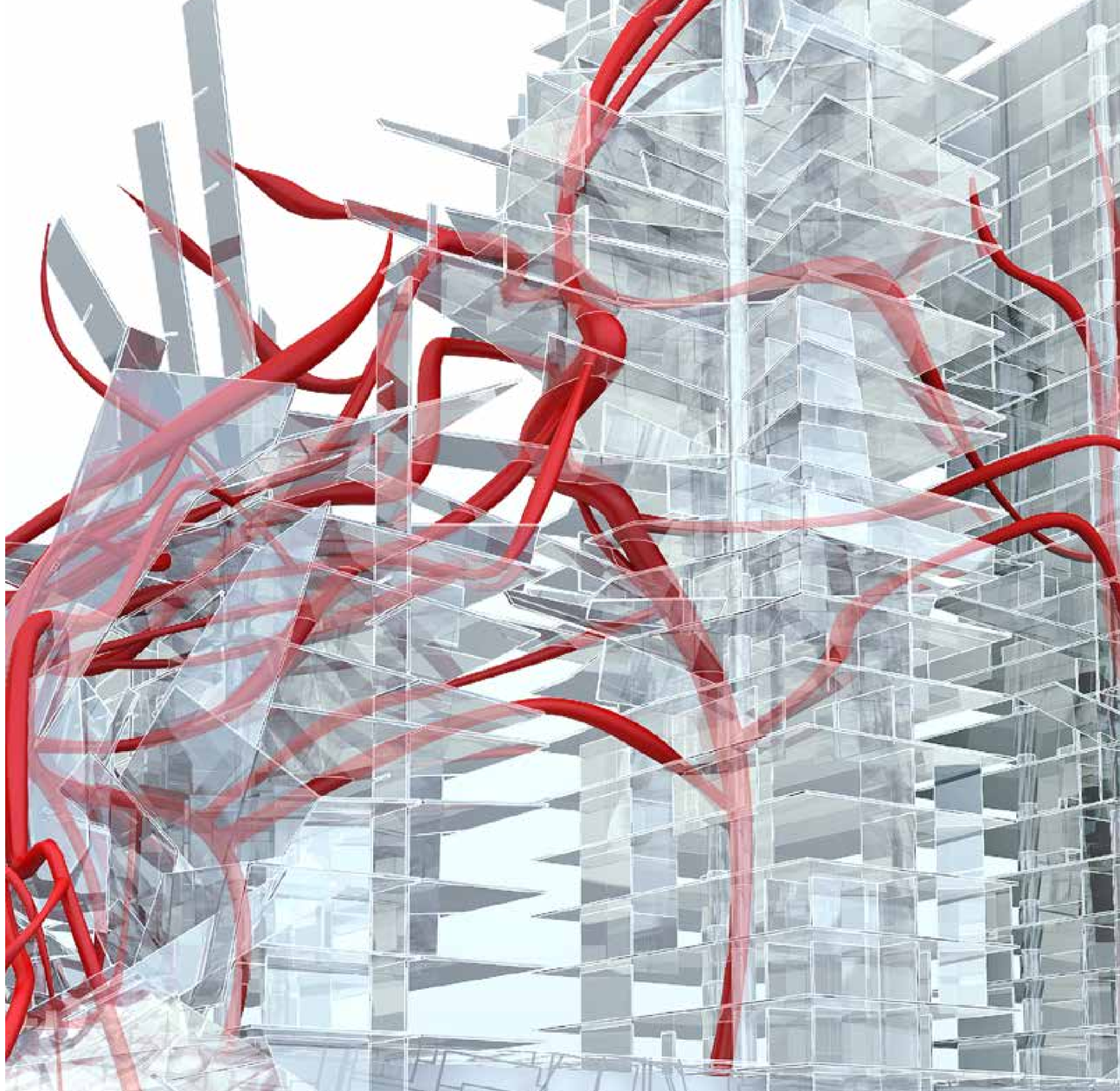
Urban Angiogenesis
BIO Smart City 3.0

Using Nanomedicine Tools Used in Cancer Diagnosis and Therapy to Tackle Urban Overcrowding.

Knafo Klimor Architects & Prof. Ronit Satchi-Fainaro, Ph.D.

BIO Smart City 3.0 is a dynamic installation which applies the biological process of angiogenesis - through which new blood vessels form from pre-existing ones - in order to explore new methods of preventing urban over-densification.

Global trends of migration towards urban centers are increasing exponentially, overtaxing urban infrastructure to the point where it risks collapsing beyond repair. In order to assess the moment – where overcrowding in a city has reached ‘the point of no return’, this project examines if tackling urban sickness could be pioneered according to biological principles and methodologies which govern cancer research.



LifeObject: Israel Pavilion at La Biennale di Venezia 2016

The Israeli pavilion 2016 ‘LifeObject’ exhibition at the 15th International Biennale for Architecture in Venice focuses on biomimcry and the subject’s affiliation to contemporary architecture and urban planning.

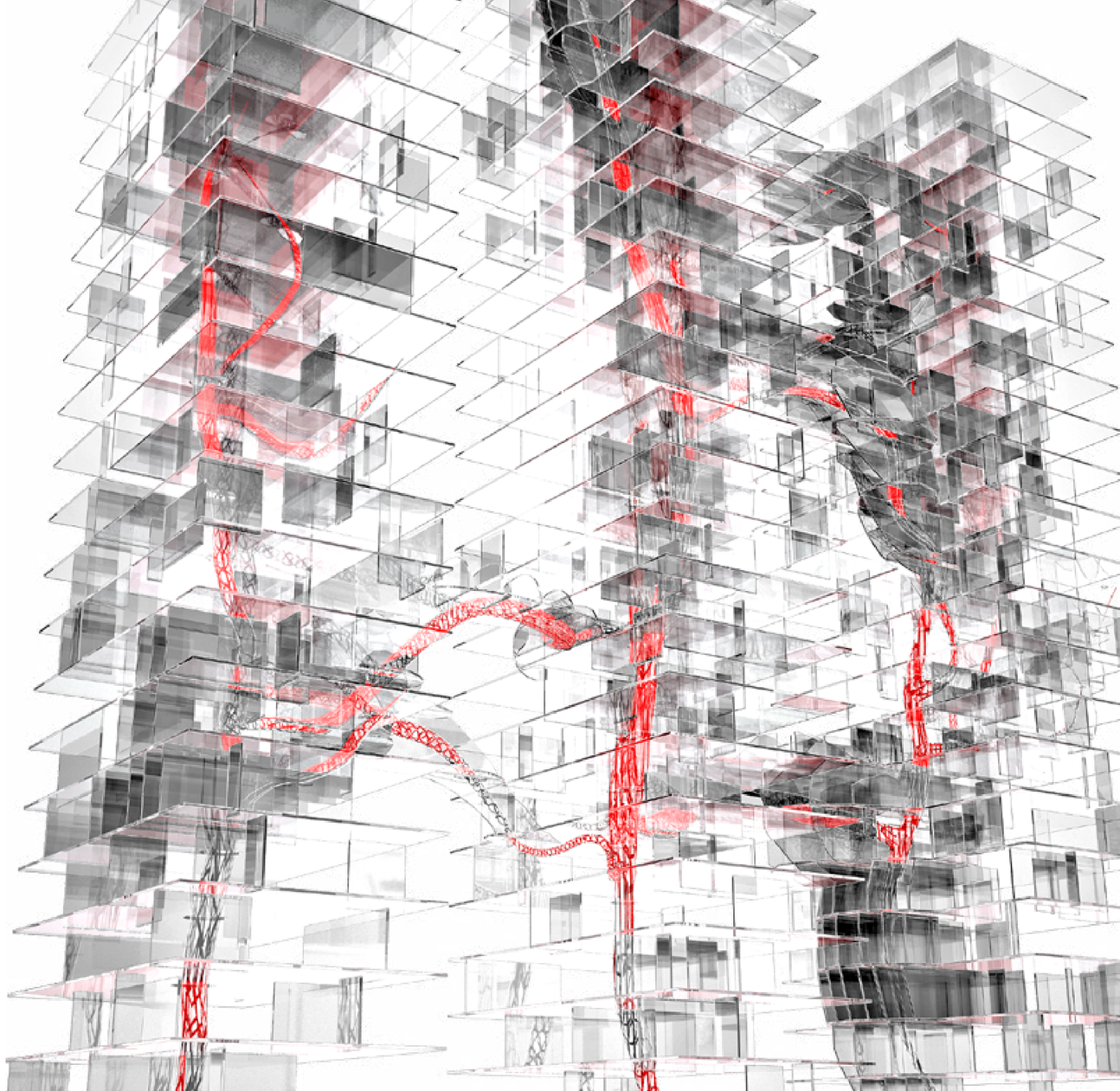
The exhibition is a multidisciplinary experiment, bringing forward new ideas, examining the relationships of humans with their environment and architectural surroundings. From the singular individuals element to a larger mechanism of an entire ecosystems, the exhibition combines different architectural and urban approaches to ‘real-time’ biological researches, creating a verity of projects related to ecology, sociology and politics at various sites in Israel.

One of the core themes of the ‘LifeObject’ exhibition is resiliency. It is an essential part of any biological, ecological and architectural system ensuring the ability to sustain any trauma without losing the system’s delicate balance. This becomes even more significant when we look at the changes our world has been going through in the last decades and the implication of resources depletion.

The curatorial team: Architect Bnaya Bauer, Architect Arielle Blonder, Architect Noy Lazarovich, scientist Dr. Ido Bachelet and curator Dr. Yael Eylat Van-Essen



Architeture State of the Art (?)

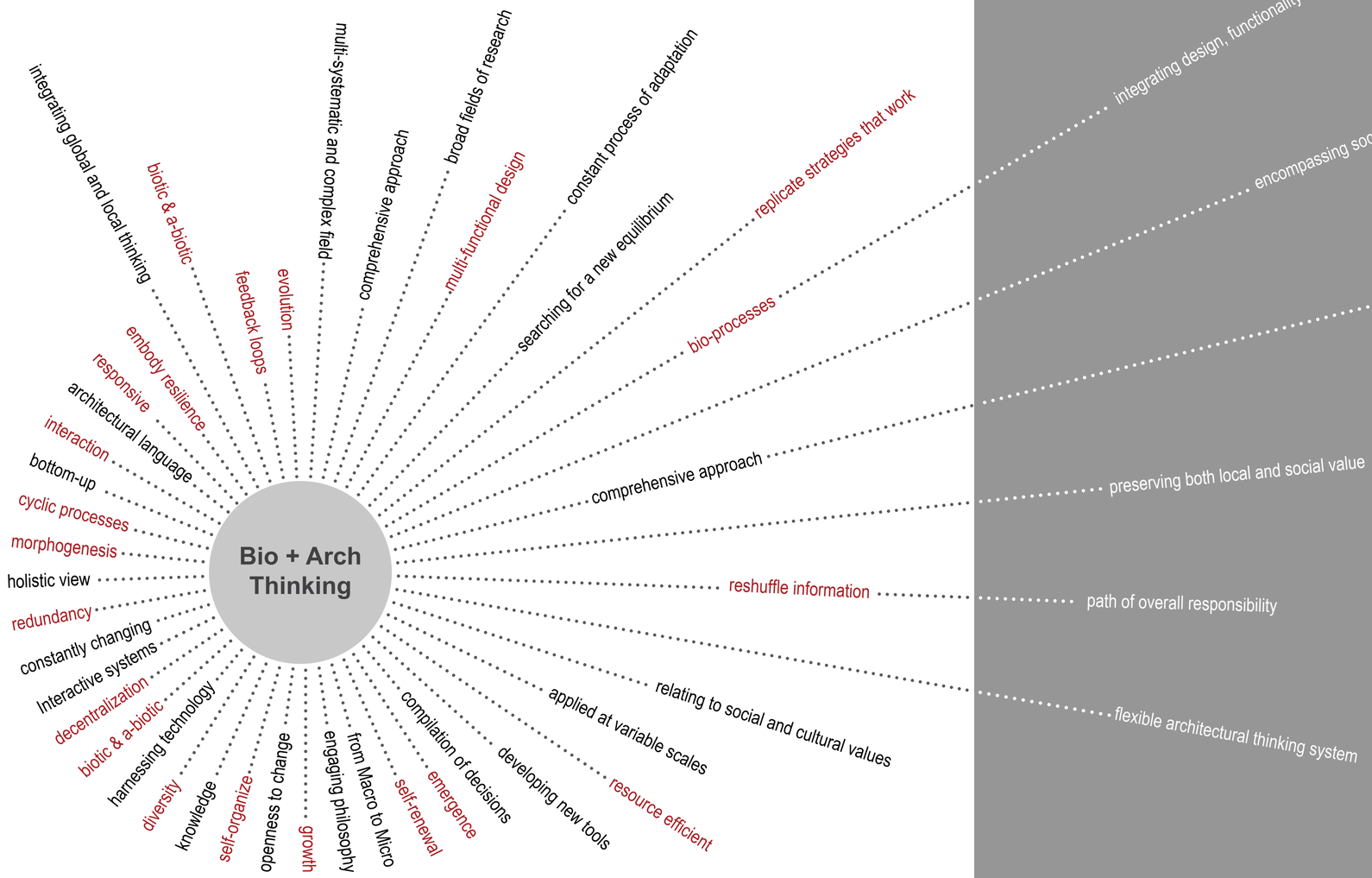


Architecture, Proficiency and Holistic Approach

The world of knowledge is expanding. The amount of knowledge and accessibility to information, both for professionals and the general public, are almost unimaginable; this vast amount of information cannot be adequately processed. The world is becoming increasingly professional, and research fields are becoming more focused and detailed. The scientific world, which by its nature strives towards achievements and breakthroughs, finds itself caught in an ongoing dilemma between the desire and need to specialize while acquiring in-depth knowledge of a specific subject, and the benefits derived from interdisciplinary, all-inclusive observations.
In order to deal with the wide range of challenges in architecture, as in other fields, there is a simultaneous need for specialization, corresponding with the exponential rate of technological development, and an overall view of the whole as a complex, dynamic system.

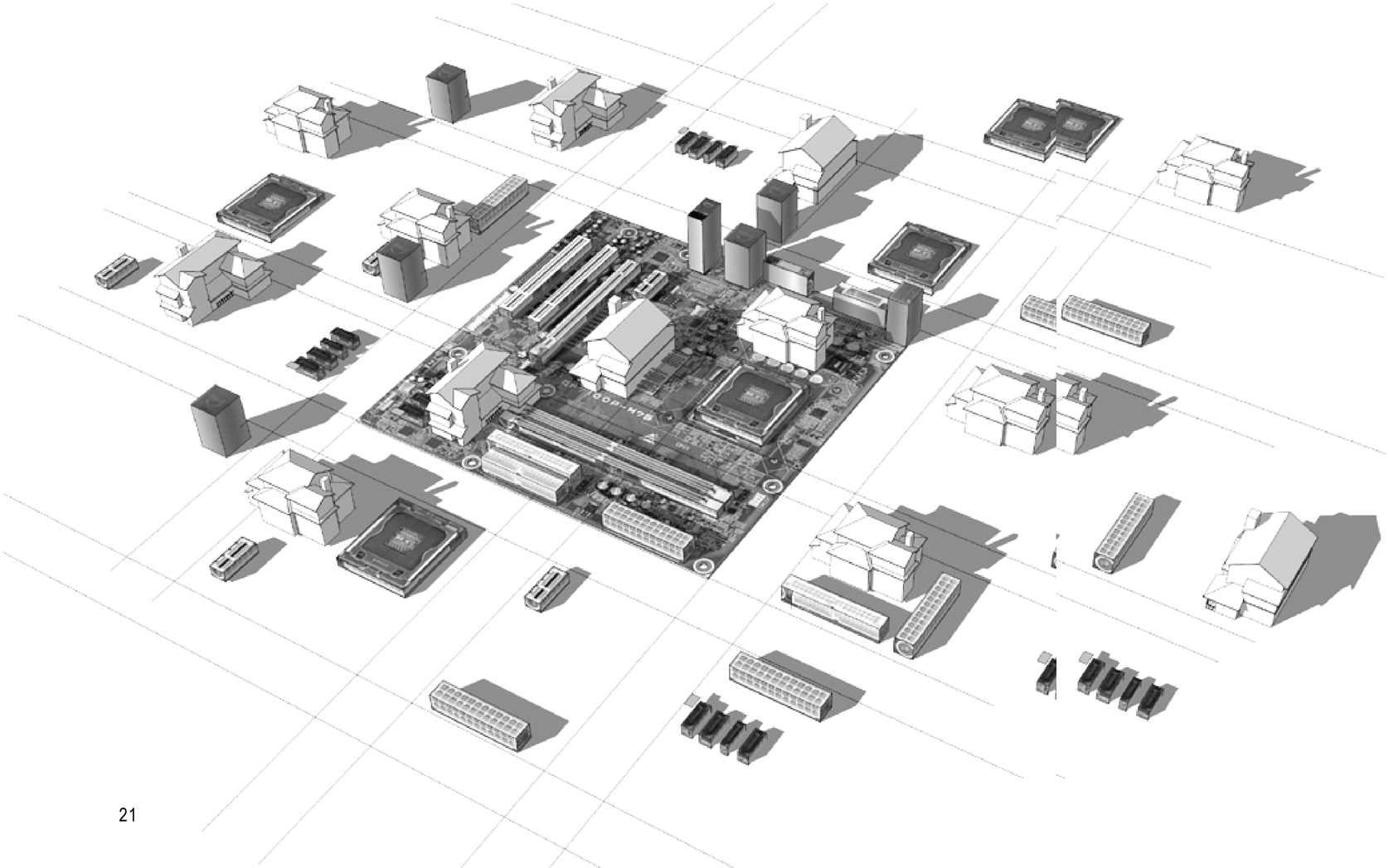
Fundamentally, architecture is a comprehensive field that encompasses a wide range of values and knowledge, integrates additional professional fields and is applied at variable scales: from the national to the regional to the local, joining forces at the structural scale and in product design. Each decision has an influence at various scales - from macro to micro. An architectural creation is a complex compilation of decisions relating to social and cultural values, philosophy, design, functionality and engineering.





