Making Space |

For the **EASE** of Multiple Sclerosis
Treatment and Research

By:

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partial fulfillment of the requirements for the degree of

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Carleton University
Ottawa, Ontario

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Figure 1. Cover Image “When Your Eyes are Open do you See?” illustrated by Cristina Ranalli

Making Space|

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Azrieli School of Architecture and Urbanism
Carleton University
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Figure 2. Collage: Portal to Recovery illustrated by Cristina Ranalli

Prologue

When patients are enrolled in a research trial for Multiple Sclerosis (MS), they have to be monitored for a period before being released. Timing ranges depending on the trial protocol. Some trials require inpatient hospitalization for several weeks. Others simply require a day visit. One trialist had to be monitored for eight hours in a room that was stereotypical of a hospital setting. Bonded within the premises of the MS/Neurology Clinic, she felt like an inpatient whilst only a day patient. She was restricted from going outside on her own because of liability reasons. The clinic is small, yet provides care to three thousand patients. Some travel from across the nation for research trials. The space can be described as “sterile” or “clinical”. There is nothing to see, except absolute whiteness. A nurse would cross when seeing the trial patient making her rounds about the hall. Jokingly she said:

“You’re still here? I’m surprised you haven’t gone crazy!”

In reality, the trialist was going “crazy”. She went through a stack of magazines that she had brought, and began feeling restless. Some patients are less mobile and sit in a chair attached to an intravenous drug. They stare at nothing. MS research patients sometimes share the research room with other trial patients. That day, she shared the room with another MSer who traveled from Northern Ontario to obtain

his research drug. This patient had a short four hour stay and had advanced significantly in his disease. He only had her to converse with. There was not much else he could have done, other than sit in a chair attached to a pole where a bag hung dripping a drug that would hopefully help him.

Patients enter research trials knowing that there are risks involved. Sometimes, they enter these trials as a last chance at life. The new MS breakthrough publicized on June 9th 2016 began its article with: “We kill you and then we rescue you”.¹ A profoundly emotional statement that holds truth. Patients risk dying in order to have another chance at living a healthy and holistic life.

Caring for MS is not simply about the medicine that modifies disease progression, rather a treatment plan with several variables. Widespread evidence indicate that a culture of treatment by interdisciplinary teams is the best approach in treating people with MS.² Patients are drafted into a battle, bravely fighting to save their bodies from attacking itself—from attacking the central nervous system, a powerhouse that controls the essence of their being. Why confine patients in a space that stirs feelings of isolation and anxiety when they may be undergoing procedures that are invasive and potentially deadly?

Figure 3. Collage: Portal to Wellness illustrated by Cristina Ranalli

Abstract

The terrain of health and illness appears very different today than it has fifty years ago. The 21st century bears witness to an increasing global burden of modern disease epidemics, particularly epidemics in neurological diseases.

Canada has the highest number of individuals affected by Multiple Sclerosis (MS), a chronic and debilitating neurological disorder. Currently, Canada houses thirty-two clinics specialized in the treatment and research of MS. Though new discoveries have been made in the last decade, science has yet to scratch the surface in finding a cure.

Medical research is constantly evolving to break new ground in MS disease therapy, yet the broader picture is sometimes forgotten. Treating both the disease and patient simultaneously are encouraged to be developed further when bridging the gaps between conventional medicine and holistic medicine. The mind and body, individual and environment have reciprocal relationships.

In order for Canada to take care of its citizens

touched by Multiple Sclerosis, appropriate infrastructure is crucial for this Nation to be a global leader in MS research and treatment.

As architects, we have a moral obligation to exercise a duty of care to the public, to take care of the environment, while promoting sustainability and human health.

How can I develop a project that creates a place for promoting health and sustainability in both patients and their healthcare providers as a foundation to break ground in MS research and therapy?

Through the analysis of existing research and studies conducted on healing spaces, neuroscience, hospital architecture, as well as the symbiosis between conventional and holistic medicine, this thesis will explore, investigate and propose a project that asserts itself as a National Centre for MS research, treatment, and recovery in Ottawa.

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00

Intro-

duction

00

Introduction

“There is a turning point in the course of healing when you go from the dark side to the light... As you lie in bed, you suddenly notice the dappled sunlight on the blinds and no longer turn your head and shield your eyes. You become aware of birdsongs outside the window... You no longer dread the effort needed to get up, but take your first cautious steps, like a child, to explore the new found space around you”.³

These steps — these carefully executed steps towards hope in a time of misfortune is the turning point in the course of healing for a person with Multiple Sclerosis. Transitioning through space and time, one moves across moments of vulnerability and anxiety because of changes in the person’s material body. This uncertainty creates an altered perception of reality, distressed by re-experiencing previous self-identities of what is/was perceived with an abled/disabled body.

The Ottawa Hospital General Campus has one of the leading MS Clinics and Research centres in the nation, directed by a world renowned neurologist who has demonstrated great scientific feats in MS therapy and disease reversibility.

Most hospitals today instill a sense of

anxiety, rather than fostering comfort. Healthcare facilities were often designed as machines to accommodate technologies for diagnosing and treating diseases rather than patients. Human beings prefer spatial conditions and environments that provide security, innate meaning and value.⁴ The need for survivability is at a fundamental level of daily existence as humanity attends to matters of life and death.⁵ When patients with MS experience loss of control over their bodies, uncertainty reigns, stirring feelings of alienation, unease and depression. More than anything, a sick body needs a space that encourages tranquility and ease as a means of promoting health and a sense of wellness.

How can a space that serves three thousand patients affected by Multiple Sclerosis inspire hope and promote wellbeing?

Patients and staff are directed by long narrow corridors and signage to maneuver around the clinic. Often times the sense of orientation in these types of spaces is comparable to being trapped in a maze. Walking and movement for MS patients is not taken for granted. A patient's walking ability is tested during appointments as a means of understanding the progression of their disease. This type of test is often viewed as a dreadful task, stirring feelings of uneasiness within patients who are less mobile and require walking aids.

How can I transform the anxiety provoking corridor into a space that stimulates a sense of community and encourages walking as a meditative journey enticed by moments of hope?

Architecture can enrich human experience since physical surroundings have an effect on our emotions, and these types of emotional responses have an effect on one's overall health and well-being.

This thesis seeks to explore how architecture can entice human experiences, for both patients and staff, within a clinical and

research based setting for Multiple Sclerosis treatment. The thesis will be divided into three parts. First, it will explore the notion of 21st century disease epidemics and why it is such a pressing issue in relation to the built environment. Secondly, it will investigate the principles of designing for health and wellbeing, particularly focusing on the elements of site orientation, nature, natural day-lighting and ventilation, as well as the healing properties of water as being key design strategies. Lastly, the project proposal will provide a new perspective in re-imagining the architecture of the Ottawa hospital MS Clinic and Research centre. Focus will be on creating a place for promoting health and sustainability in both patients and clinicians as a foundation to help break ground in MS research and therapy.

How can I create a space for the ~~dis-~~EASE of Multiple Sclerosis treatment and research?

Figure 4. Collage: Portal to Hope illustrated by Cristina Ranalli

We experience our surroundings with all our senses as one of the most powerful art forms in our lives.

Yet,

WHEN YOUR EYES ARE OPEN, DO YOU SEE?

— Cristina Ranalli

01

Part -

One

21st Century
Modern
Disease
Epidemics

1.1 | Disease Epidemics

what creates disease ?

why is it important ?

how do we prevent ?

Shifting the disease profile away from infectious diseases, the twenty-first century is an era of chronic disease epidemics. Currently, the world is confronted with profoundly alarming issues regarding climate change, environmental pollutants and global warming. The human population has considerably increased pollutants in the land, water, and air that surround habitations.⁶ The magnitude of humankind's impact on living organisms has increased to the point of posing threats to the survival of many species, including the human species.⁷ The health of the planet is in turn impacting human health. Current biological research is beginning to link the built environment to changes in human behavior, mood, and well-being on a cellular and molecular level.⁸ As a result of constant exposure to environmental issues, the human body can develop a disruption in its biochemistry, fostering an inner environment for disease and illness.

dis-ease/də'zēz/

Disease— Dis-ease is literally the absence of ease based on the notion of an impediment to free movement.⁹ It is a pathological process, an obstruction or a deviation from the biochemical norm of the human body, causing imbalance and disorder in cellular structures.

Urban air pollution: Causes and effects

figure 5. Cause and effects of urban air pollution

The above definition is a scientifically prescribed description of what disease means. It is important to look at the greater picture when diagnosing why disease came about as a means of initiating a course of healing and health promotion, as well as designing for well-being. When a patient visits their physician, presenting a series of ailments or symptoms, understanding the patient's overall state is sometimes overlooked by the physician who is faced with accessing the conditions and causes of dis-ease. Life factors that may have contributed to the onset of the illness are rarely discussed. Unlike traditional Eastern or Aboriginal cultures, the dominant Western cultures separate the mind from the body and the individual from the environment.¹⁰ Scientific evidence concludes that the environment determines 70 to 95 percent of the risk of developing some form of sickness, disease, or illness.¹¹ Environment alludes to what one eats, drinks, and inhales, as well as what one bathes in, how one moves about, and how one thinks and interacts with people.¹² The network of genetic factors accompanied with the exposure to environment and accumulation of lifestyle choices is what will determine good health or the onset of chronic diseases. Lifestyle factors such as prior infections, diet, environmental pollutants, amount and types of exercise, stress, vitamin D levels, hormone balance, even attitude and approaches to life circumstances can stimulate harmful genes, obstruct biochemical factories, and result in harmful alterations to nutrient absorption, hormone production and neurotransmitter function.¹³ These types of obstruction in the body are

DISEASE // DIS • EASE // DE'ZĒZ //

figure 6. sketch depicting the notion of urban toxicity

what fosters a platform for the development of chronic diseases.

Modern day medicine has an unprecedented capacity to profoundly alter the diagnosis and treatment of diseases. Medicine's ability to make powerful and effective interventions to improve the health of individuals sheds light onto new ethical responsibilities.¹⁴ In order to distribute limited healthcare resources, it is important to have a clear idea of, first what a disease is, and secondly, which diseases are priority in investing time and money for the furtherance of humanity.¹⁵

Figure 7. Mapping of Neurological Epidemics

WHAT IS MS ?