The key issue in architectural planning is openness to change while preserving values. Architectural thinking must strike a balance between the local, that represents permanence, and the global world, that is constantly changing. This process is analogous to ecosystems that are in a constant process of adaptation, while searching for balance and a new equilibrium during their development. The key to architectural thinking lies in combining diverse sources of knowledge, and learning from the structure and behavior of systems across broad fields of knowledge, while integrating global and local thinking, and harnessing technology while preserving both local and social values. Architecture, as a multi-systematic and complex field, has a leadership role that, via integration and creating thinking, may lead to a path of overall responsibility, encompassing social, environmental and economic perspectives.

Architecture Between High and Low-techs



Advanced technology has been integrated en masse into most facets of life and has changed the face of society. At the same time, population growth and increased standards of living place a heavy burden on the environment and disturb the delicate balance of nature's ecosystems. However, Building technology has advanced slowly and lags noticeably behind other facets of life. Bridging this gap requires the channeling of interdisciplinary creative thinking to provide solutions for ever-increasing physical requirements while reducing resource exploitation.

The extended dialog must be based on the interaction between architecture and science, moving away from machine ideology and searching for materials and buildings with principles similar to those of ecosystems. Interdisciplinary integration will assist in developing new tools to influence both the built-up area and architectural language. This approach represents the over-arching interdisciplinary trend that examines technological capabilities and scientific principles from broad fields of research. The link between architecture, life sciences, and computer systems is the key to a more flexible architectural thinking system, and advancement of dynamic and variable architecture that deals with interactive systems and responsive environments rather than with stationary objects.

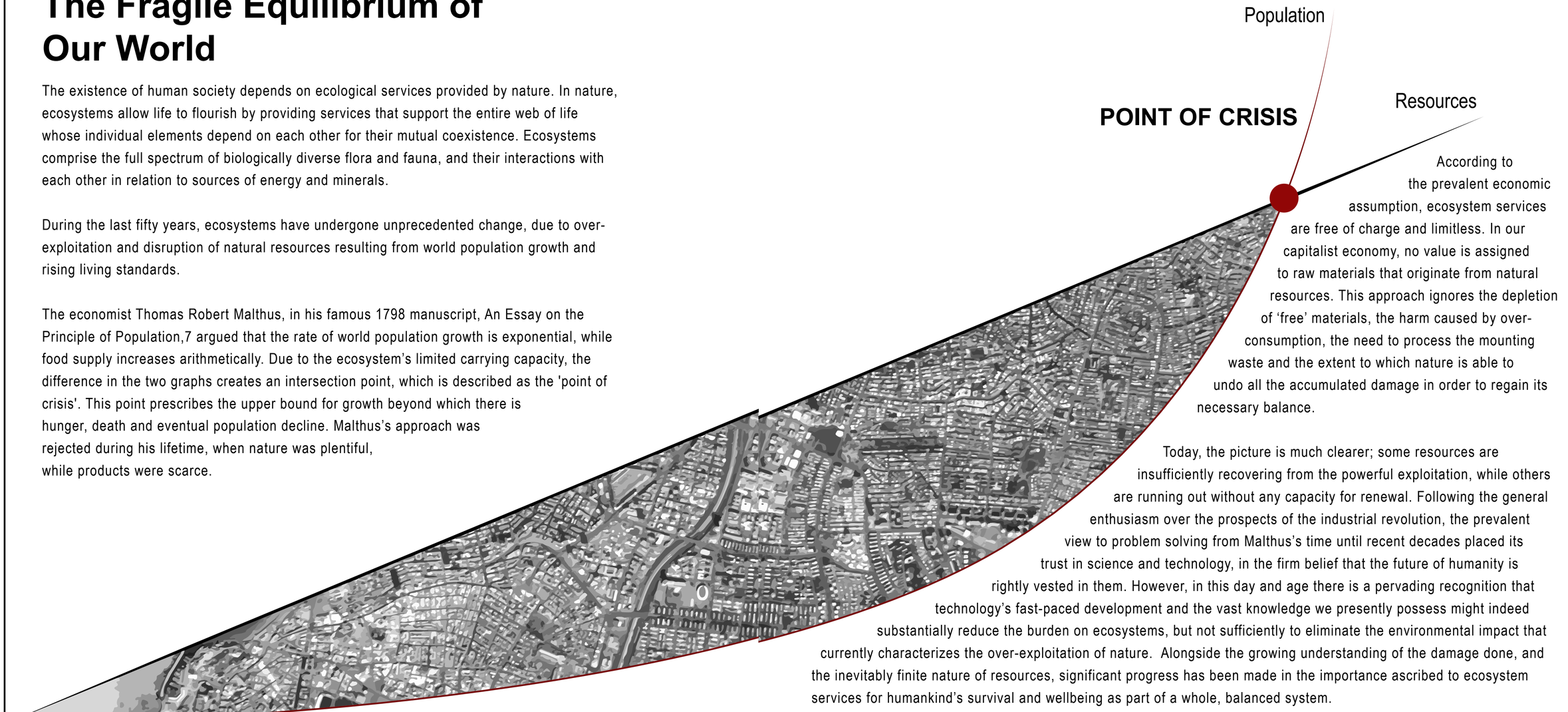

ECO
logic

The Fragile Equilibrium of Our World

The existence of human society depends on ecological services provided by nature. In nature, ecosystems allow life to flourish by providing services that support the entire web of life whose individual elements depend on each other for their mutual coexistence. Ecosystems comprise the full spectrum of biologically diverse flora and fauna, and their interactions with each other in relation to sources of energy and minerals.

During the last fifty years, ecosystems have undergone unprecedented change, due to over-exploitation and disruption of natural resources resulting from world population growth and rising living standards.

The economist Thomas Robert Malthus, in his famous 1798 manuscript, An Essay on the Principle of Population,7 argued that the rate of world population growth is exponential, while food supply increases arithmetically. Due to the ecosystem's limited carrying capacity, the difference in the two graphs creates an intersection point, which is described as the 'point of crisis'. This point prescribes the upper bound for growth beyond which there is hunger, death and eventual population decline. Malthus's approach was rejected during his lifetime, when nature was plentiful, while products were scarce.



According to the prevalent economic assumption, ecosystem services are free of charge and limitless. In our capitalist economy, no value is assigned to raw materials that originate from natural resources. This approach ignores the depletion of 'free' materials, the harm caused by over-consumption, the need to process the mounting waste and the extent to which nature is able to undo all the accumulated damage in order to regain its necessary balance.

Today, the picture is much clearer; some resources are insufficiently recovering from the powerful exploitation, while others are running out without any capacity for renewal. Following the general enthusiasm over the prospects of the industrial revolution, the prevalent view to problem solving from Malthus's time until recent decades placed its trust in science and technology, in the firm belief that the future of humanity is rightly vested in them. However, in this day and age there is a pervading recognition that technology's fast-paced development and the vast knowledge we presently possess might indeed substantially reduce the burden on ecosystems, but not sufficiently to eliminate the environmental impact that currently characterizes the over-exploitation of nature. Alongside the growing understanding of the damage done, and the inevitably finite nature of resources, significant progress has been made in the importance ascribed to ecosystem services for humankind's survival and wellbeing as part of a whole, balanced system.

The City as an ‘Ecosystem’

In the age of sustainability, cities are being re-conceived as ‘ecosystems’. Environments marked by a fragile balance between ‘biotic’ living organisms and the non-living ‘a-biotic’ factors of their surroundings. The ability of inhabitants to thrive in nature is dependent upon the carrying capacity of its ecosystem. Earth systems are governed by a dynamic equilibrium. The complexity of nature is derived from the contradiction between these two terms.

The urban ecosystem is dependent on the reciprocal relations between living elements and the infrastructure which conditions their quality of life.These systems can be found in a variety of scales within many aspects of our lives, but a violation of their delicate balance will almost certainly instigate a process of compensation in order to regain stability.

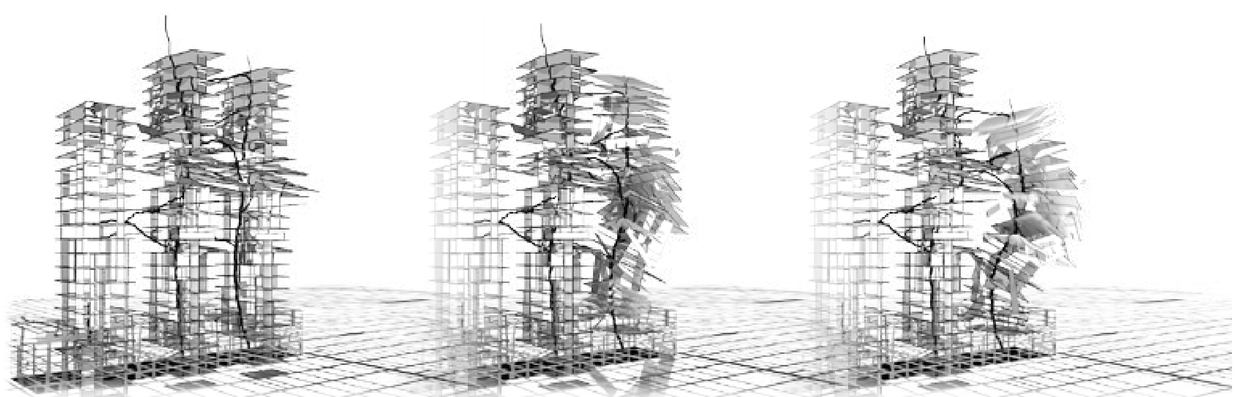
Moving beyond the traditional binary which separates the natural from the artificial, towards a more porous integration of the biotic and the a-bioticcan imbue our cities with greater resilience and sustainability.



Technology’s Limited Ability to Save the World

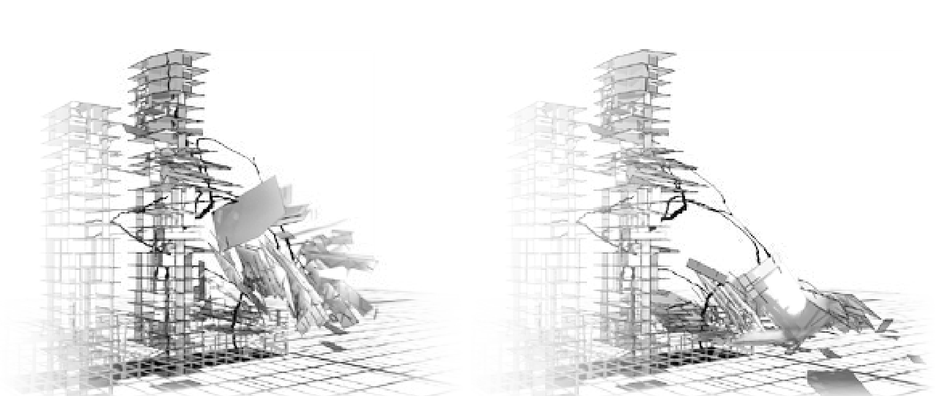
The mounting evidence concerning the overall environmental impact provides fertile ground for debates and disagreements between those who believe that through technology we cause our ecosystems irreversible damage and devastation that is impossible to overturn, and those who believe technology is the key to saving the world. The truth, most likely, is more complex: it is located somewhere between the two extremes.

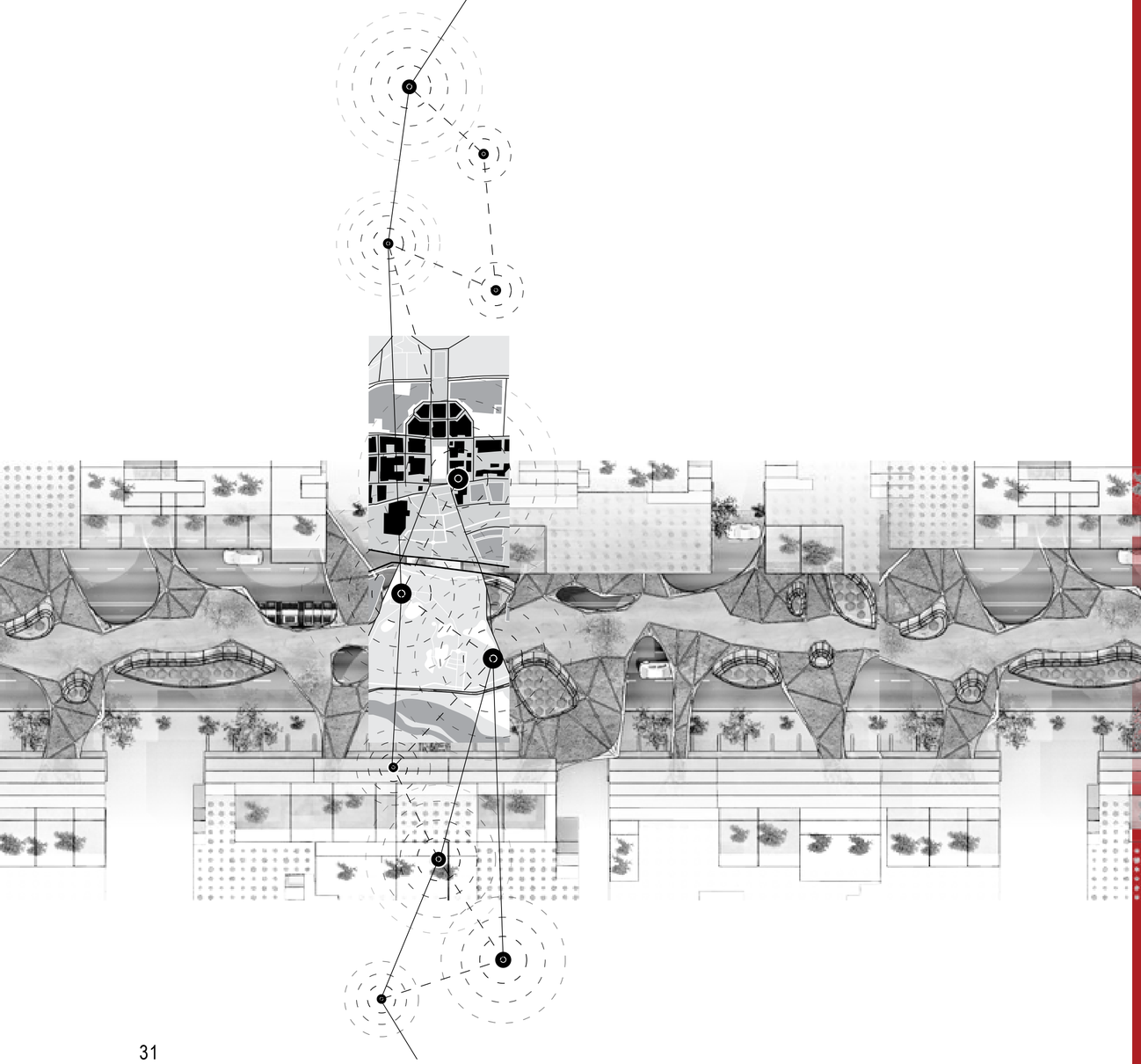
The mathematician and philosopher René Descartes believed that the purpose of science is to control nature and guarantee that technological know-how will enable humanity to claim mastery over nature. The belief that technology alone will suffice to solve the world's problems began to weaken during the 18th century with a shift in the scientific paradigm and the consolidation of the ecological approach.



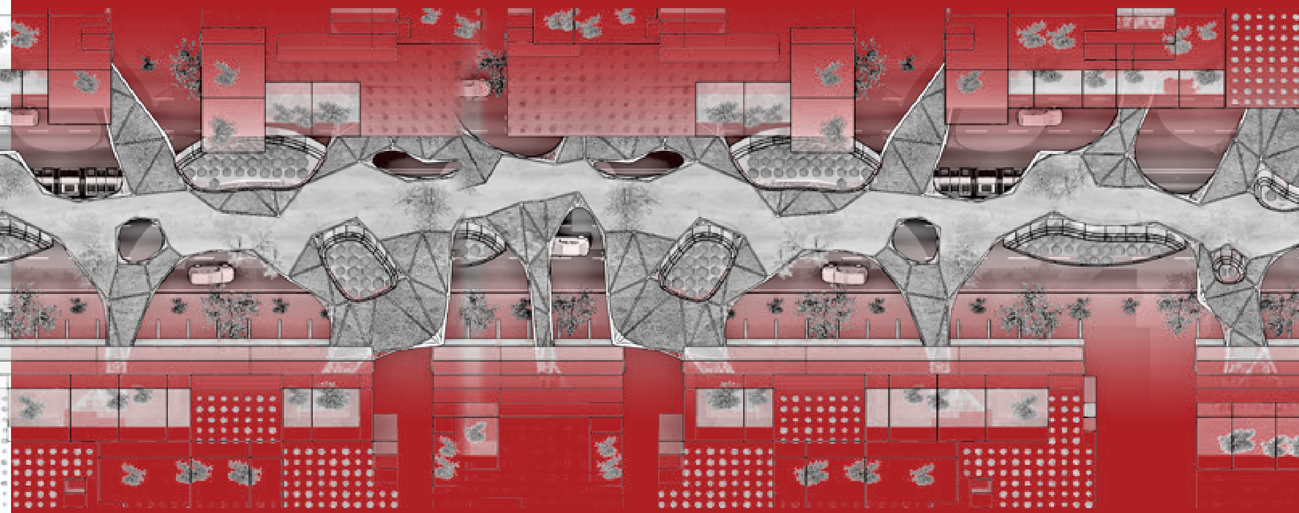
The evolution of ecological thinking leans heavily on the development of modern physics, Einstein's theory of relativity, quantum physics and chaos theory. The physicist Fritjof Capra notes that: 'Quantum theory thus reveals a basic oneness of the universe. It shows that we cannot decompose the world into independently existing smallest units. As we penetrate into matter, nature does not show us any isolated 'building blocks', but rather appears as a complicated web of relations between the various parts of the whole'[1].

The shift in the scientific approach demonstrated the dynamics and diversity in nature and the complex interactions among all the components. Instead of the mechanistic, reductionist world view, which was dominant for many years, wide range of approaches emerged that draw inspiration from the development of various scientific fields and from nature. The separation between nature and science and the condescending attitude towards nature changed and allowed a learning, cooperation and a symbiotic approach to appear and restore nature’s primordial honor with scientific insights.





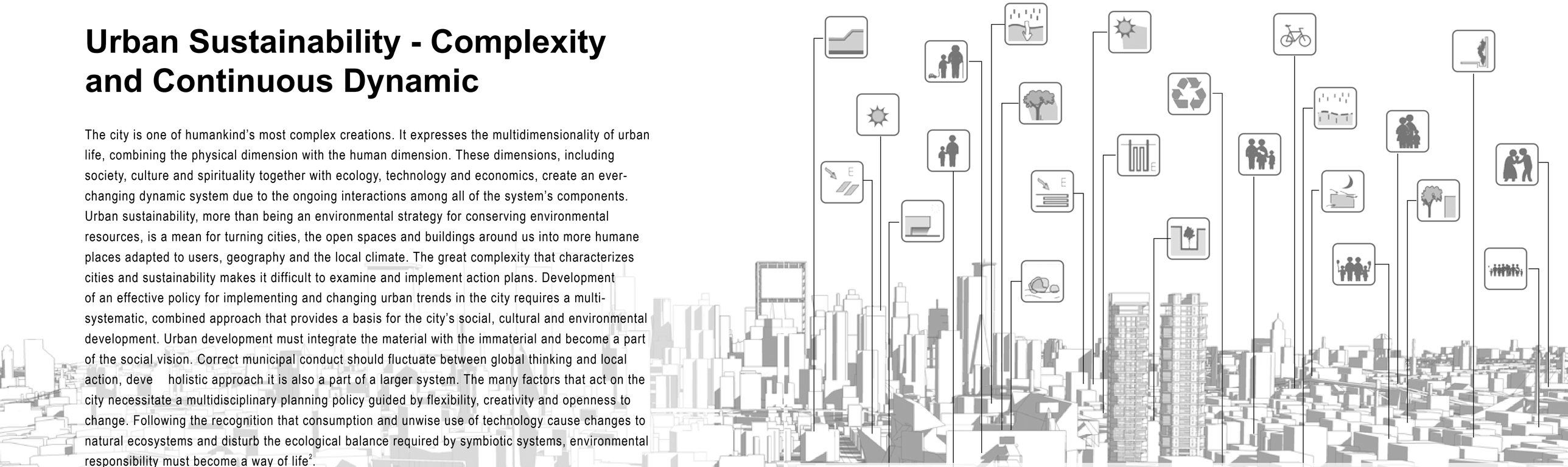
URBAN (needs) M



Urban Sustainability - Complexity and Continuous Dynamic

The city is one of humankind's most complex creations. It expresses the multidimensionality of urban life, combining the physical dimension with the human dimension. These dimensions, including society, culture and spirituality together with ecology, technology and economics, create an ever-changing dynamic system due to the ongoing interactions among all of the system's components. Urban sustainability, more than being an environmental strategy for conserving environmental resources, is a mean for turning cities, the open spaces and buildings around us into more humane places adapted to users, geography and the local climate. The great complexity that characterizes cities and sustainability makes it difficult to examine and implement action plans. Development of an effective policy for implementing and changing urban trends in the city requires a multi-systematic, combined approach that provides a basis for the city's social, cultural and environmental development. Urban development must integrate the material with the immaterial and become a part of the social vision. Correct municipal conduct should fluctuate between global thinking and local action, deve holistic approach it is also a part of a larger system. The many factors that act on the city necessitate a multidisciplinary planning policy guided by flexibility, creativity and openness to change. Following the recognition that consumption and unwise use of technology cause changes to natural ecosystems and disturb the ecological balance required by symbiotic systems, environmental responsibility must become a way of life[2].

The necessary connection between technology and nature's wisdom is expressed by Daffara: 'City form in the future, I believe, must follow function and function will be reassessed to follow life.'[2] Daffara's comment combines the modernistic approach, that urban planning provides a linear and rational solution for humankind's functional requirements, with the broad approach that sees planning as a multi-dimensional, adaptive system that provides a solution for the future existence of life systems on Earth. This approach sees nature as a source of inspiration and learning. Using these tools it is possible to estimate anew the solutions for human requirements as part of a complex system based on insights from nature. This understanding is valid for cities in the present that consume resources and create waste at unprecedented scale and scope.

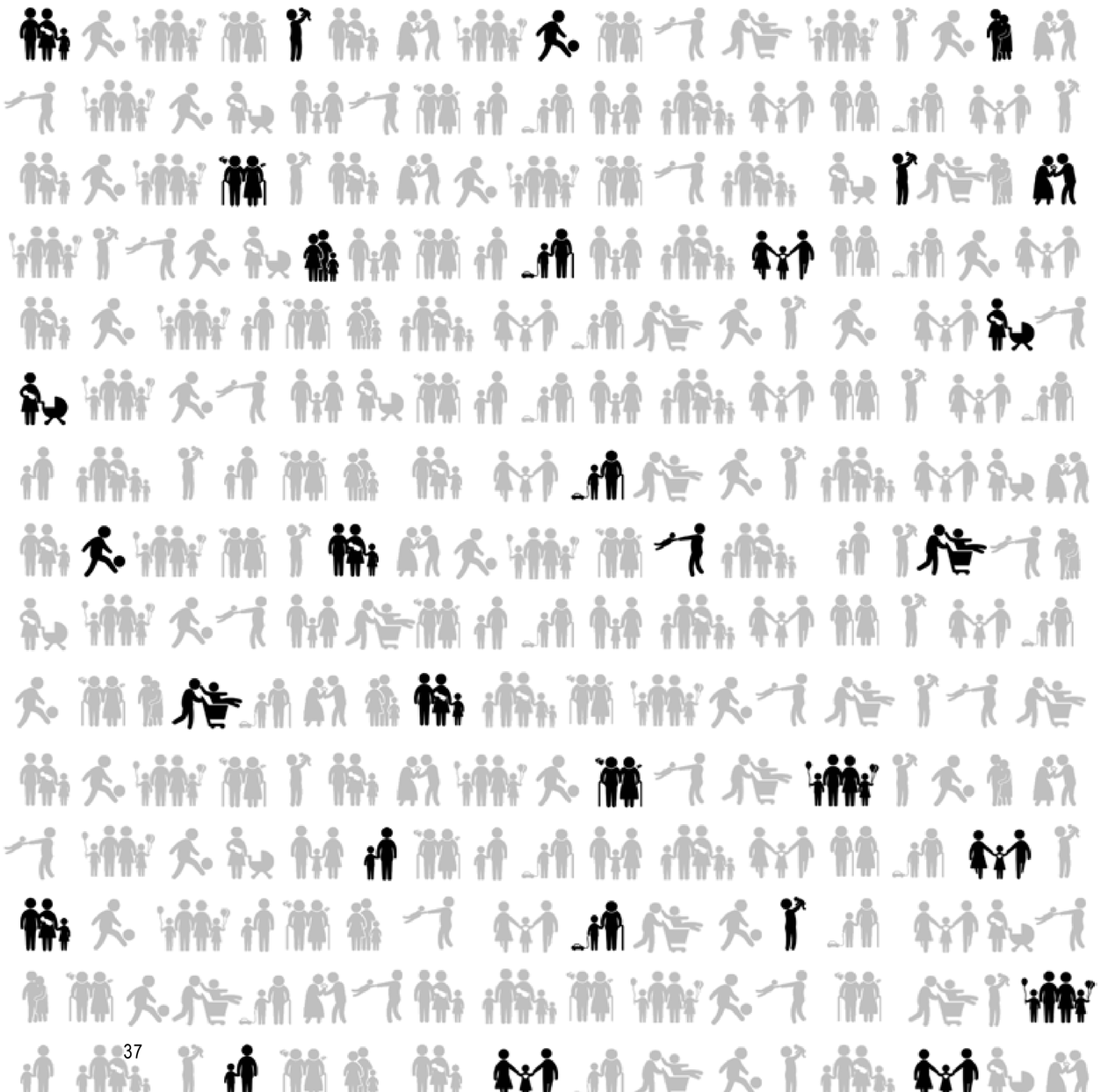


Resource turnover in most cities is linear and concern for the source or final destination of the by-products and waste is almost non-existent. The result is dwindling, non-renewable resources and continuous and irreversible pollution. Therefore the ecological, social and economic urban systems must formulate action plans that imitate nature's cyclical system, and adopt the natural approach that acts from 'cradle to cradle'. Due to the many implications of trends in urbanization, urban policy should be guided by environmental thinking. Promoting urban sustainability necessitates a multi-systematic vision and ability to cope with the constant variability of the city's components. A comprehensive vision promotes planning that enables adaptation to variable requirements, saving resources and reducing the burden on the ecosystem. Sustainable urban planning, according to this approach, requires flexibility of 'systems thinking' to facilitate planning that provides a solution to urban complexity and dynamics.

The Ecological Footprint of the City

In an ever-densely populated world where massive urban migration plays a central role, the city becomes a key player within the social, economic and environmental fields. Urbanization is driven primarily by an economic vitality that finds its expression in the many job opportunities offered in the city. City population growth and the rise in standards of living with its increasing levels of consumption, further accelerate the city's ecological footprint, whose land cover considerably exceeds its actual physical dimensions.

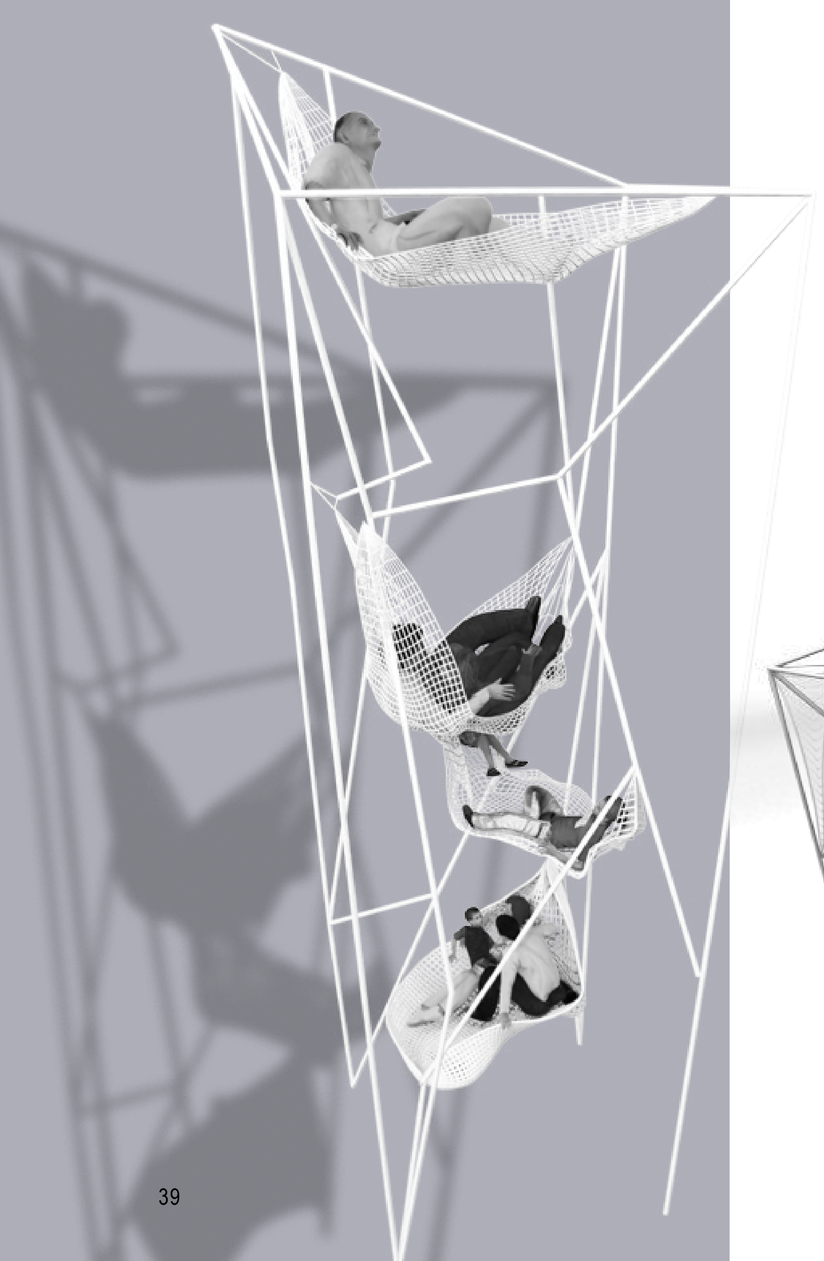




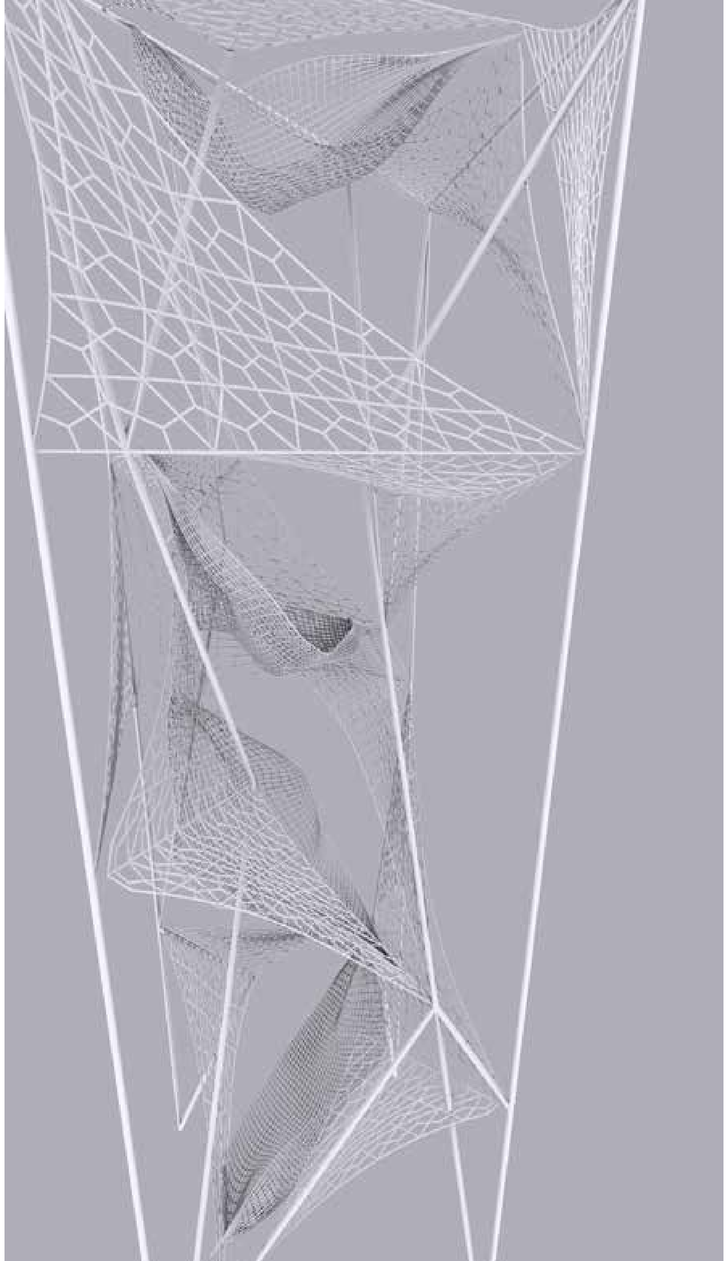
Socio-Cultural Dynamics and Lifestyle Change

The world is in the throes of significant lifestyle change. This change is an outcome of increasing life expectancy, an increased standard of living, and the impact of technological development on society. Thanks to communication networks, it is easier to compensate for distance and knowledge gaps while smart technologies have become a significant player in the daily life of both individuals and society. These accessible factors formulate new interactions in the social structure, change the face of the family unit and propose a multi-faceted texture of relationships between the individual and society. We are witnessing a transformation from the traditional family of a heterosexual couple with children, and from a patriarchal and multi-generational family, to a ‘different family’ – a single-parent or single-sex family unit, or a family of individuals; from stable, long-term families to variable and transient relationships; and from physical friendships to the development of virtual life that forms alternative interpersonal communication systems. Society is becoming more dynamic, open and exposed to external social influences arising from the process of globalization.

With this in mind, residence in the crowded city must be the basis for incorporating this diversification. The residential unit must respond physically and dynamically to these changes. The response could be in the form of flexible housing units, whose size may be changed according to the requirements of their owners, while maintaining the basic dimensions, in order to minimize the ecological footprint and consequent harm to exhaustible natural resources. Flexibility may come from resource sharing such as open code, by providing variable identities to private and public spaces. The shared spaces are a resource that is also flexible and may take on variable roles according to user requirements. Residences may expand in their definition and become a space that includes employment or leisure activities such as sport or culture. Physical proximity between different activities and the ability to arrange them in a non-linear way at any hour of the day significantly increases the efficiency of managing temporal and environmental resources. This program dictates a new agenda in the most literal and physical sense as well as from a broad philosophical perspective.