Multiple Sclerosis is an unpredictable, often disabling disease where the immune system attacks the central nervous system (CNS), comprised of the brain, spinal cord and optic nerves.⁶

NORMAL NERVE⁷

MS NERVE⁸

1.2 | Epidemic of Neurological Diseases

Global:

There has been a significant increase of neurological disorders at a global scale, and the magnitude will continue to upsurge exponentially in the foreseeable future. Neurological disorders concern the chronic inflammation and degeneration of healthy nerve tissue that transpire through an entire lifetime.¹⁶ Types of neurological diseases may manifest as Attention Deficit Disorders (ADD) or Autism in children, Multiple Sclerosis (MS) or Epilepsy in adults, as well as Alzheimer's or Parkinson's disease in older adults.¹⁷ Modern living has been speculated to be responsible for a hidden epidemic of neurological diseases.¹⁸ Neurological diseases are quickly becoming the most debilitating modern day epidemic,

accounting for 4% of deaths and 5% of disability-adjusted life-years from non-communicable disease.¹⁹ A study published in the journal of *Surgical Neurology International* compared twenty-one Western countries from 1989 to 2010, concluding death caused by neurological disease have escalated significantly in adults within the last twenty years.²⁰ The rate of increase in such a short period of time suggests that environmental influences that result from modern living are a cause for today's neurological disease epidemic.²¹ These crucial issues are alarming and pose threats on the global health and wellbeing of the human race. The World Health Organization (WHO) has reported that healthcare providers and policy makers may be vulnerable in coping with the unprecedented increase in the prevalence

Expanded Disability Status Scale (EDSS)

Figure 8. Progression of Disability in Neurological Diseases

of neurological diseases of worldwide populations.²² In most instances, neurological conditions are incurable, often worsening over time and posing daily challenges for individuals, their families and the social economy.

Canada:

Until today, little emphasis has been placed upon the affliction of neurological disorders, diseases, and injuries in the Canadian population, yet, Canada is one of the leading nations representing these ailments as the primary cause for disability.²³ There are still several gaps in understanding the cause and issues related to the development of neurological diseases. Some studies have been conducted on the impact of several neurological conditions to quantify their social and economic burdens, as well as their impact on the Canadian health care system. For the

purpose of this thesis, particular attention will be placed on Multiple Sclerosis and its effect on Canadians. In the last twenty years the prevalence of individuals affected with MS has more than double from 35,000 to 100,000²⁴, ranking Canada as the dominate nation in the world with the highest incidences of individuals with Multiple Sclerosis.²⁵ Patients are under the care of neurologist and other MS clinicians in 32 MS outpatient clinics across Canada, but not all have a MS research centre. Figure 9 is a map indicating the number of MS clinics in Canada.

The darker provinces have the most clinics ranging from 5 to 8. As the provinces become lighter the number of clinics decrease from 1 to 3. Considering that Canada has the highest incidence of people affected by MS, the number of clinics within the nation are far too few.

Figure 9: Map illustrating the number of MS Clinics in Canada

1.3 | Multiple Sclerosis (MS)

The patient hears the doctor say the words—*Multiple Sclerosis*— and may wonder if their life will ever be the same again. Perhaps they are uncertain of what those words mean, but they have seen what happens to people with the disease. Overwhelmed during this bleak moment, the patient may be discerning what this diagnosis may lead to; progressive loss of mobility, the need for walking aids, wheelchairs, and periods in a hospital bed for acute care.

Multiple Sclerosis is one of the world's most common neurological disorders, affecting 2.5 million people.²⁶ Though reasons for the difference in MS risk between genders remain unclear, it has been recorded that the disease is twice more common among women than men.²⁷ The disease can be fierce and aggressive, impacting each individual differently depending on one's biochemistry and genetic composition. There are several theories about the development of MS, but it is generally agreed upon that the disease is related to a form or genetic vulnerability that engages with many unknown environmental factors.²⁸ When the disease is triggered, patients often experience an “attack” or a “flare-up” in which immune cells begin attacking and damaging their

central nervous system, comprised of the brain, spinal cord and optic nerves.²⁹ During an MS attack, the myelin, which is the fatty sheathing that covers the nerve fibres of the neuron, deteriorates, decelerating the transmission of information towards the nerve cells.³⁰ At this moment the patient has absolutely no control of what is happening to their body, experiencing an array of symptoms such as vertigo, loss of balance and strength, numbness and tingling of the extremities, as well as impaired movement, vision and cognitive functions.³¹ To have absolutely no control of the body's motor functions, while feeling weak and vulnerable can be a profoundly traumatic experience. At this moment, trust as well as control is placed in the hands of the clinical professionals—the doctors, the nurses, the specialist, the individuals that are trained to be experts when it comes to “taking care”— to “restore” someone to health. Like other types of neurological disorders, Multiple Sclerosis is a *progressive disease*. There are two main types of MS, Relapsing-Remitting MS and Primary-Progressive MS. At the initial onset of the disease, 85% of people are typically diagnosed with relapsing-remitting MS, 10% with Primary Progressive, and 5% with Progressive Relapsing.³² 80% of these individuals will develop Secondary Progressive MS (fig.10).³³