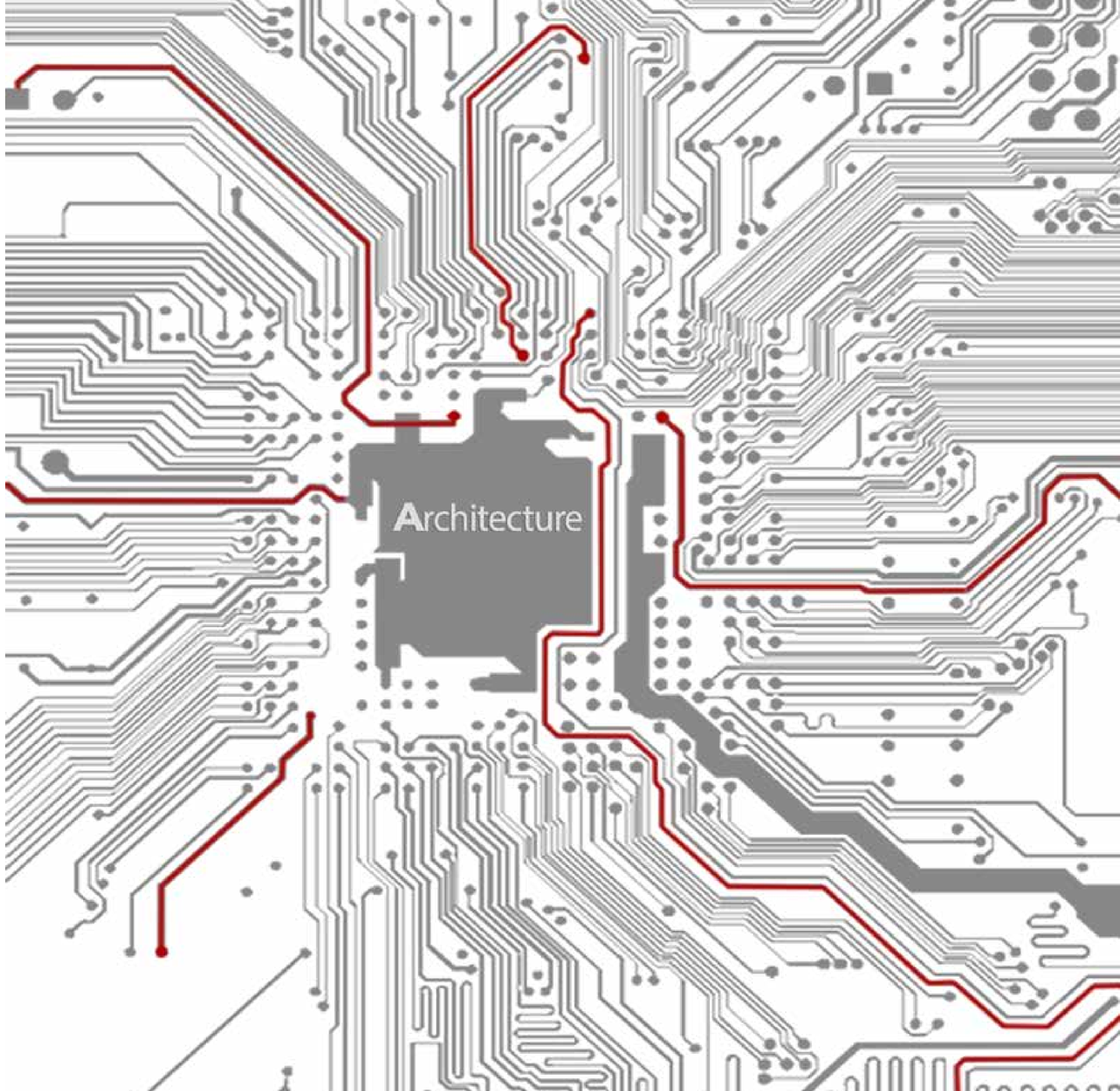


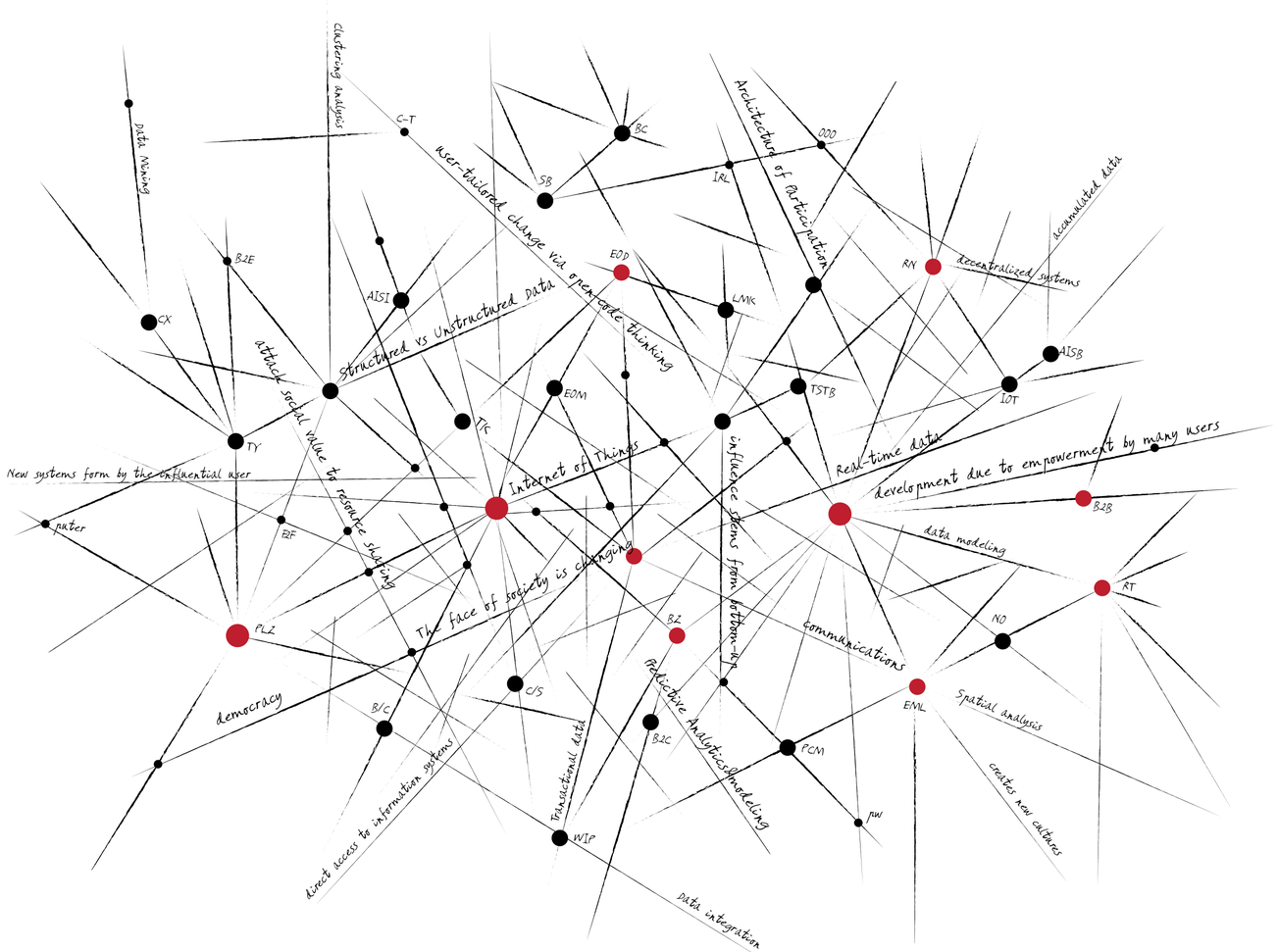




The Open Code City –
The City in the Information Age

The face of society is changing: from slow development of social and cultural trends to rapid assimilation of changes; from a society based on local culture to a society feeding on and influenced by global culture; from ‘tangible life’, experienced subjectively and in the context of cultural background, to ‘virtual life’, that bridges gaps in tradition and heritage and creates new cultures. New systems form and are defined by the influential user, who, until yesterday was an anonymous and unseen user. This influence stems from bottom-up, grass-roots growth and it heralds the beginning of a social process of mutual influence of the individual on society and of society on the individual. This discourse develops and leads to user-tailored change via open-code thinking, allowing direct access to information systems, and allowing the user to directly use and change the system. This cooperation reaps the many benefits of empowerment of a system that sustains its participants. The analogy is taken from open-code development of software systems that are based on standardization as a flexible platform that enables construction of additional layers. This system encourages innovation and develops due to empowerment by many users. Tim O’Reilly described the birth of Web 2.0 as a turning point in the history of the human species. The developing work infrastructure, which he nicknamed 'Architecture of Participation', will lead, by its existence, to renewed contemplation of the society in which we live, both as a community and as an individual.





Marina Gorbis from the Institute for the Future writes in her article 'Think the Unthinkable': *'...new structures emerge little by little from the contribution of many. In this, they resemble biological structures in which complexity emerges without a grand central design'*[3].

Kevin Kelly in his article 'Atom Versus Net'[4] characterizes the change in the social-cultural paradigm as a transformation from atom imagery to net imagery. In his words: 'the definitive scientific symbol of the twentieth century is the atom. It rotates by itself and symbolizes individuality. The atom is clear in its simplicity, representing power, knowledge and confidence. The atom is the past'. In Kelly opinion, the scientific symbol of the twenty-first century is the dynamic net characterized by its lack of a beginning, end, or middle: 'The net represents all the circles, intelligence, mutual dependence, economic, social and ecological issues, communications, democracy and large groups and systems'[5]. The open-code culture and the net-like distribution of the different forces embody ideological approaches that attach social value to resource sharing. Assimilation of this culture when planning our environment opens up a discussion on the status of central planning as opposed to decentralized systems, and on the impact of market forces on decision making. The open system strengthens the flexible planning alternative. Establishing a basic, standard structure allows flexibility and encourages active mixing of its users and sharing of physical resources. These approaches allow exploitation of infrastructures and overall resource saving together with broadening the private choice space and generating many opportunities that endorse freedom, open space and diversity.



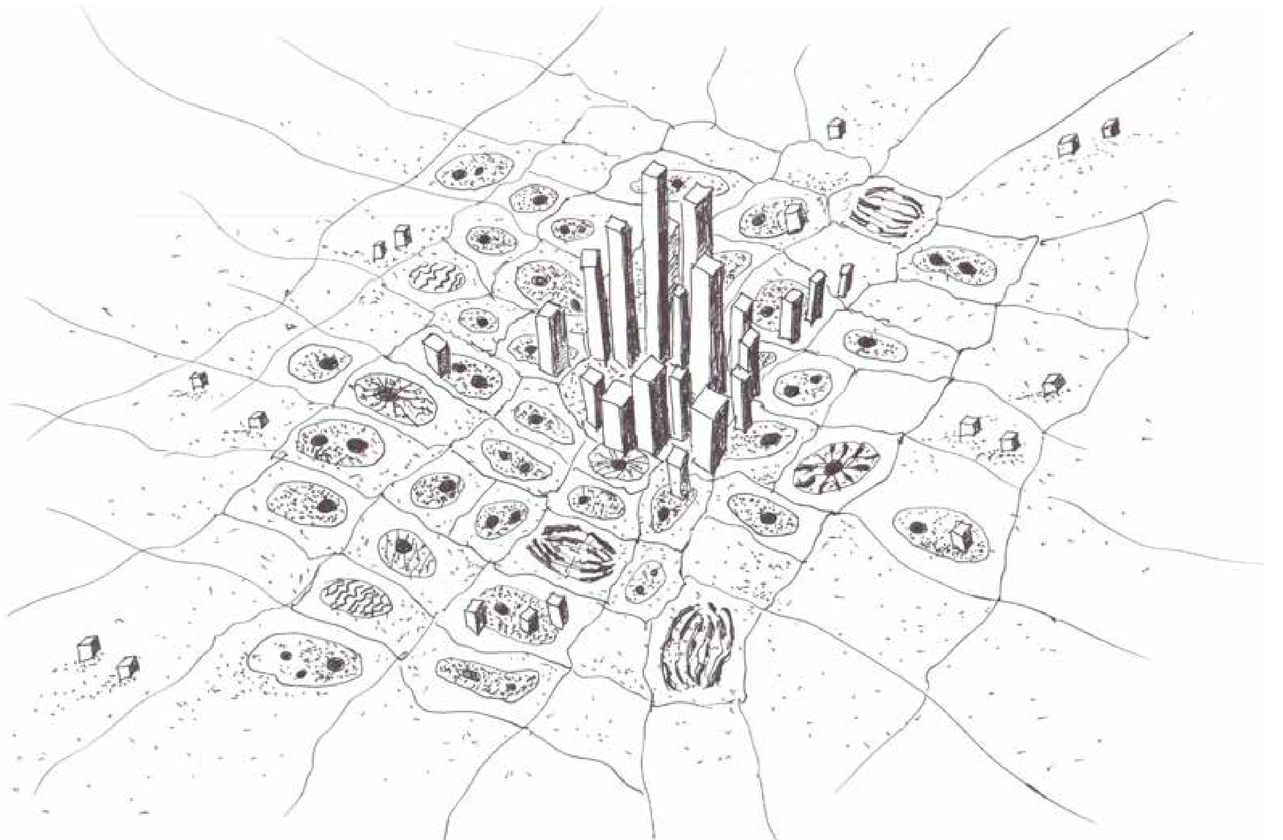
diversity
balanced system
porous integration
symbiotic approach
Self-organization
Feedback loops
mutual coexistence
insights from nature
adaptation Emergence
integrate the material with the immaterial
nature as a source of inspiration
holistic approach
ecological services
Morphogenesis
resilience sustainability

Biology as a 'Model, Measure and Mentor'[6]

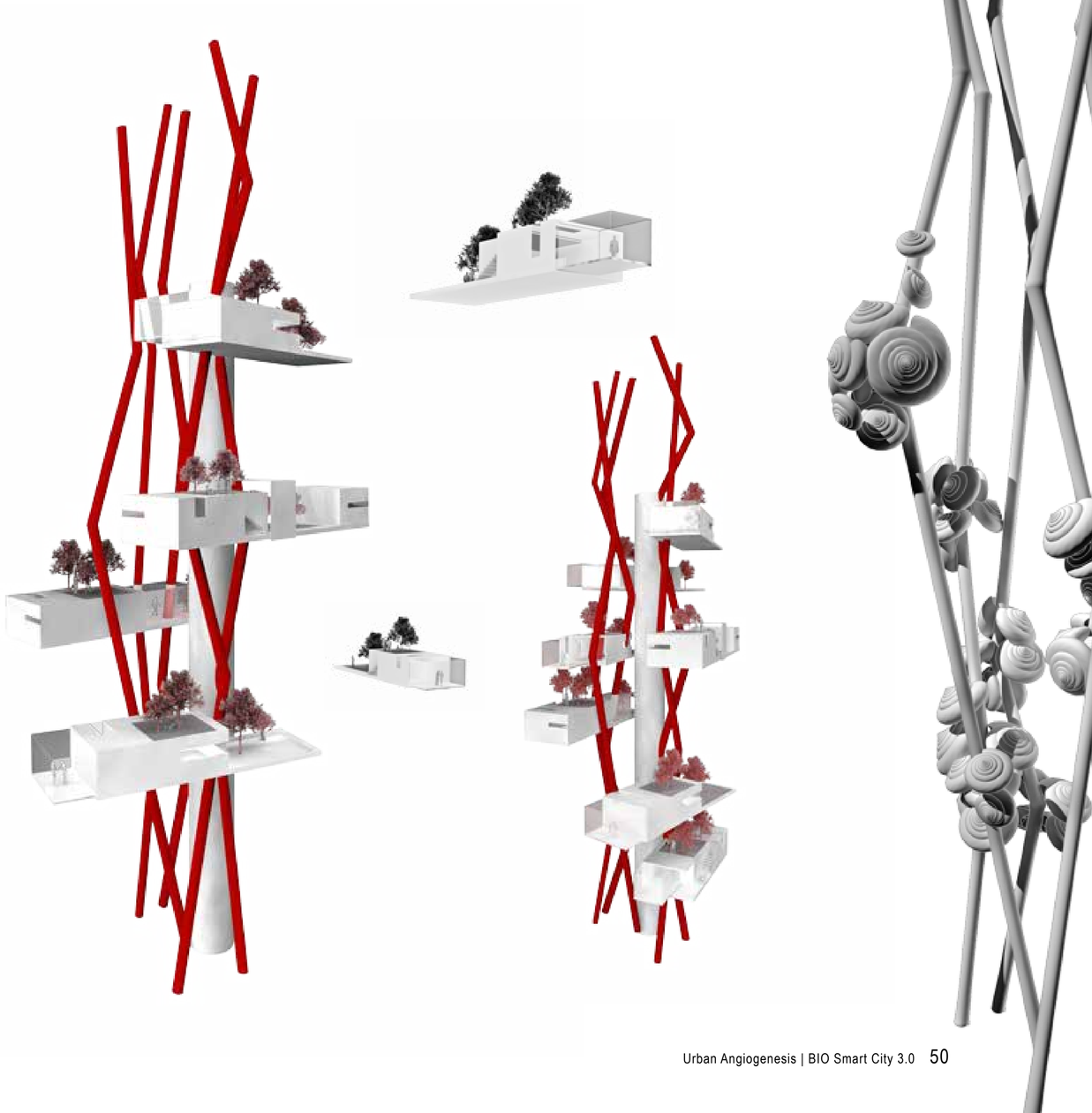
The prevailing worldview from ancient times until the Middle Ages was holistic, organic and ecological. Humankind, from the dawn of history, valued nature as a source of inspiration in its variety, wisdom and ability to integrate across the range of factors that maintain this complex system. The study of nature was characterized by theoretical contemplation and wondering, while implementation was intuitive. The Renaissance heralded the beginnings of modern science – empirical and systematic. Descartes' mechanistic worldview opened a gap between mankind and nature and established a worldview that believes in the power of humankind over his environment. The scientific paradigm switch of the twentieth century undermined the deterministic worldview and reinstated the renewed holistic and contemplative approaches to nature to center stage. The complexity of nature and the wide range of solutions, due to 3.8 billion years' evolution of research and development, provide many opportunities for inspiration.

In architecture, we can identify two fundamentally different basic trends of inspiration from nature: formal mimicry on one hand, and adoption of functional capabilities and organization on the other. The formal-morphological or ornamental imitations of natural motifs, such as Art Nouveau or Zoomorphism, customary in architecture, are external and do not leverage nature's wisdom. In contrast, planning that arises from in-depth study of construction or processes in nature leverages the potential embodied by this field. Notable examples of this approach include the pioneering work of Gaudí, who studied the structural foundations of nature and implemented them in buildings, and the cradle to cradle approach to understanding natural processes and implementing them in production systems or in recycling of the building life cycle.
Today, we are exposed to vast knowledge and the diverse range of tools provided by science; from the cosmic scale of fundamental questions about creation of the universe to the molecular scale of medicine and biology. As architects, we have at our disposal numerous sources of information and powerful tools supported by computing capabilities and numerical and architectural modeling. These tools and capabilities, combined with ever-strengthening human knowledge allow us to leverage nature's wisdom and develop new solutions for urban planning and architecture.

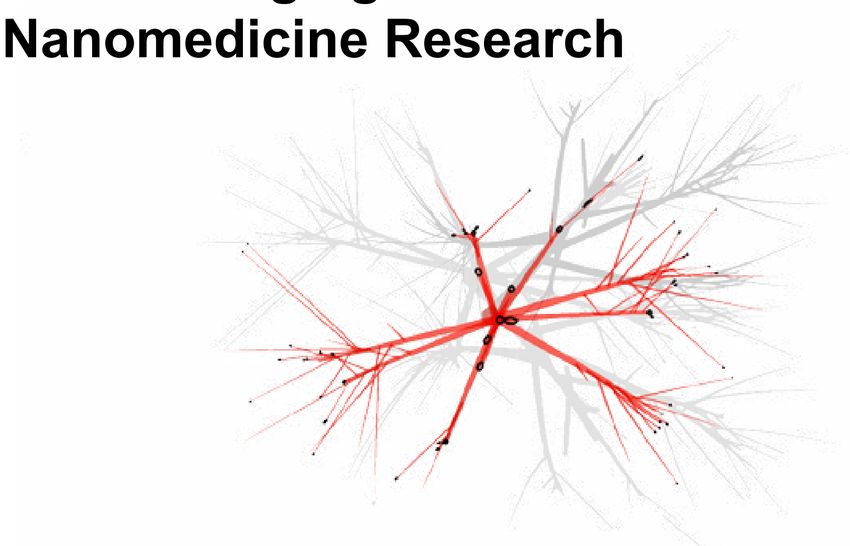
Perceiving the city as a living organism suggests looking to nature for inspiration, and develops a mechanism that can mimic nature's dynamic means of maintaining balance and resilience.





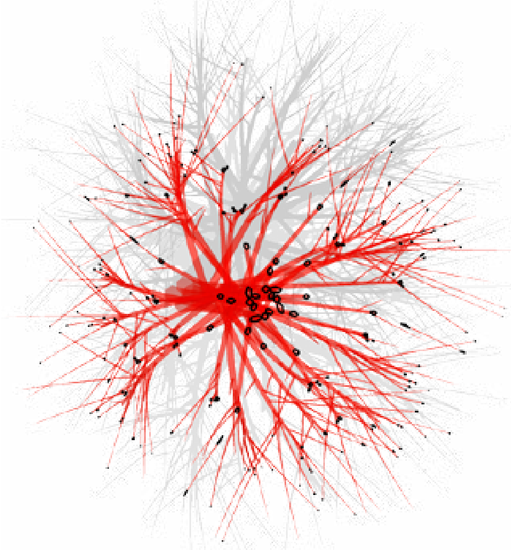


Cancer Angiogenesis and Nanomedicine Research

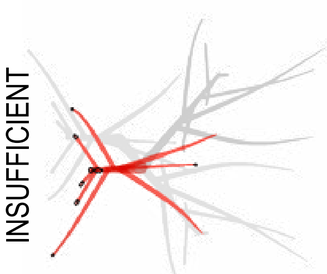


Angiogenesis, the growth of new blood vessels from pre-existing ones, is an important physiological process used for healing and reproduction. Abnormal angiogenesis, either excessive or insufficient, is associated with many diseases, including cancer, diabetes, cardiovascular disease, amongst many others. In these cases, new ‘abnormal’ blood vessels grow and feed diseased tissues with nutrients and oxygen, provoking the destruction of normal tissues. In the case of cancer, the abnormal vessels allow the tumor mass to grow in size, and facilitate the spreading of cancerous cells into the circulation system, where they lodge in other organs and create tumor metastases[7].

EXCESSIVE

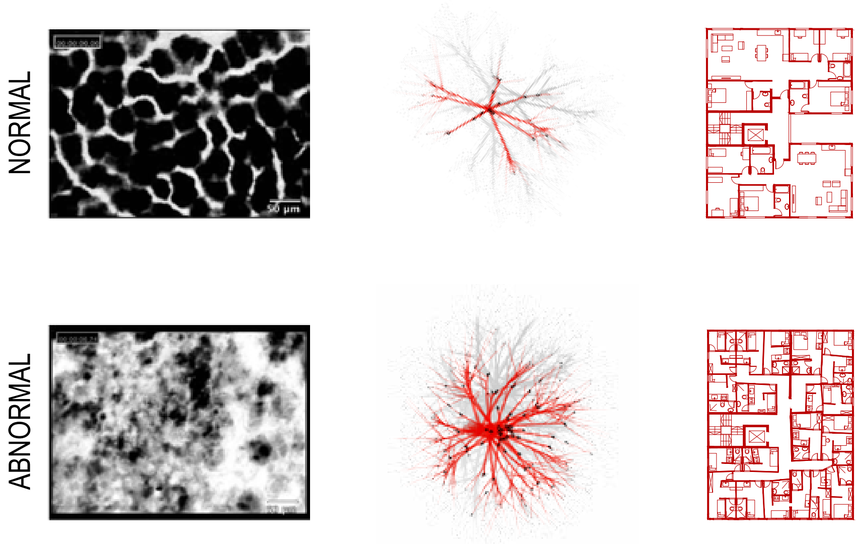


INSUFFICIENT

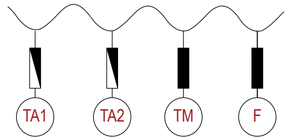


Interfering with the creation of these new networks of abnormal blood vessels prevents the delivery of oxygen and nutrients, stopping the cancer’s growth. While research shows a high prevalence of microscopic cancers in healthy people, the vast majority of these small lesions will never become cancerous and deadly, because they are not able to induce the formation of new blood vessels that nourish them. Therefore, there is an urgent unmet medical need to create smart probes that detect tiny lesions before they become symptomatic, or alternatively, to find a way to regress them in a selective manner back to a dormant or normal state[8].

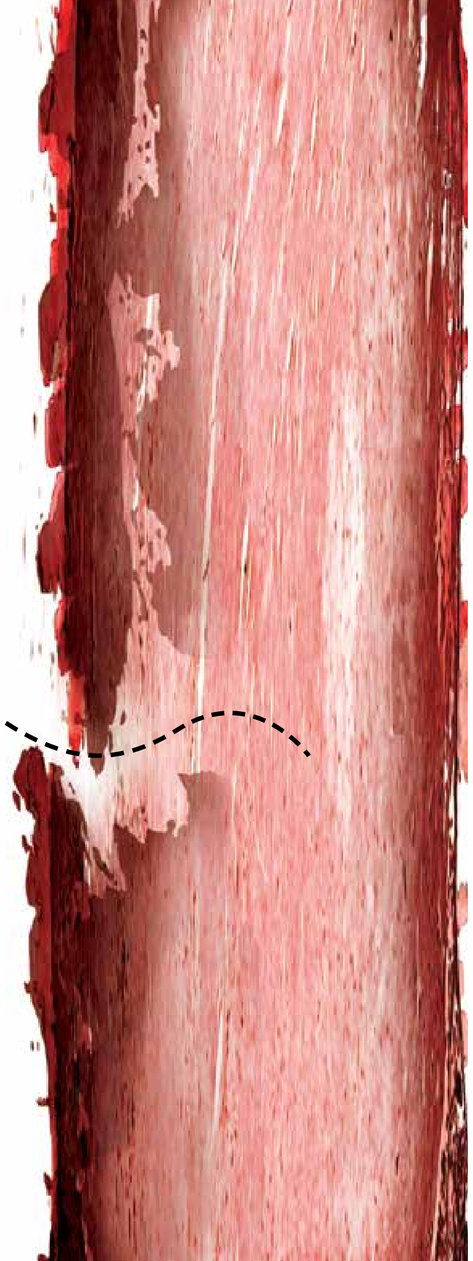
Urban Angiogenesis



The suggested treatment relies on connecting existing methods to nanometer-sized smart carriers that will lead them selectively to target tumors and their surrounding network of blood vessels, and significantly reduce the amount of drugs required as well as the extent of the treatment, ultimately abrogating the side effects associated with standard chemotherapy [9].
It will eventually be possible to treat cancer patients based on a blood test, obfuscating the need to detect the tumors and their precise location. Using non-toxic nanomedicines, it may be possible in the future to treat cancer as a preventive measure before it becomes symptomatic or, in cases where one cannot be cured completely, to make cancer a chronic yet manageable disease.



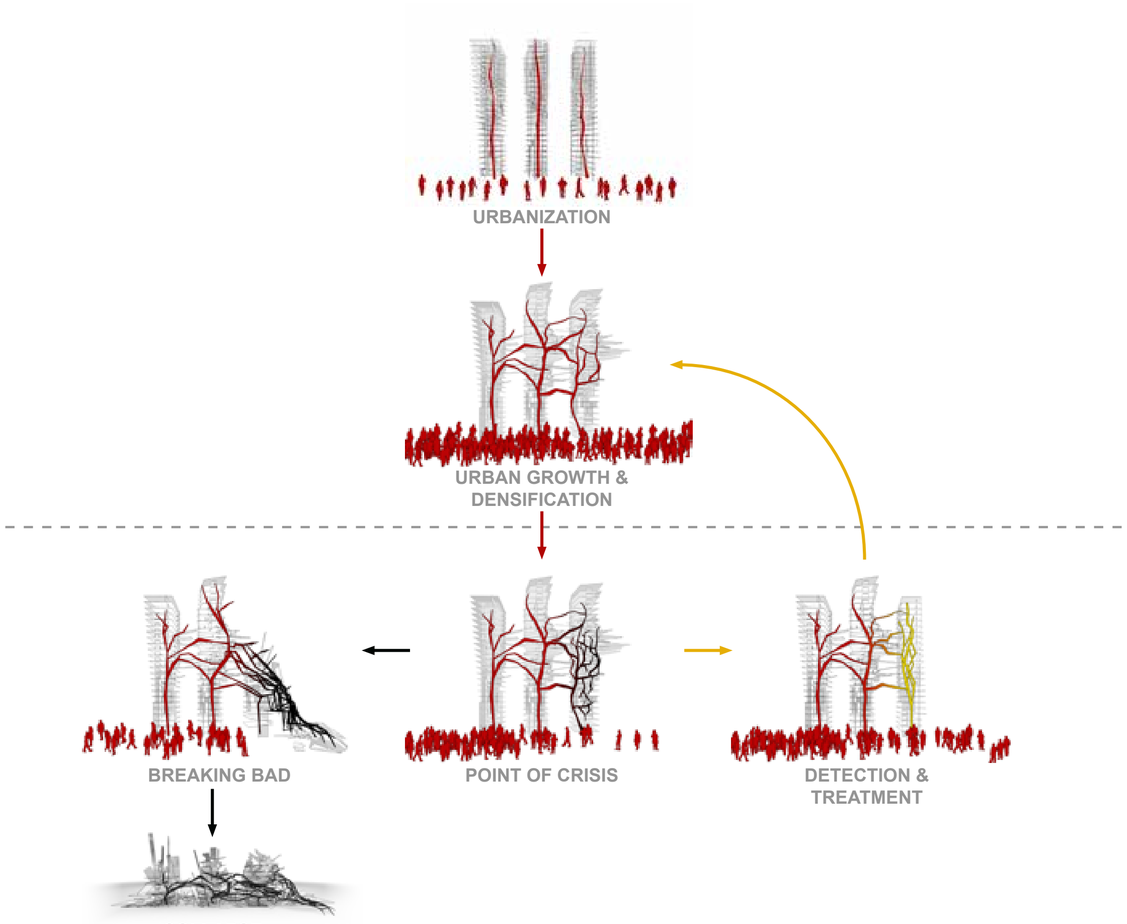
Understanding the interactions between tumor cells and normal cells will revolutionize the way we think about cancer, making it a curable or at least dormant disease leading to major improvement in the quality of life of those who suffer from it.

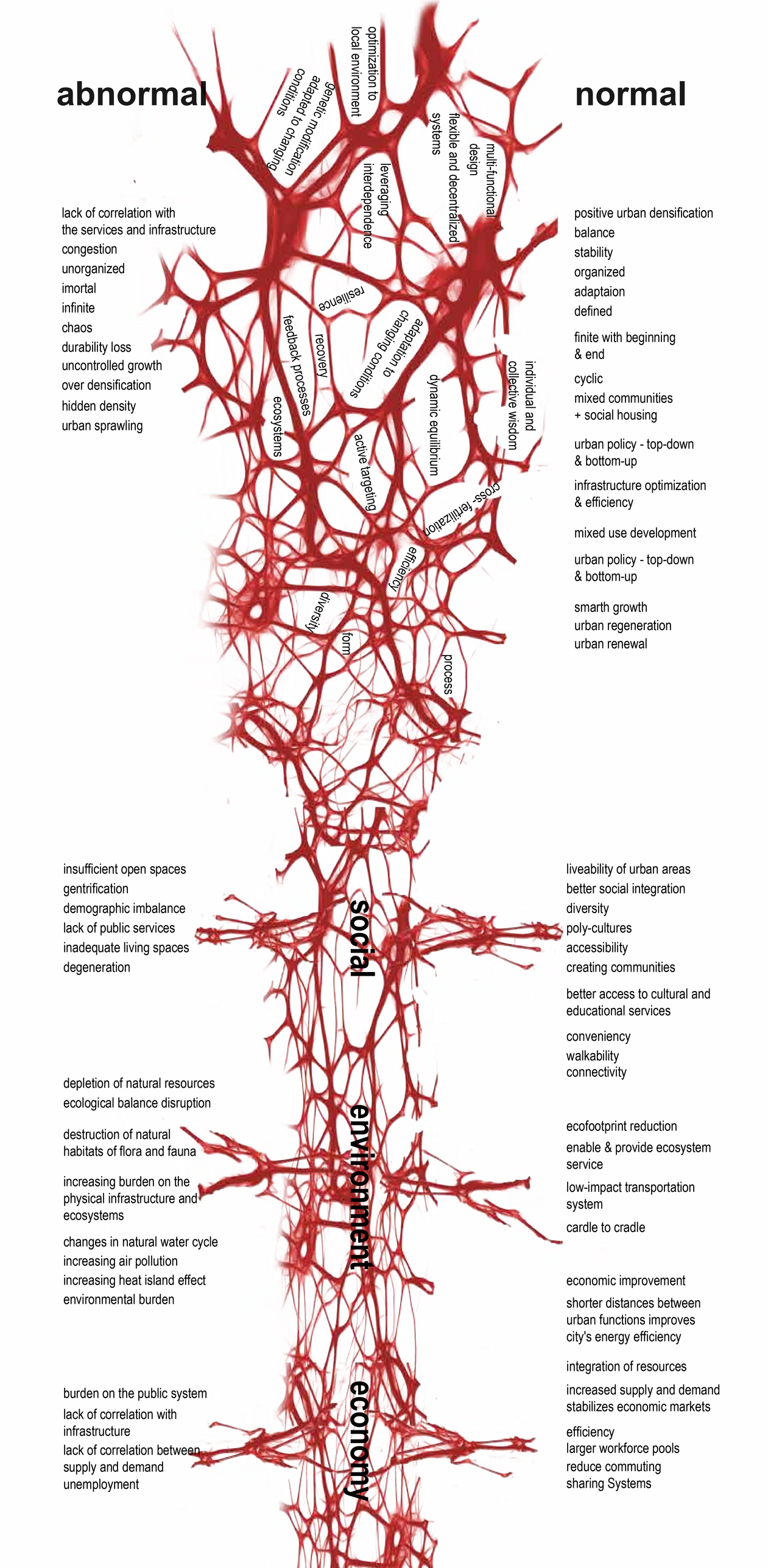


Comparing cancer tumor development with rapid urban growth exhibits similarities in both processes: In both cases if left untreated, infrastructure grows at an uncontrollable pace in order to nourish the new ‘tissue’, both within the biological and urban realms, bringing the system closer to its ‘point of collapse'.

Cancer treatment engages smart nano-probes to identify and disrupt the infrastructure created during angiogenesis to treat diseased areas before they reach their pathological stage. This begs the question; can we treat overcrowding through the identification of both healthy or unhealthy infrastructure created as a result of rapid urban growth?

The application of bio-processes challenge current planning practices, and raise questions about the ways we can control the different disorders associated with urban densification. Can we monitor existing densification, determine the problematic issues and diagnose them in time to prevent collapse? Or should we expect a ‘point of Crisis’? The challenge is to use big data to leverage the benefits of densification, strengthening the advantages while simultaneously averting the 'breaking bad' scenario.




abnormal
normal
optimization to local environment
genetic modification adapted to changing conditions
leveraging interdependence
flexible and decentralized systems
multi-functional design
resilience
feedback processes
recovery
adaptation to changing conditions
dynamic equilibrium
individual and collective wisdom
ecosystems
active targeting
cross- fertilization
efficiency
diversity
form
process
social
environment
economy
lack of correlation with the services and infrastructure
congestion
unorganized
imortal
infinite
chaos
durability loss
uncontrolled growth
over densification
hidden density
urban sprawling
positive urban densification
balance
stability
organized
adaptaion
defined
finite with beginning & end
cyclic
mixed communities + social housing
urban policy - top-down & bottom-up
infrastructure optimization & efficiency
mixed use development
urban policy - top-down & bottom-up
smarth growth
urban regeneration
urban renewal
insufficient open spaces
gentrification
demographic imbalance
lack of public services
inadequate living spaces
degeneration
liveability of urban areas
better social integration
diversity
poly-cultures
accessibility
creating communities
better access to cultural and educational services
conveniency
walkability
connectivity
depletion of natural resources
ecological balance disruption
destruction of natural habitats of flora and fauna
increasing burden on the physical infrastructure and ecosystems
changes in natural water cycle
increasing air pollution
increasing heat island effect
environmental burden
ecofootprint reduction
enable & provide ecosystem service
low-impact transportation system
cardle to cradle
burden on the public system
lack of correlation with infrastructure
lack of correlation between supply and demand
unemployment
economic improvement
shorter distances between urban functions improves city's energy efficiency
integration of resources
increased supply and demand stabilizes economic markets
efficiency
larger workforce pools
reduce commuting
sharing Systems

Redefining the City
Towards Bio Smart City 3.0

When we examine the idea behind Smart City 3.0 we can see that it is supported allows us to monitor events and changing urban situations that require our response. Like the human body, where normative and pathological processes exist, the city is in a process of constant dynamic change where various processes of densification are carried out simultaneously as a new ‘tissue’ forms. In the body, there are natural mechanisms of control that monitor the natural normal development of the biological tissue. However, there are cases when this mechanism fails and the body loses its ability to cure itself. This is when pathological processes begin and in some cases overtake and destroy the system. Just like the purposed cancer treatment, that relies on smart nano-particals, the use of ‘big data’ for analytical purposes, combined with the proposed nano-technological approach, can be applied to urban zones, sending 'intelligent agents' to identify, detect and treat the affected area without destroying healthy tissues. These tools can prevent the development of destructive pathological phenomena, and strengthen the healing processes through a focused treatment suitably adapted to local problems.