Figure 10. Percentage of people with each stage of MS

The stages of MS:

i. Clinically Isolated Syndrome (CIS)

The stages of MS typically follow a predictable pattern. The primary form of MS is known as Clinically Isolated Syndrome (CIS) (fig.), referring to one episode of Multiple Sclerosis neurological symptoms.³⁴

ii. Relapse-Remitting Multiple Sclerosis (RRMS)

The disease is seen to have progressed to a relapsing form, when patients have flare-ups or attacks of MS, followed by periods of remission.³⁵

iii. Secondary-progressive Multiple Sclerosis (SPMS)

About half of people with relapsing-remitting MS start to worsen within 10-20 years of diagnosis, with increasing levels of disability.³⁷ During this time the individual no longer experiences acute relapses and remissions, rather there is only gradual worsening of the MS-related symptoms and increasing disability.³⁸

iv. Primary –Progressive MS (PPMS)

Approximately 10 to 15 percent of MS patients are initially diagnosed with Primary-Progressive MS, experiencing only a gradual decline from the beginning, without defined relapses or periods of remission (fig).³⁹

v. Progressive-Relapsing MS (PRMS)

Occurring in five percent of patients, this form of MS experience relapses with or without recovery and steadily experience a worsening of disease from initial onset.⁴⁰

01 figure 12. Clinically Isolated Syndrome (CIS)

02 figure 13. Relapsing Remitting MS (RRMS)

03 figure 14. Secondary Progressive MS (SPMS)

04 figure 15. Primary Progressive MS (PPMS)

05 figure 16. Primary Relapsing MS (PRMS)

1.4 | What Creates Health? “I Feel Healthy when...”

Human beings are comprised of trillions of cells which are building blocks that make up the body.⁴¹ In order for cells to function at their optimal potential, they need certain nutrients, exercise, and an environment that will allow them to thrive. When cells do not obtain basic requirements to feel enriched, they will begin to malfunction and eventually, adversely impact one's health, resulting in certain ailments such as cancer, diabetes, and autoimmune diseases.

*The World Health Organization (WHO) defines health as “...a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity”.*⁴²

*“Newman (1994) does not distinguish health from well-being, but singularly defined it as a manifestation of expanding consciousness, which may occur during but is not separate from the experience of illness”.*⁴³

Based on these definitions, one can still be healthy though being afflicted with a chronic disease. Moments of healing may be experienced during moments of physiological and mental suffering. A suffering body realizes it's prospective to heal, creating a relationship between well-being and awareness. This type of conscious awareness signals readiness for moving towards one's potential towards health, which is positively associated with attaining a greater sense of vitality within a human-environmental field.⁴⁴

Martha Roger's, an American nurse, researcher and theorist, measured general well-being on the notion of human beings as energy fields. According to Roger's, energy fields are identified as two categories: the human field and the environmental field.⁴⁵ These two energy fields extend to infinity such that the human and environmental energy fields flow intrinsically with each other at a subatomic level.⁴⁶ Environmental energy fields shape human energy fields, and vice-versa, an interaction that reveals the “...intrinsically dynamic nature of matter... [where]...the whole universe is thus engaged in endless motion and activity, in a continual cosmic dance of energy”.⁴⁷ These principles describe a process that is associated with well-being and human development, revealing the intrinsically dynamic nature of matter that does not exist as separate entities.

Tools of modern science have helped decipher how sensory organs receive signals from the world around us, and how brain cells and molecules come together to generate signals into a perception of negotiating spaces.⁴⁸ This information may help determine how nerve chemicals produced by the brain when one reacts to the environment, may in turn influence immune responses to encourage healing.⁴⁹

This thesis explores the potential of well-being and spatial awareness, re-imagining clinical spaces that will assist in promoting comfort, while creating moments of healing for MS patients and their health providers.

"I Feel Healthy when..."

figure 17. Diagram illustrates building blocks for a healthy body
illustrated by: Cristina Ranalli

02

Part -

Two

Designing for

+ Ease

+ Well-being

+ Research

+ Recovery

2.1 | Designing for ~~dis~~EASE + well-being

Though this thesis intends to re-imagine healthcare environments by proposing places for healing through time and space, it does not suggest that architecture is a cure for ailments. Rather, this thesis suggests that architecture may be used as a tool to care and promote well-being by creating a place that fuses conventional and functional medicine as an integrated plan for Multiple Sclerosis research, treatment, and recovery. Since Multiple Sclerosis is a disease that has adverse effects on the patients, neurology and physiology, the research emerging from a new field called *neurodesign* will be implemented when executing the design strategies for this project. *Neurodesign* alludes to designing with a deeper understanding of the impact architectural design has upon the mental and physical welfare of the user.⁵⁰ Practicing medicine has a scientific component, however, it is ultimately a moral practice. As the Hippocratic Oath (an oath taken by physicians to protect all life), states:

*“...warmth, sympathy, and understanding may outweigh the surgeon’s knife or the chemist’s drug... this awesome responsibility must be faced with great humbleness and awareness of my own frailty... I will remember that I do not treat a fever chart, a cancerous growth, but a sick human being, whose illness may affect the person’s family and economic stability”.*⁵¹

figure 18. Diagram by Cristina Ranalli illustrating Conventional Medicine vs. Functional Medicine

Similar to physicians, architects also have a moral obligation to exercise a duty of care to the public. The primary role of the architect is to serve — to try to make things better in a world that lacks to be functioning in a manner that is sustainable for all life forces. Hence the need to strive for change and progress by designing not just for the physical body but for the person as a whole resulting from the union of body and mind—making physical spaces practical and inspiring.⁵²

Hippocrates distinguished medicine as a separate entity from philosophy, arguing that

the physician [architect] must hold a strong understanding of environmental determinants in having an influence on human health.⁵³ He viewed the manifestation of disease and sickness as being largely influenced by environmental and climatic factors.⁵⁴ Possessing knowledge of the four seasons, site orientation strategies, fresh water supplies, landscape design and the impact of prevailing winds as essential as being relative to their impact on human health.⁵⁵ Each of these elements are perceived as being methods of therapeutic modalities from the scale of a city to an inpatient hospital room.

figure 19. Diagram connects performance impact areas through components of the built and human health environments

2.2 | The Relationship Between the Built Environment + Human Health

Landscape + Site Planning:

Awareness of place is rarely expressed in recent hospital architecture. The concept of civiness, environmental sustainability and stewardship have been diluted, resulting in a sense of placelessness and architectural entrapment.⁵⁶ Postmodernist hospitals (1950s onward) took on the expression of functional deconstruction, by which hospitals were fractured into parts and redistributed among the urban fabric and community.⁵⁷ These 'puzzle pieces' were recast as freestanding healthcare facilities such as wellness centers, oncology clinics, and outpatient diagnostic and treatment centres.⁵⁸ This type of venturing from the enclosed mega hospital type of environment expressed critical regionalism of the type of healthcare a city or town was predominately specialized in.

The Ottawa hospital's Multiple Sclerosis Clinic/ Research centre is one of the best in the nation lead by a world renowned neurologist that has made cutting edge discoveries in MS treatment and disease reversal. In the last twenty five years, thousands of freestanding healthcare facilities and wellness centers have been designed and built as a result of functional deconstruction, having little to do with sensibility of place—its *genius loci*.⁵⁹ The current MS Research Clinic in Ottawa is in a secluded location on the fourth floor of the General Hospital, sharing a space with general neurology and the clinical investigative unit (CIU) (fig.21) Upon arrival patients check-in at the desk and are asked to

sit in the waiting area of typical rowed seating facing blank walls with a few decals of natural scenery (fig.22). This type of setting feels sequestered from the outside world, stimulating the notion of placelessness rather than community. MS is known as a Canadian disease, and individuals affected by the disease benefit from community support and interaction, hence the establishment of the MS Society of Canada. Siting a research/treatment centre in a setting that embraces place and asserts itself as a national symbol for scientific discoveries and MS treatment is a stepping stone towards hope in finding a cure.

figure 20. The Ottawa Hospital General Campus entrance on Smyth Road, **photographed by** Cristina Ranalli

figure 21. Entrance into the clinic, **photographed by** Cristina Ranalli

figure 22. Waiting Room, **photographed by** Cristina Ranalli

figure 23. Conversation Space : Teach patients of the different treatment options, **photographed by** Cristina Ranalli

figure 24. Typical patient examination room , **photographed by** Cristina Ranalli

Views to Nature:

“Climb the mountains and get their good tidings, nature’s peace flow into you as the sunshine into the trees. The winds will blow their freshness into you, and the storms their energy, while cares will drop off like autumn leaves”.⁶⁰

Nature as an inherent element for healing has been exploited since ancient times, and has been used as a therapeutic modality in both the East and West. The common phrase ‘stop and smell the roses’ is a reminder to take a moment, relax and be drawn to the beauty of nature. Fredrick Law Olmsted’s 19th century innovative parks and landscapes reflect the era’s accepting of public health and argues how natural settings within a congested urban environment is beneficial in promoting both physical and mental health.⁶¹ Within the last couple of decades scientific studies and evidence based design approaches have reprised nature as a therapeutic modality. Hospitals, primary care clinics and rehabilitation facilities are facing high construction and renovation costs, and the economic benefits of the healing impact of nature are being calculated.⁶² Incorporating a play garden at the Rusk Institute of Rehabilitation Medicine in New York has been proven to help children regain mobility faster than simply relying on being rehabilitated indoors.⁶³ The benefits increase significantly when families can take part in the time spent with the patient outdoors, interacting in a calm setting that is separate from the hospital.⁶⁴ Staff also gain benefits from interaction with nature as it provides a retreat from the stress of clinical work.⁶⁵ The volume of research has grown

considerably in recent years and has gained considerable attention by designers when designing for health and well-being.

Why are human beings in a continual mutual process with nature and their environments as a means of measuring well-being?