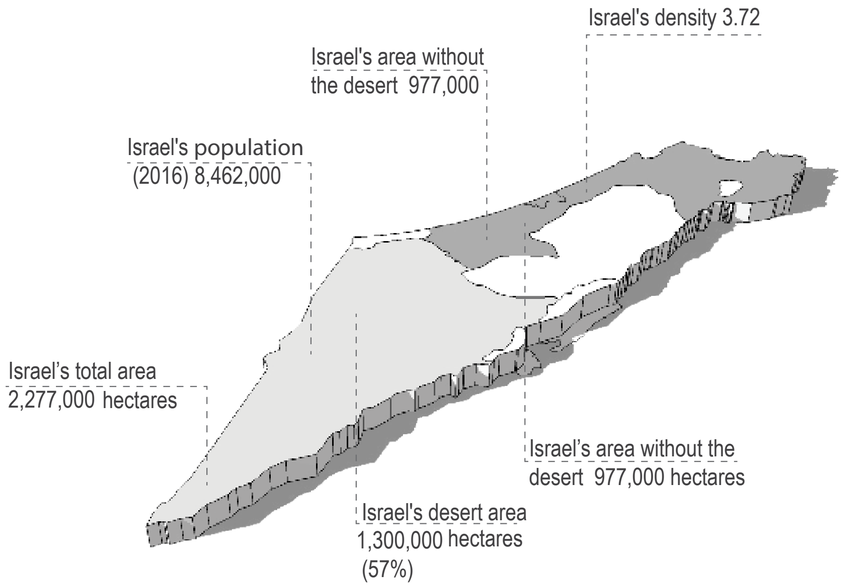
Making the analogy between the biological research and urban planning constitutes a call to learn from physiological and pathological processes in nature and explore how we can harness the wisdom of nature and science for the benefit of planning and architecture. Just as the proposed cancer treatment uses the already accruing process in the body for the benefit of the treatment, Smart city 3.0 should use the evolving and accumulated data and information to provide targeted solutions for local situations. Integrating responsive technology that will react to a variety of issues and events is the key for establishing balanced, stable and resilient cites, all the while introducing a new social and environmental approach to the nature-human ecosystem.



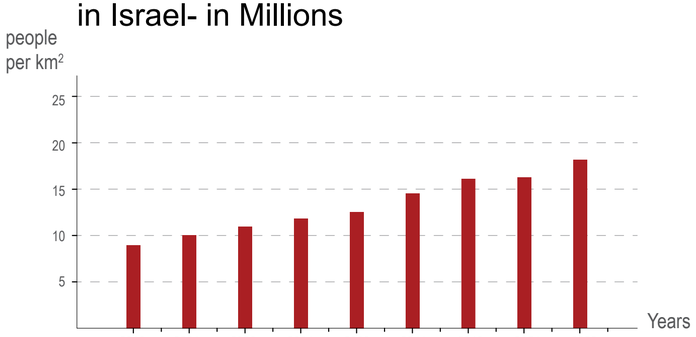
Smart City 3.0 - The Permissive City

Bottom up Strategy - Harnessing the Creative Class as an Active Partner for Smart City 3.0





Population Growth Expectancy in Israel- in Millions



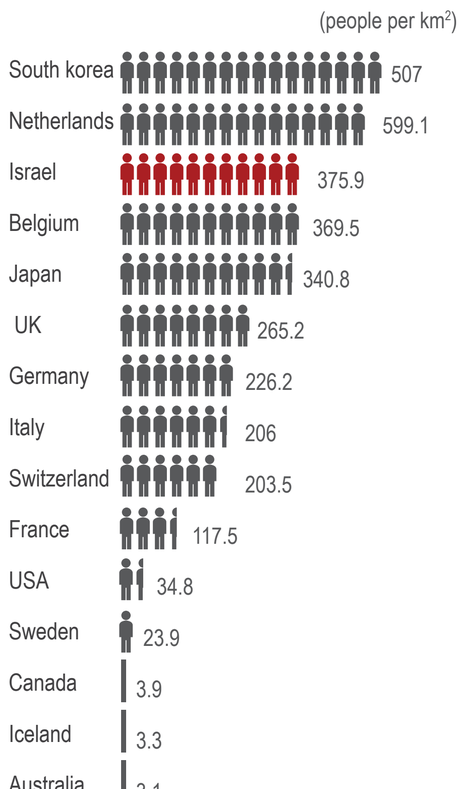
Israel Density

2000	290 People per km²
2014	363 People per km²
2020	410 People per km²

92% of israel's population lives in urban areas. By 2020 israel will have to double its built area .

Turning cities into sustainable cities is a key factor in the process of reducing our ecological footprint , creating a sustainable environment.

Population Density Israel Vs. World



Consumption and Land Use - What do we Need?

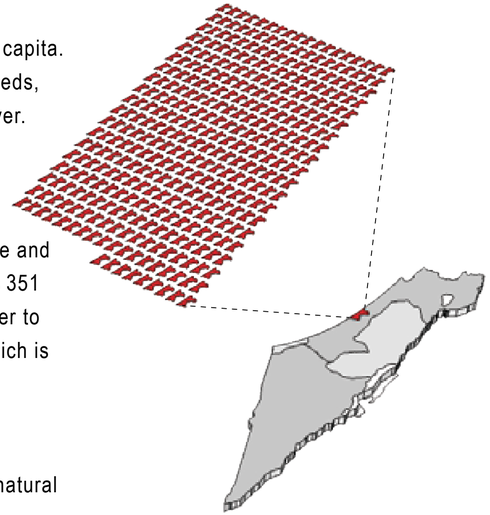
The Land cover of cities stands at 2.3% of the world's total surface area
Cities are responsible for 70% of greenhouse gas emissions (UN Habitat)

The ecological footprint of city dweller8
Europe 0.03 km^2 per capita
USA 0.04-0.05 km^2 per capita

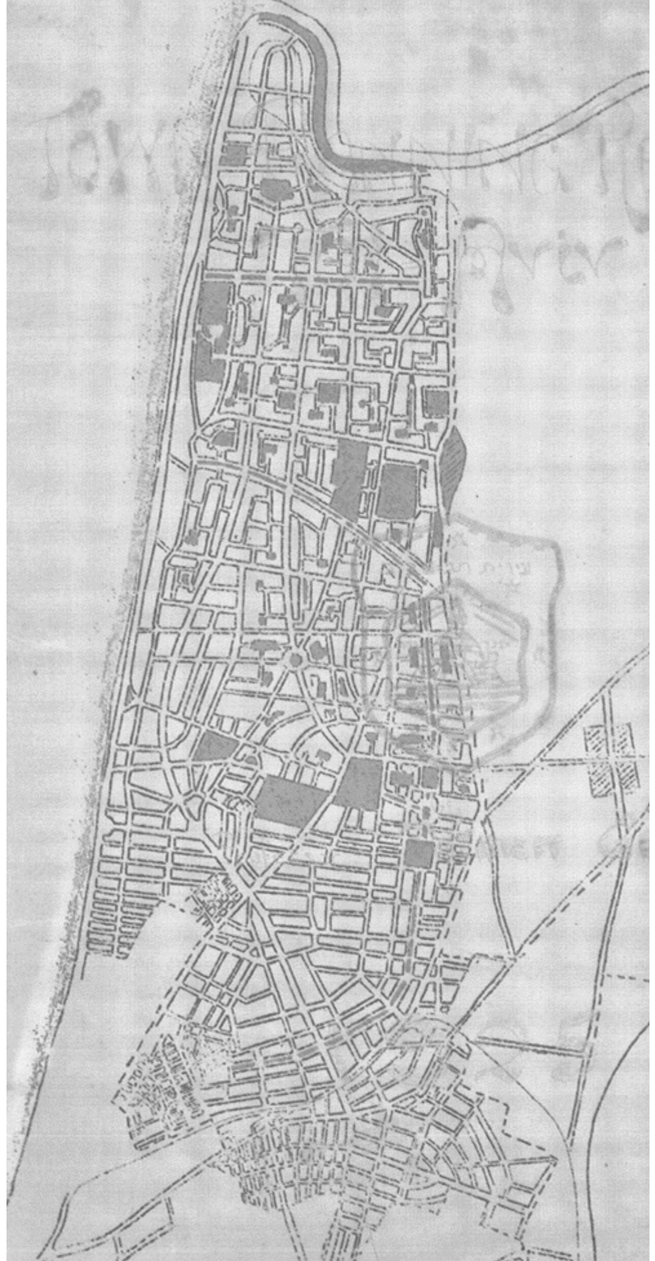
Israel's ecological footprint is evaluated at 0.062 km^2 per capita. Its biocapacity is estimated at - 0.059 km^2. To meet its needs, Israel requires 524,644 km^2 which is 23 times its land cover.

Most of Israel's open land are already violated.

If we focus on TLV, the data shows that in order to provide and support the city's everyday life we need am area which is 351 times bigger than its current area. This means that in order to sustain the city's ecological footprint we need an area which is 82% of the entire country.



*Biocapacity is the capacity of an ecosystem to produce natural resources, to absorb waste and to filter carbon dioxide.

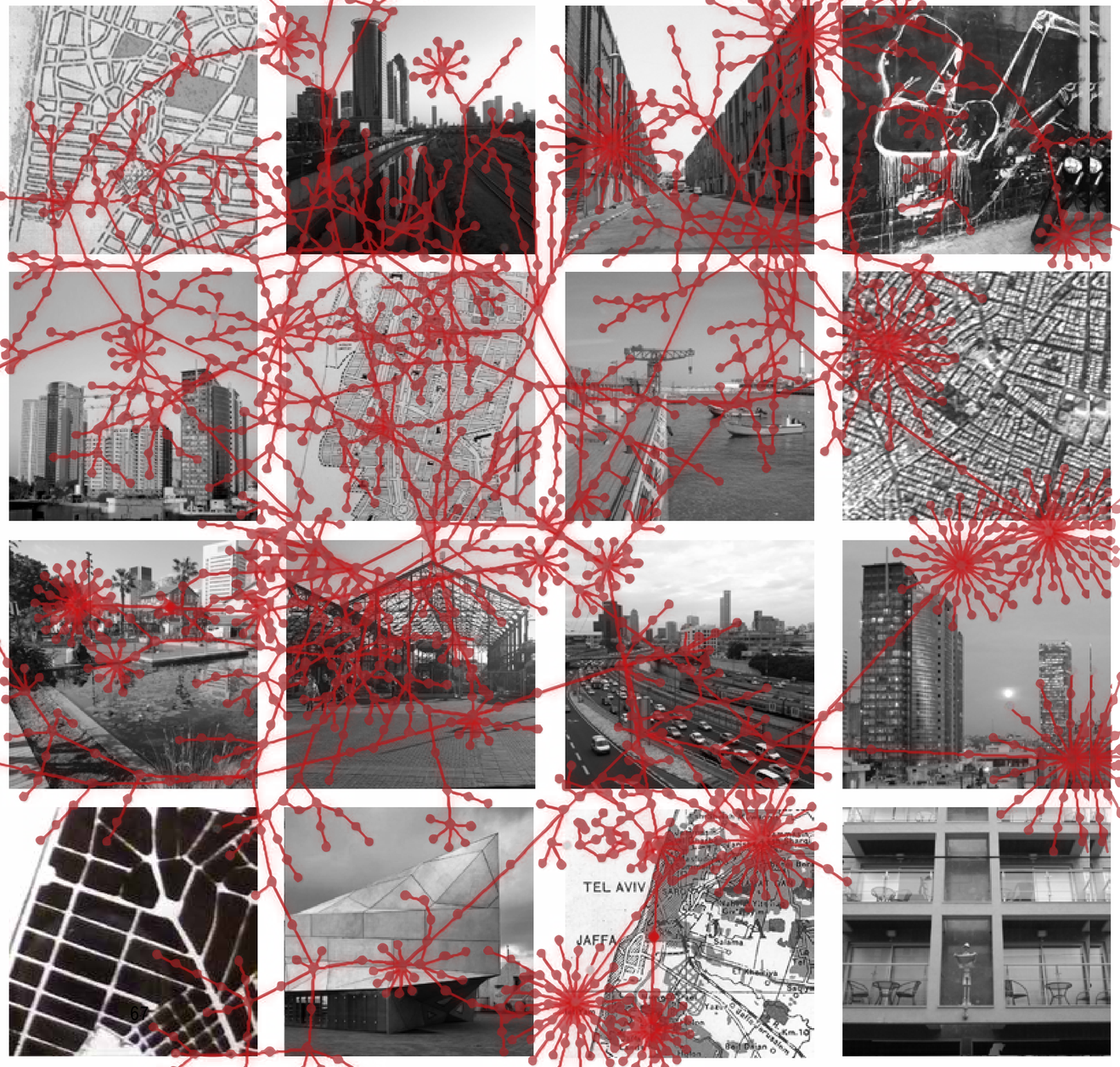


'By leaves we live'

Sir Patrick Geddes
a biologist, sociologist, geographer and pioneering town planner

Geddes Master Plan For Tel Aviv, 1925

In his work and especially in the field of town planning Geddes focused on the preservation of human life and energy, rather than superficial beautification.



Sleepless Tel Aviv - Towards Positive Angiogenesis

One of the greatest threats to the nature-human ecosystem balance has to do with overpopulation, a point echoed by Malthus [10], who claimed that when population growth outgrows its resources, we reach a 'Point of Crisis'. If we associate this theory with Israel's urban population (92%), it becomes necessary to think of ways of maintaining balance within our urban ecosystem in order to prevent the 'point of collapse'.
This issue becomes increasingly urgent in the case of Tel-Aviv, where market forces have created a massive change in the structure of the city, with little research or understanding as to how this will affect the city social and ecological services.

Over the past decade, the city has evolved into a magnet for different communities, especially young creatives, causing a rise in growth and a change in the cities demographic structure. As a result, the local housing market has not been able to keep up with increasing demand. Various urban solutions are evolving in order to provide affordable and appropriate housing solutions, but these solutions often lack the necessary support and infrastructure, and frequently bring forth questionable living standards. One can't help but wonder, how can we provide a faster, more flexible and adaptable planning process to our fast pace, ever changing urban landscape?

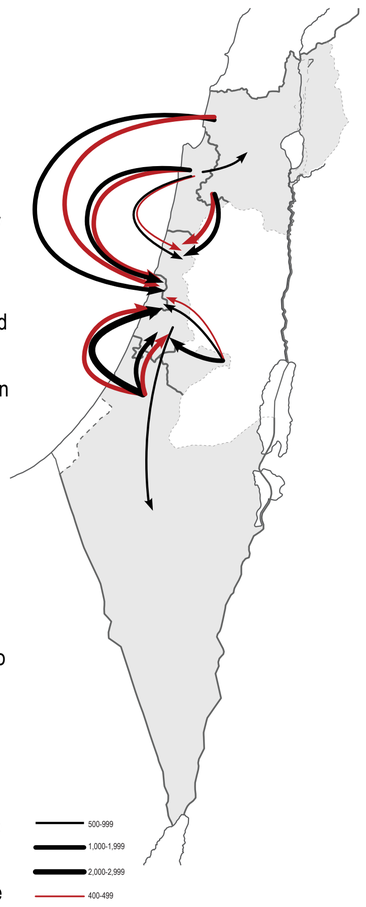
The Case Study of Tel Aviv
The Hidden Density Story

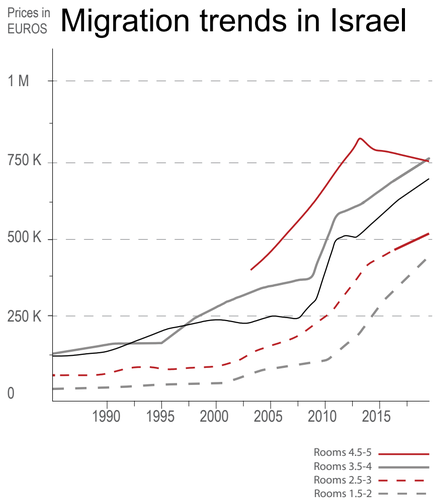
According to Israel's Central Bureau of Statistics, Israel is one of the densest countries in the world. Compared to other countries in the OECD, Israel is in third place (375.9 pop. per km^2), behind Korea(507 pop. per km^2) and the Netherlands (499.1 pop. per km^2)[11]. The greatest population density in Israel is in Metropolitan Tel Aviv, standing at 2,449.3 pop. per km^2, while in the city of Tel Aviv it reaches 8,229 pop. per km^2. However, statistically, Tel Aviv is still not considered the densest city in Israel. In nearby Bnei Brak, the population density reaches 24,280 pop. per km^2; for the sake of comparison, the population density of Manhattan is 27,812.2 pop. per km^2. If so, why is Tel Aviv characterized by symptoms typical of cities with much higher population density than that recorded by the Central Bureau of Statistics?

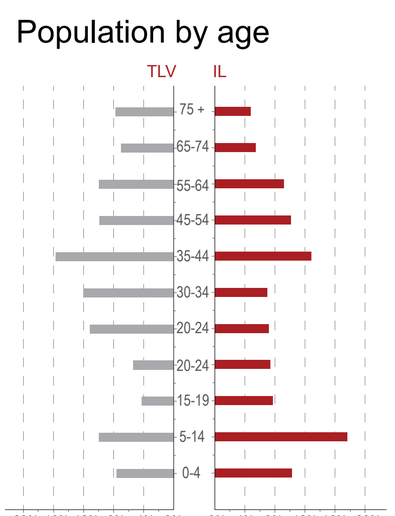
In order to analyze this problem, we must understand processes of immigration in Israel and the unique characteristics of Tel Aviv.

Tel Aviv is a focus of immigration due to its great and diverse array of opportunities for employment, culture and academia, and by virtue of its pluralistic atmosphere that facilitates development of diverse populations. Tel Aviv attracts populations with polarized socio-economic backgrounds; on the one hand, young adults searching for diversity in the job market, students, and the established elite, and on the other hand, migrant workers, and minority populations to which the city offers diverse work opportunities and allows them to establish themselves.

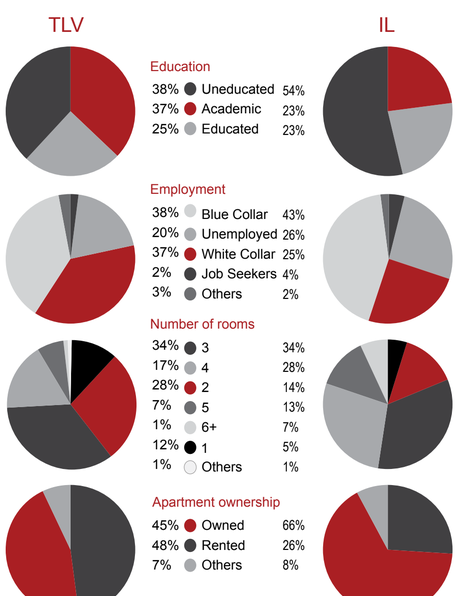
Based on the data showing that Tel Aviv is not the densest city, while its housing shortage is the most severe in Israel, the assumption is that since Tel Aviv became a multidisciplinary focus of attraction it absorbs a large number of residents who are not formally registered in the population registry and therefore are not part of the statistics. These residents settle temporarily in Tel Aviv for a period of time lasting from months to years, in order to benefit from, and use, the many services the city offers.







This 'hidden immigration' creates an increase in demand for housing solutions and urban services. Besides the drastic rise in prices following this high demand, the process leads to instability of existing urban systems due to the uncontrolled and ever-growing consumer base. The inability to predict and plan for the number of users leads to a situation in which some of the systems are likely to collapse and thus bring Tel Aviv to the point of crisis. The implications of this hidden immigration and sharp increase in prices create social, economic and physical problems that present a serious challenge for the city's decision makers.



The Implications of Hidden Density

The State Comptroller's report for 2013[12] deals with data relating to illegal migrant workers. According to the Population, Immigration and Border Authority, the number of legal migrant works (not defined as residents) is approximately 80,000, while the number of illegal workers is 15,000. Most of them live in south Tel Aviv. In his report, the Comptroller highlights the problems arising from the heightened and uncontrolled crowding:



'The noticeable population growth in Tel Aviv's southern neighborhoods increases the demand for rental apartments. Some of this demand has been met via two approaches: subdivision of apartments into smaller apartments and residence of many foreigners in an apartment that was planned for fewer tenants. According to professional authorities, the physical conditions in these neighborhoods, including the subdivided apartments, private connections to gas facilities and dangerous connections to the electricity grid, lead to safety risks and sometimes even to actual life-threatening situations. This report draws attention to one of the most prominent examples of the impact of crowding, both documented and undocumented, and the direct consequences it causes to urban and physical infrastructures and to residents' well-being.[13]'







StartUp TLV
& Bio Smart City 3.0











The city is a suprasystem encompassing a complex and dynamic array of subsystems, while at the same time it is also a component in a larger interconnected system at the regional and national level. The city comprises both physical and natural systems that are mutually dependent and linked via complex and variable interactions. The human system that populates the city is connected in the Information Age by ordinary devices embedded with electronics and by various platforms to the 'Internet of Things', which constitute a significant portion of Big Data. Every individual in the network consumes and transfers information directly to the systems associated with it. These systems are part of a large, infinite network of accumulating information; due to the connectivity and availability of these data, it is possible to conduct data mining, or to store, exchange and process information for problem solving.

The idea of the 'Smart City' evolved due to the availability of Big Data, leading to the development of computing systems for enhancing the tools required for data processing. Advancement of the idea was based on understanding the great potential embodied in Big Data as a smart management tool that responds to dynamic systems in real time. These systems, thanks to their technological sophistication, are able to analyze vast amounts of random, accumulated data and within a short time produce focused information to answer specific issues.

'Smart City' was developed by the technology-business sector that understood the commercial potential embodied by new technological developments. This stage was defined as Smart City 1.0, the first of three distinct stages. Smart City 2.0 was initiated later by the local municipalities. The initiative arose from the identification of a need to respond to variable urban situations that can be monitored, allowing provision of an appropriate solution to improve the urban systems with an emphasis on the physical infrastructure. A primary characteristic of these two stages is a central control system in which technological parameters related to water, electricity, transportation and sanitation are processed in real time, or else the information is used to provide emergency services and to locate and prevent crime. The 1.0 and 2.0 stages are practical and functional at the most basic level, relying on technology and the top-down approach. Smart City 3.0 enhances the hidden potential by harnessing technology and information for the residents' benefit by integrating city dwellers and the information that they produce and consume as an integral part of city management. Smart City 3.0 integrates top-down policy with a bottom-up approach and operates as a democratic, holistic system. The strength of strategies built upon bottom-up information transfer lies in being based on the various fundamental parts of the system, which provide a broader picture that represents many factors of influence. Fulfilling the potential of Smart City 3.0 requires synergy between city management and residents, the end users, who must comply with a high level of accessibility to the range of network platforms, including social applications and networks, file-sharing interfaces, and online forums.

StartUp Tlv

Tel Aviv is the perfect candidate for the implementation of Smart City 3.0 tools and technology. Known as Israel’s startup capital, Tel Aviv today is ranked as one of the most innovative cities worldwide. The city is undergoing a digital revolution through the implementation of innovative systems that enhance the well-being of city dwellers.

The profile of Tel Aviv's young professional creative class generates an opportunity to establish an integrated system of the formal top down with the informal strength of collective wisdom. These Generations Y & Z, characterized as Tech-Friendly and very active on social media websites, can play an important role as a leading force in the implementation of the BIO Smart City system.

By extracting the required information from the data cloud it is possible to produce a tool for early diagnosis and accordingly, a device for targeted treatment of urban problems, both physical and social, in similar fashion to the healing process offered by nanotechnologies. The challenge is to embrace these new emerging solutions by innovatively applying and cross-referencing accumulated data, and by optimizing tools for the creation of a more balanced urban ecosystem.



Bio for Arch



Urban Angiogenesis Installation

The installation represents the potential for an interdisciplinary dialog between architecture and biology. It deals with the common denominator between normal and pathological processes of angiogenesis and processes of densification in both the building system and the urban context. The installation suggests that we learn from the scientific ability to use the traits of the pathological system for identifying unhealthy tissues and enabling targeted healing.

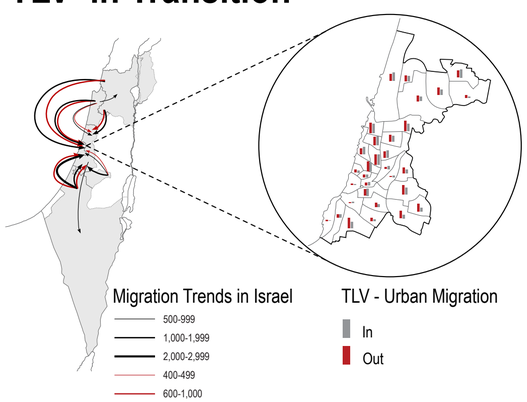
The installation consists of two 'towers' measuring four and seven feet high, constructed from acrylic sheet. Red liquid flows continually through a series of Polyurethane conduits, intertwining within the two towers, demonstrating a healthy level of habitation. Simultaneously two other systems are working alternately: one showing the healing process of a diseases area in the structure, and the other emphasizing the collapse of an untreated area. The structures allude to the built and unbuilt urban fabric, the shade of the fluid is the identification and treatment of diseased areas due to unattended changes in population overcrowding.

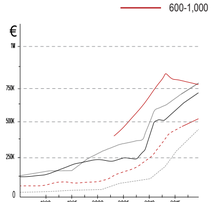


Urban Angiogenesis

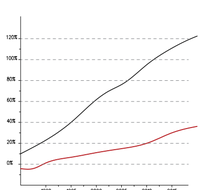
From Permeable Urban Tissue to the Permissive City