The brain is a critical organ in sensory experiences. Like nature, the brain is composed of fractals with its countless replicating folds. Mountain ranges, coastlines, trees, and the cells in the human body are examples of fractal structures.⁶⁶ A precise reason has not been established as to why humans find repeating fractal patterns pleasing to the eye and mind. Perhaps, when the brain is exposed to a stimuli of similar geometric compositions like nature, a calming harmonious influence is made. Ary Goldberger, professor of cardiology at Harvard Medical School, proposes that when humans gaze at fractal structures, whether Gothic cathedrals or Hokusai’s wave, the mind is freed from rigid boundaries of scale and responds to complex patterns, moving inward or outward, up or down at will.⁶⁷

This type of enticing stimuli has been effective in reducing stress hormones, in turn increasing endorphins (a neurotransmitter that helps lower stress and support the immune system). Having sight and access to nature will be a beneficial design strategy for the proposal of the MS Clinic and Research Centre as a means of enhancing well-being for both patients and staff, as well as inspiring the imagination of scientist for further ground breaking discoveries.

figure 25. Collage by Cristina Ranalli: illustrating fractals in the brain and in nature

"My architecture starts in the spaces I create in my mind. Space is in here and out there, it is a continuum between inside and outside, mental and physical...Now I am designing with the mind in mind"

--Extract from 'Dreaming of a project', from Lines by Ian Ritchie, 2010
[Neural Architects,40]

Healing Properties of Water:

Leonardo da Vinci believed that the motion of fluids was at the center of understanding the power of the universe.⁶⁸ Human beings possess this innate curiosity to interact with water for its multisensory stimulation and intrinsic phenomena. Water propels the vitality of life, yet, this element also possesses hygienic, healing and purification properties. To decipher purification and cleaning is important, for purity refers to a state of being, rather than a type of engagement in the removal of dirt.⁶⁹ When purity appears on a being's surface, it is professed as the manifestation of something rooted within, and its beauty is lost through a corruption at the being's core.⁷⁰ This corruption may be viewed as illness or disease—dis-ease in the human mind, body, and spirit. The power water has to penetrate the body and soul,

communicating its own freshness, clarity, and purity..."⁷¹, is a fundamental theme in the design process of this thesis. The Roman Baths were a form of a sustainable architecture towards health, and were used throughout the Empire. In the past decade several healthcare centres have integrated water elements within the facility or adjacent to the campus.⁷² Features such as ponds, waterfalls, and fountains provide positive visual, auditory and aesthetic responses to a potentially intimidating ambient environment: "The water we seek is the fluid that drenches the inner and outer spaces of the imagination".⁷³ The Banner Estrella Medical Center (fig. 26) is an example which embraces indigenous plant species as well as contains a therapeutic pool for spiritual respite and physical therapy.⁷⁴ Water is therefore an important factor in establishing the genius loci of healthcare settings.

figure 26. Reflection pool + therapeutic landscape, Banner Estrella Medical Center

Light as Therapy:

Variations of luminance and colours influence individual's capacity to strengthen alertness, trigger emotional responses and affect mood. The impact of light, natural or artificial, has been analysed by scientists interpreting how different wavelengths and intensities of light affect the sleep-wake cycle and stress responses.⁷⁵ Technologies have been developed to access the effects of light waves and intensity on immune molecules. Such technologies will help determine spatial features that may induce stress, relaxation and effects on immune responses in a manner that marks design strategies.⁷⁶

Architects must understand how the circadian clock (the response of the brain to the changing time of day) functions when making light design decisions. Changes in light levels feed directly into the receptors of the brain's circadian clock.⁷⁷ Research labs are designed with little penetration of natural daylight, which contains the full spectrum of colours, since it may tamper with certain specimens or technologies. In these types of spaces where researcher scientists spend most of the working day, their circadian rhythm may be unbalanced due to lack of natural daylight exposure. Through his work on the 24-hour circadian rhythms regulated within the central nervous system, Russell Foster (Oxford Professor of Circadian Neuroscience) has conducted studies to inform therapeutic approaches that will improve quality of life.⁷⁸

Light can be a form of therapy by using full spectrum natural and artificial light to promote an overall sense of well-being, realign imbalances caused by absence of natural

daylight, or stimulate bodily healing responses.⁷⁹ Studies have concluded that 480 nanometres of blue light (fig. 27) is the wavelength that instills the most alertness and is visible to the morning sky.⁸⁰

figure 27. Diagram of light spectrum

For the architect to fathom how buildings affect the circadian clock, it is important to question if the architecture designed allows for appropriate and natural cycles of light into spaces, especially during winter months in northern countries such as Canada.⁸¹

The Sainsbury Wellcome Centre (SWC) at UCL, London is a precedent example which takes into account the spatial effects of light. An entire wall of the SWC is translucent glass, inviting soft daylight to filter into the building, allowing for a soft registration from daylight to night.⁸² Windows along the west façade allow the scientists to have a degree of control, welcoming fresh air, and louvres to provide privacy and reflect sunlight.⁸³ Having a level of control over lighting and windows has helped with stress reduction and improved productivity.

Though empirical studies need to be further conducted, lighting design within buildings have biological and neurological impacts. Since, scientists and research are continually making discoveries in the treatment for Multiple Sclerosis, it is important to consider lighting effects within the lab spaces and patient rooms.

figure 28: SWC concept etch by Ian Ritchie

figure 29: Sainsbury Wellcome Centre by Ian Ritchie

Way-Finding within Therapeutic Walking:

*"I have designed my style pantomimes as white ink drawings on black backgrounds, so that man's destiny appears as a thread lost in an endless labyrinth. I have tried to shed some gleams of light on the shadow of man startled by his anguish."*⁸⁴

— Marcel Marceau, 1923-2007, French mime artist

Hospitals are notorious for confusing and anxiety provoking spatial organizations, disorientating circulation corridors and poor signage for direction. Hospital circulations have been often compared to being trapped in a maze, which triggers a stress response since there are no clear lines of sight or sounds to guide or orient someone.⁸⁵ Like mazes, hospitals constantly present dead ends, difficult choices and new territories that make it difficult to quickly find a solution in affectively arriving at a destination. These types of uncertainties and novelty potentially elicit stress response and anxiety in visitors and patients who are unfamiliar with the hospital's context.⁸⁶ As a means of coping with unpleasant emotions, labyrinths have found their way into hospitals grounds as paths to healing—comparable to embarking on a meditative journey towards the road of recovering. The structure of a labyrinth differs from a maze. Rather than instating fear or stress response, a labyrinth calms.⁸⁷ Walking a labyrinth is intended to allow those who enter find their way along a single clear path, without feeling a sense of entrapment and focusing attention on inner thoughts while freeing the

mind of preoccupations.⁸⁸ This type of ritual is intrinsically soothing.

Often patients feel powerless and confused in the medical system. By walking labyrinths (fig. 30), patients feel a sense of empowerment and gain a proactive outlook towards their treatment plan and recovery process.⁸⁹ A positive mental and emotional attitude are key attributes for successful healing when the physical body has fallen ill. Employees and staff also benefit in participating in a labyrinth walk for it is an effective strategy to handle the stress and tension associated with their positions (fig. 31).⁹⁰

There are three stages in a labyrinth journey:

Release: Begin by standing at the entrance on the edge of the labyrinth. Gracefully inhale and exhale. Gently follow the path at a pace that feels comfortable. Clear your mind and allow thoughts and worries to pass as you embark on the journey.⁹¹ **Refresh:** Upon reaching the center, take a moment to pause. Visualize yourself in a peaceful place, breathe, reflect and remain calm.⁹² **Return:** When the time feels right, follow the path back out from the center. Bring the feelings or insights you experienced with you when exiting back into the world.⁹³

Applying this concept of the labyrinth to the circulation corridors of a building may reduce patient anxiety when undergoing the walking test, as well as allow for pleasant and inspiring experiences while meandering throughout the facility.

figure 30: Patient and family walking a labyrinth

figure 31: Clinician walking a labyrinth

03

Part -

Three

The Project:
A Treatment and
Research Centre
for
Multiple Sclerosis

3.1 | Designing for Treatment + Research + Recovery

This thesis began by examining how the current terrain of health has shifted to an increase in chronic disease epidemics, and how the built environment affects the physical and emotional well-being of individuals on a cellular and molecular level. Neurological diseases such as Alzheimer's, Parkinson's and Multiple Sclerosis are increasing exponentially at a global scale, ranking Canada as the leading nation in the world with the highest prevalence of individuals affected with Multiple Sclerosis. Designing places for well-being in the open context of nature has been explored in promoting patient recovery, reducing stress, improving mood, and supporting health. In applying this research, the subsequent section proposes a design scheme for the disease of Multiple Sclerosis treatment and research. The current MS Clinic has gone to extraordinary measures in taking care of patients and leading varying research trials. In moving forward, how can a greater space emerge from an environment which allows patients and staff to feel more comfort and inspiration within their surroundings? How can views to nature act as a portal to escape from the frightening reality of disease, into scenery that offers a better time and place?

Design Objectives + Principles

The design objectives will be based upon three guiding principles that establish an architectural approach towards designing enticing spaces for MS treatment, research, and recovery. The intent of these spaces is to use architecture as a platform for service to enhance the quality of life and wellbeing for patients, clinicians, and visitors.

Principle 1: Drawing Awareness

Principle 2: Programming Spaces of well being, Research and Discovery

Principle 3: Therapeutic walking and Meandering

figure 32. Diagrams of pragmatic spaces for project

figure 33. Panoramic view of Lynda Park looking north towards the Ottawa General Hospital
photographed by: Cristina Ranalli

The General Hospital appears to be sprouting from the landscape, rendering a less anxiety provoking view that is often associated with the image of a hospital.

3.2 | Context: Site Analysis + Planning

Principle 1: Drawing Awareness

Similar to the Ottawa's Cancer Survivors Park, the facility shall be embedded within the urban fabric to draw awareness of Multiple Sclerosis. Particularly, awareness in the number of Canadians affected with MS and how Canadian doctors are leading groundbreaking research studies in hopes of finding a cure.

In order to continue on this course towards sustainable healthcare, it is important to reflect on the ancient aspects of healing and wellness as a means of moving forward. Nature played a fundamental role in therapeutic modalities during the ancient and Middle Ages (predominately in the East). The classical Greek Physician Hippocrates believed that disease and sickness was influenced by climatic

and environmental factors, and that healing occurred in the context of nature. Owned by the City of Ottawa, Lynda Park is the proposed site for the project because of its luscious forestation. The site was specifically chosen as a means of connecting occupants to nature in order to optimize health and wellbeing, as well as remaining in close proximity to the Ottawa Hospital for other treatment services.