TLV in Transition





House Prices Acording to Size



Population Growth

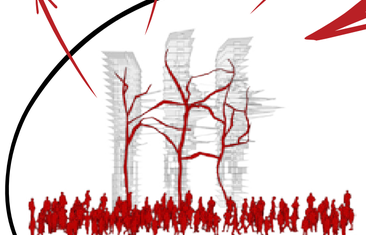
Hidden Density

Challenging Densification Demands

Environment

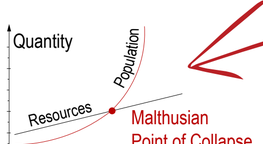
Economics

Social

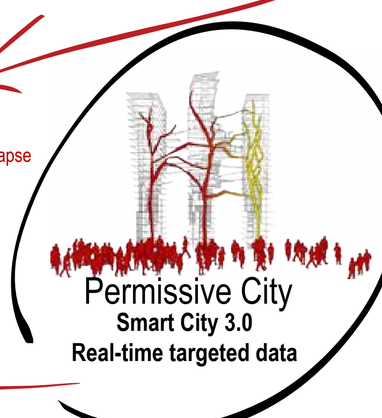


Normal Densification

Durability Loss







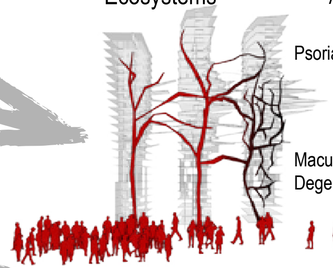
Permissive City

Smart City 3.0

Real-time targeted data

Excessive

Increasing Burden on the Physical Infrastructure and Ecosystems



Arthritis

Psoriasis

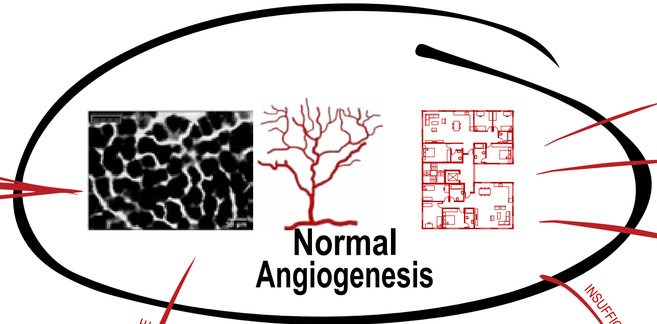
Macular Degeneration

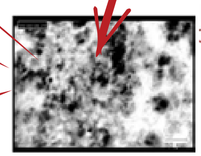
Leaky Tumor Vessels



Cancer

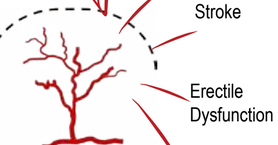
Detection & Treatment Targeted Agents



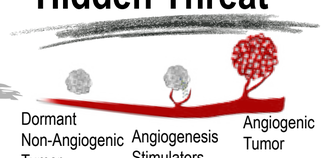


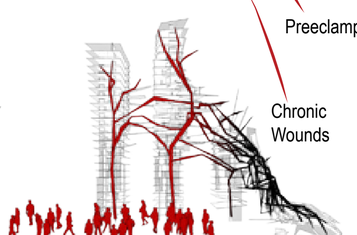






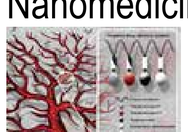
Hidden Threat





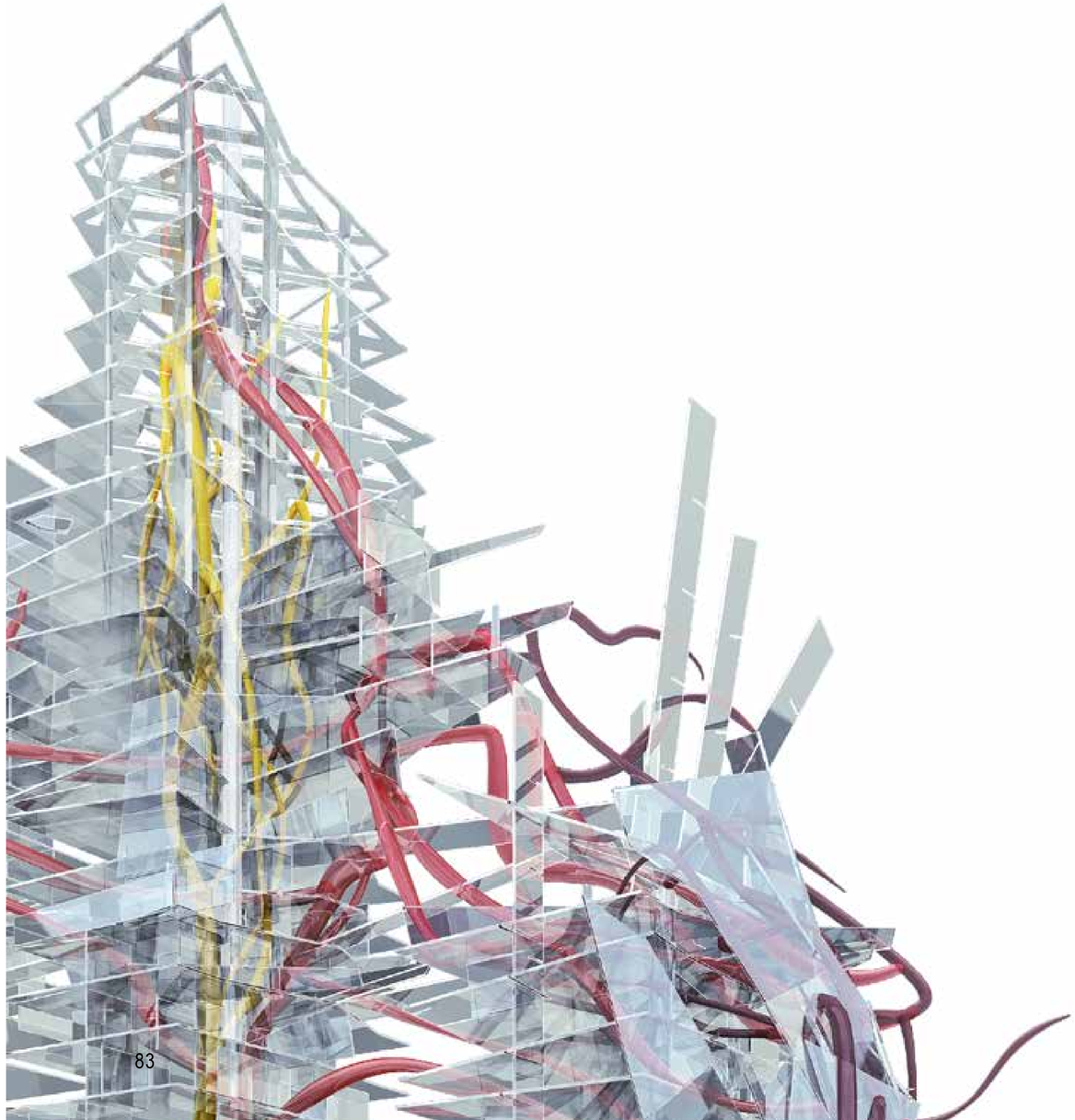
POINT OF CRISIS

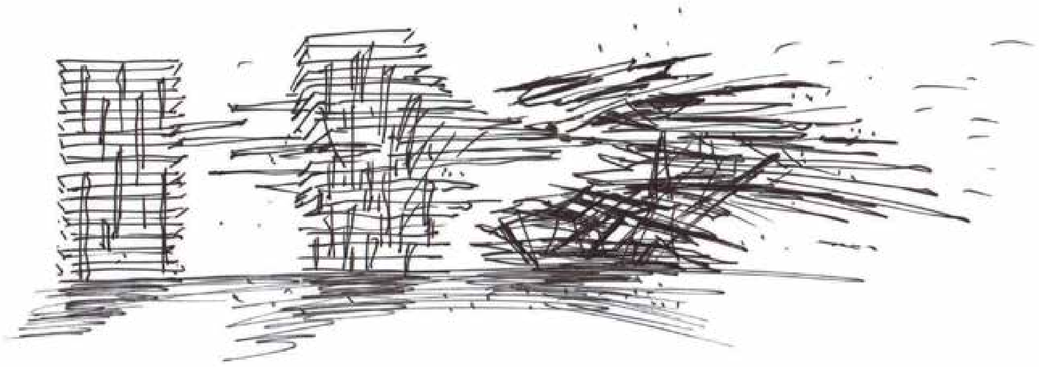
Multifunctional Polymeric Nanomedicines

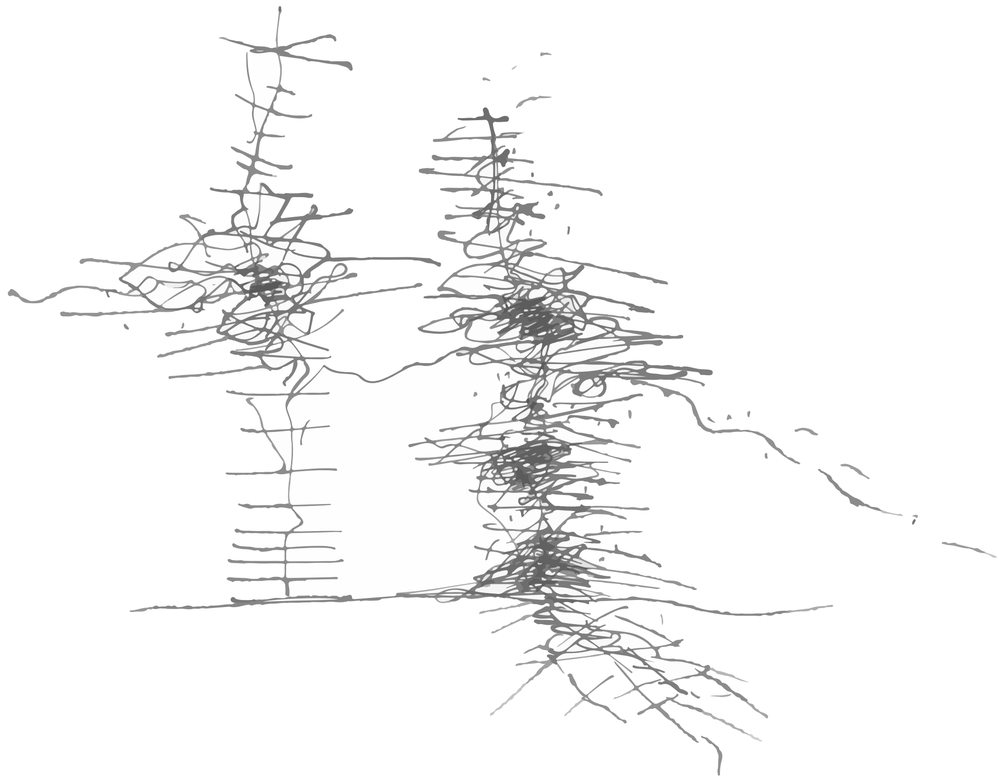


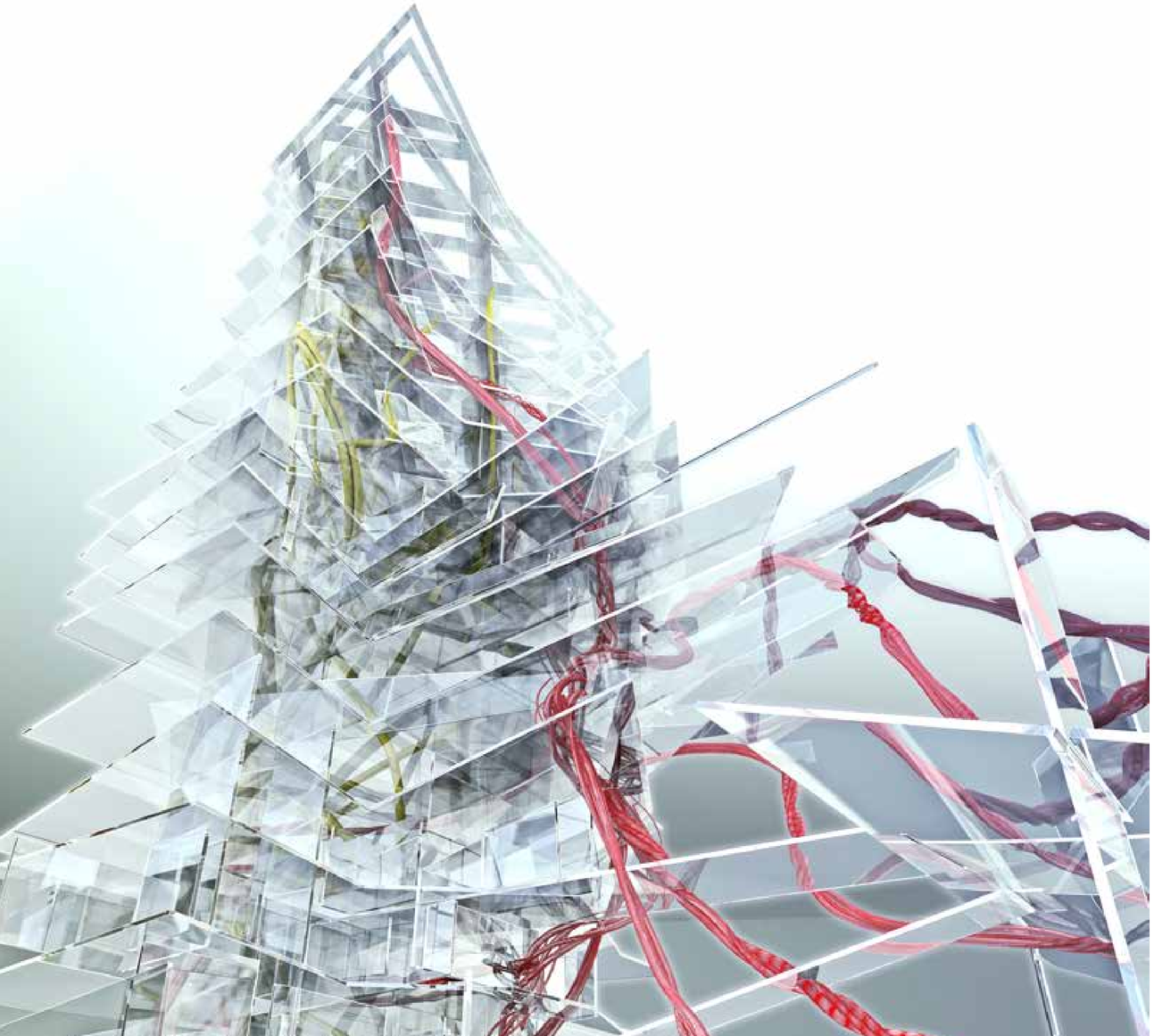


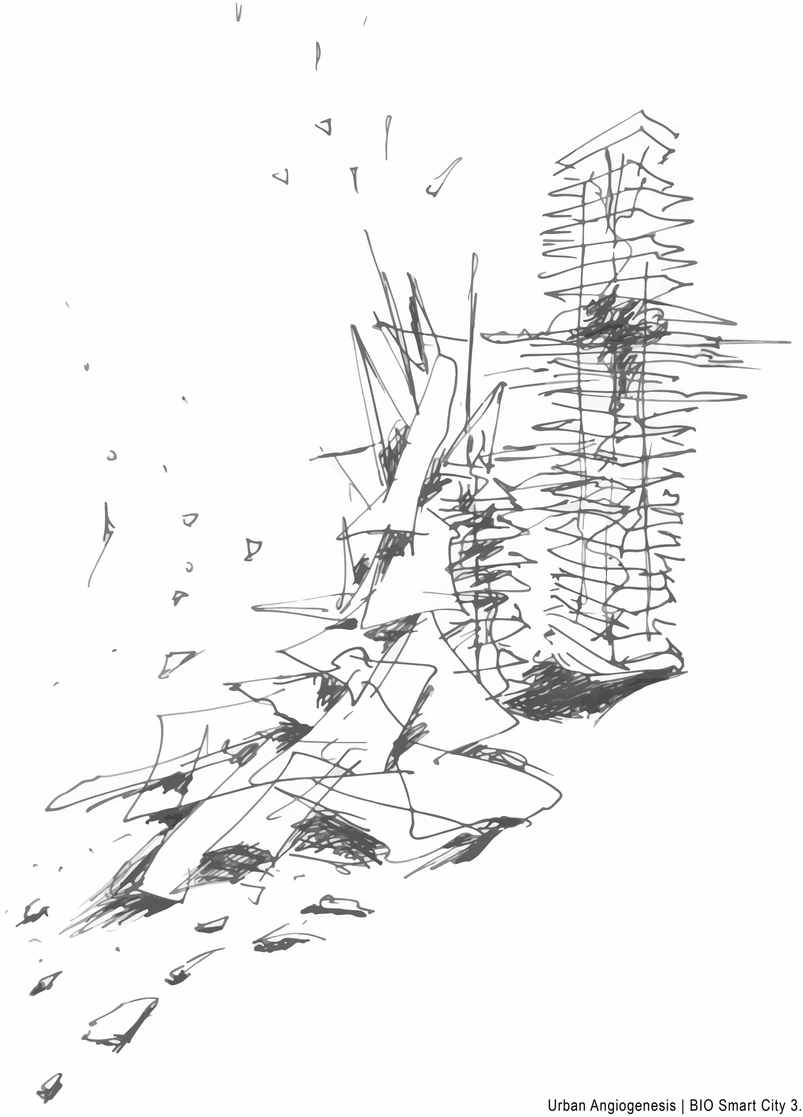
COLLAPSE

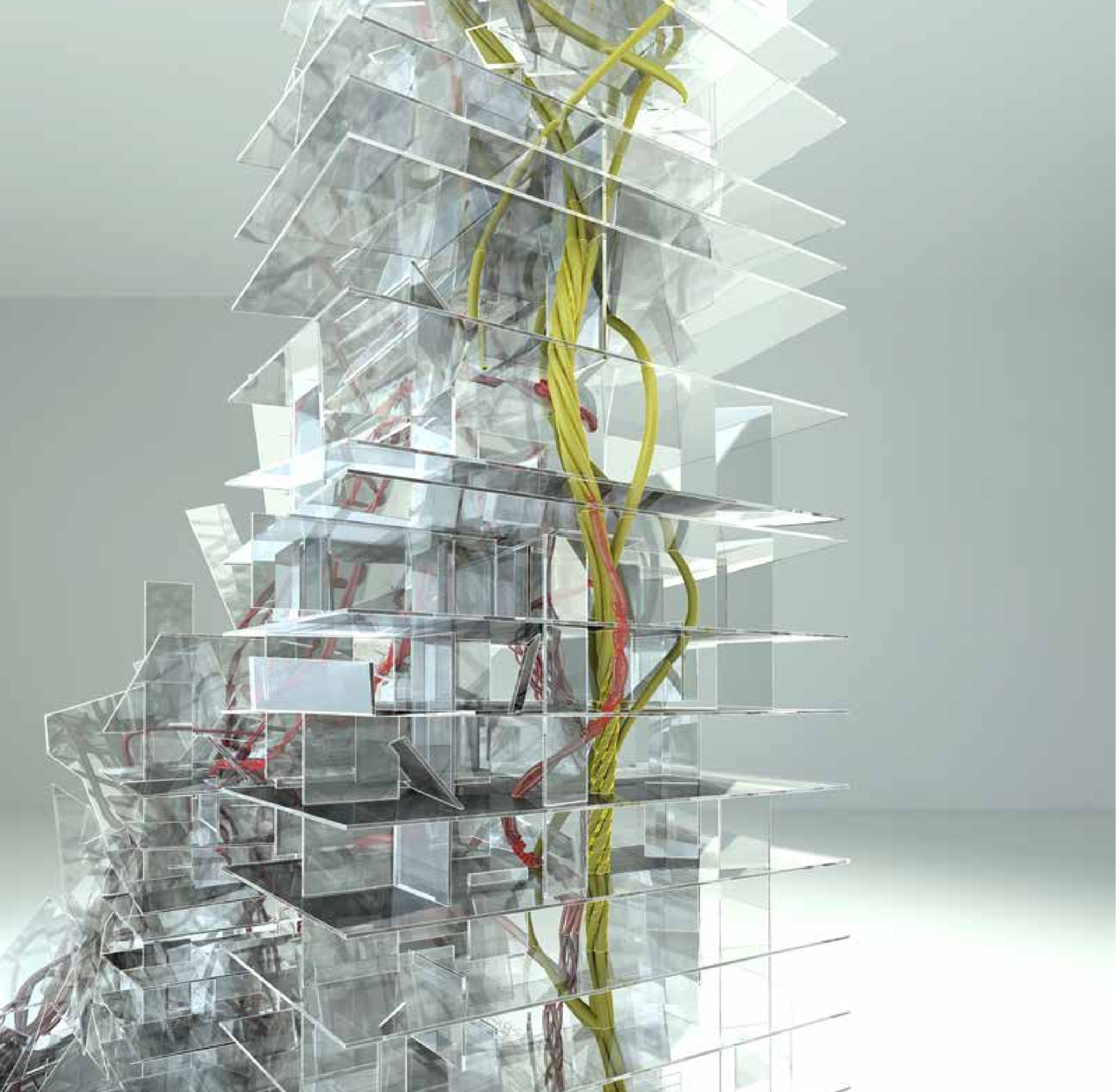












Knafo Klimor Architects
www.kkarc.com

T + 972.4.8243147 I office@kkarc.com I 2 Hasvyonim st. I Haifa 3464119, Israel
T + 972.3.5624262 I tlv@kkarc.com I 14 Karlibach st. I Tel-Aviv 64730, Israel

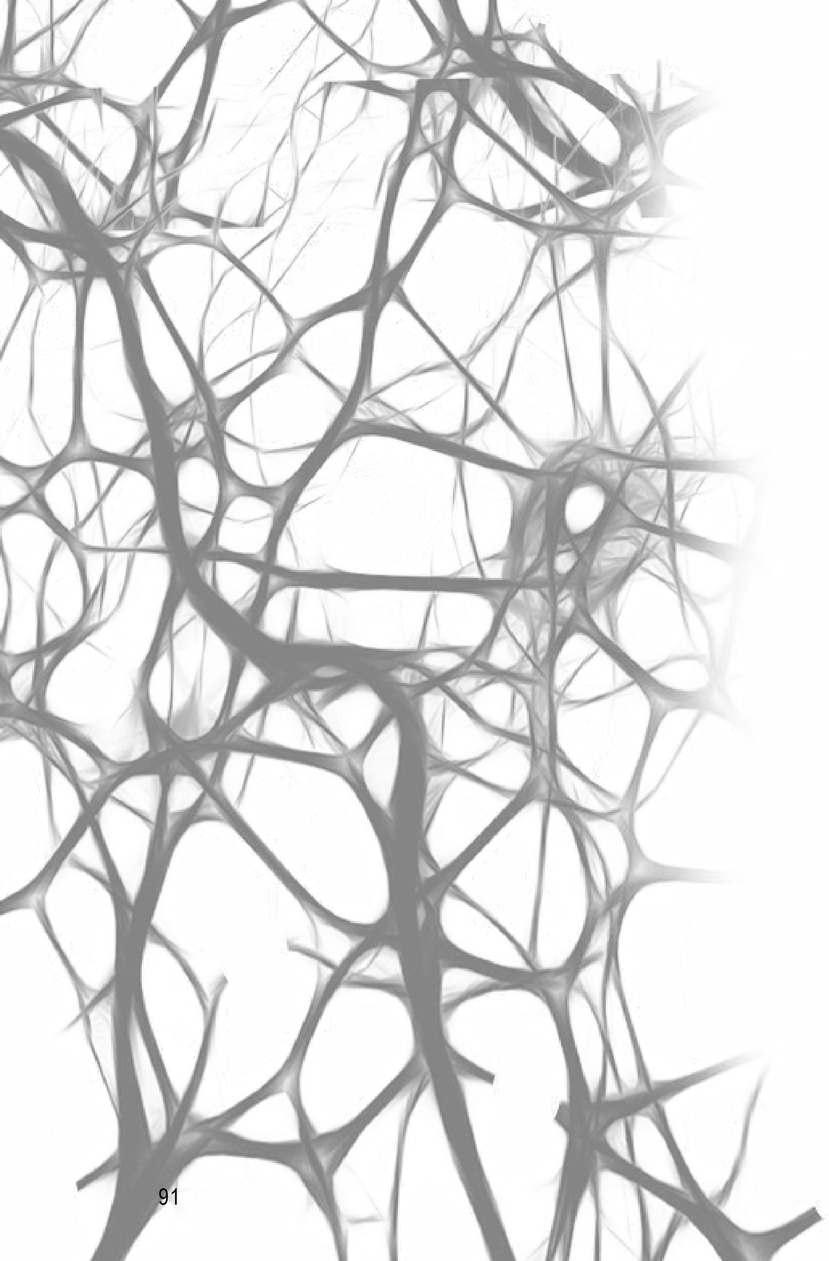
Knafo Klimor Architects, founded in 1980, is run by the founding directors Tagit Klimor and David Knafo. The firm has established a reputation of producing innovative and highly original design solutions. The firm is characterized by an uncompromising attitude to design quality, striving for excellence in design and invention of new architectural expressions. Employing a holistic approach to architecture, Knafo Klimor Architects' objective in each design project is to embrace wider environmental and social concerns.

Among the firm's clients are government offices and local authorities, private developers and construction companies. The strength of the firm is based on its commitment to build lasting relationships with its clients. With a diverse staff of architects, urbanists and designers, the firm has been responsible for the design of a wide variety of numerous large-scale projects in the highest architectural standard.

Comprehensive approach, involvement throughout all phases of the design and construction process have consistently resulted in award-winning prizes for the firm's professional achievements. The firm's projects have been featured in professional journals worldwide, and have been exhibited in numerous galleries and architectural institutions.

With extensive design experience the partners are dedicated to a thoughtful, original and contemporary architecture that aims to inspire and to promote a healthy, sustainable lifestyle. As a part of their dedication for environmental issues and their belief in the important role of education, both partners have been teaching for many years as senior lecturers at the Technion - Israel Institute of Technology thus endowing their holistic approach to the young generation.

Knafo Klimor Architects' work is driven from their belief that the effort to promote sustainability will lead to a real change and will bring back the human dimension in design towards a more sustainable environment and balanced society.



Prof. Ronit Satchi-Fainaro, Ph.D.

Head, Cancer Angiogenesis and Nanomedicine Laboratory
Chair, Department of Physiology and Pharmacology, President, Israeli Chapter of The Controlled Release Society

Sackler Faculty of Medicine, Room 607Tel Aviv University, Tel Aviv 69978, IsraelTel: +972-3-640 7427 (Office); Tel: +972-3-640 8733 (Lab)Fax: +972-3-640 9108; Email: ronitsf@post.tau.ac.il
http://medicine.mytau.org/satchi-fainaro/

Prof. Ronit Satchi-Fainaro (Ph.D.) is Head of the Cancer Angiogenesis & Nanomedicine Laboratory; Chair of the Department of Physiology & Pharmacology, Sackler Faculty of Medicine and serves on the Preclinical Dekanat of the Faculty of Medicine. Prof. Satchi-Fainaro received her Bachelor of Pharmacy from the Hebrew University, Israel (1995) and her Ph.D. from the University of London, UK (1999). She then spent two years as postdoctoral fellow at Harvard University and Children's Hospital Boston working with Judah Folkman on novel angiogenesis-targeted nanomedicines. In 2003, she was appointed Instructor in Surgery at Boston Children's Hospital and Harvard Medical School and continues to have a Visiting Associate Professor position there to date. She joined Tel Aviv University in 2006.

Prof. Satchi-Fainaro is a leader in the field of nanomedicine and angiogenesis (cancer and vascular biology). She has major expertise in tumor biology, tumor dormancy, angiogenesis, molecular imaging, non-invasive intravital imaging of animal models, personalized nanomedicines for cancer theranostics (therapy and diagnostics). Throughout, she has maintained an interest in understanding the biological rationale for the design of nanomedicines suitable for transfer into clinical testing. Her multi-disciplinary research laboratory focuses on basic research elucidating the mechanisms underlying the switch from dormancy leading to the discovery of new molecular targets interrupting host-tumor interactions. Her approach is followed by the design of highly-selective targeting molecules integrating biology, chemistry, protein engineering, molecular imaging, computational approaches, material sciences and nanotechnology to selectively guide drugs into pathological sites.

Prof. Satchi-Fainaro serves as advisor to several Israeli and International Biotechnology and Pharmaceutical companies, is President of the Israeli Society for Controlled Release, and is on the editorial boards of several biological and chemical journals. She has published more than 70 papers, 12 book chapters, edited 2 books, is named inventor on 40 patents, and was awarded numerous prestigious grants and prizes, among them Fulbright, Rothschild, ERC Consolidator Award, Alon, Young Investigator Award of the EACR, Juludan Prize and Teva Pharmaceutical Industries Founders Award. Her scientific achievements were acknowledged numerous times by inclusion in honorary lists by leading magazines such as Forbes, The Marker, Globes and Calcalist.

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Sources

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