Another notable park in Ottawa, is the Cancer Survivors Park located on Riverside Drive and Industrial Avenue. This park fundamentally inspired the concept for this thesis project. Simulating the notion of a labyrinth (fig. 34), the park is a circle encompassed by trees, acting as a soft protective enclosure from the surrounding noisy streets. Upon entering the

figure 34: Site plan of Cancer Survivors Park

figure 35: Victor Salmones sculpture “Cancer: There is Hope”
photographed by: Cristina Ranalli

park, visitors are greeted by a sculpture called “Cancer: There is Hope” (fig. 35), created by the renowned Mexican sculptor, Victor Salmones. The sculpture freezes in time the expressions and emotions of people about to undergo treatment. They are afraid and scared, hesitant to enter the “MAZE” which is symbolic of a form of cancer treatment. On the other side of the maze the expressions of the sculpture change. They radiate a sense of relief, optimism and triumph, alluding to completing a successful treatment that offers them hope for their future — a light at the end of the tunnel. A sense of tranquility and ease is experienced when circulating the paving within the landscape. These paths pave a “Positive Mental Attitude Walk” which lead visitors to read inspiring plaques. Paths leading to each plaque are symbolic of “the road to recovery”.

photographed by: Cristina Ranalli

photographed by: Cristina Ranalli

figure 36. Panoramic view of Ottawa's Cancer Survivors Park
photographed by: Cristina Ranalli

The adjacent map indicates Lynda Park, located directly across the Ottawa General Hospital intersecting Lynda Lane and Smyth Road. The park is a notable feature within the Ottawa community and is often bustling with activities. Within the surrounding area exists several other community gardens, parks, green spaces, and the Rideau River. The site has the potential to be transformed into a form of sustainable infrastructure that promotes the health and well-being of MS patients, staff and visitors. Lynda Park is encompassed by stunning natural scenery, allowing for

programming to accommodate enticing views while being embodied within the existing natural landscape. The site engages with the surrounding urban fabric, alluring pedestrian traffic with paths located North, East, South and West. These paths act as nerves for entry onto the site, transferring passersbys as though they are signals of information trying to arrive at a destination with a message. Having the MS Treatment and Research Centre located on this site will also draw awareness about the disease, and establish a sense of inclusion within the community.

figure 37: Context map illustrating surrounding parks and community gardens around the General Hospital and Lynda Park

The General Hospital
 Parks + Community Gardens
 Lynda Park (proposed development)
 Cancer Survivors Park

3.3 | Programming

Principle 2: Programming Spaces of wellbeing, Research and Discovery

The programs main objectives are intended to support the notions of healing environments, contributing to patient and staff wellbeing. In addition, provide research laboratories and offices which act as factories of ideas for revolutionary discoveries by scaling up science.

The programming of the new MS facility is composed of examination rooms, inpatient and day patient rooms, wellness and rehabilitation spaces, as well as a research centre .

figure 38: Program design parti diagram

figure 39: Concept section of program

1. Research	3. Administration	5. Garden Courtyard	7. Exam Rooms	9. Therapeutic Walking
2. Discovery	4. Library/Contemplative Space	6. Imaging	8. In-Patients	10. Day Patient/Wellness

Notable features throughout the design include:

- *Access and views to nature as a form of therapy.*
- *Site orientation on North South axis to allow for natural cross ventilation.*
- *Natural day-light will be maximized in common spaces, offices, patient rooms. Alternative lighting will be used for research labs.*
- *Water features for meditative resonance*

figure 40. Massing axonometric of program + site

Site |

figure 41. Site Plan 1:2250

day parking

enclosed
courtyard

open
courtyard

outdoor labyrinth/
water catchment area

forested area

circulation ramp prospect of patient accommodations

figure 42. Panoramic view of Lynda Park looking south west
photographed by: Cristina Ranalli

figure 43. Ground Floor Plan in context with site 1:1000

figure 44. View of entrance space into building from north-west corner

figure 45. View of seating/waiting area

Examination Rooms

The existing clinic has twelve examination rooms. Some of the rooms are used for patient assessment and checkup, while others are used to conduct other tests. Patients are typically in an examination room for 15 to 20 minute intervals to meet with their neurologist, nurse, or another clinician. Certain tests can be invasive and frightening, such as a lumbar puncture, which is the extraction of cerebral spinal fluid from the spinal canal for diagnostic testing. Memory and fine motor skill tests may also trigger a stress response for some patients. Some of the examination rooms for this project will be oriented along the north façade of the building, opening sightlines to Ottawa's re-forestation project. The remainder of the exam rooms will be running along an interior courtyard, projecting sightlines to an intimate and private landscape of vegetation. Having visual exposure to nature from varying perspectives allows for a more calming space, and has the potential to reduce patient anxiety prior to testing.

Day Patient Rooms

Day patients are typically enrolled in research trials in which they need to be monitored for a period of time while the study drug is distributed. The length of stay for these types of research patients is usually eight hours. The clinic currently has one open concept room to house the patients, and it contains six beds partitioned by hospital curtains. Depending on the trial protocol, patients may have vital checkups every few hours. Study drugs may cause side effects that can leave patients feeling

unstable. Due to certain liabilities and research protocols, patients are required to stay within the boundary of the MS research clinic. Since patients are required to remain at the clinic for the day, they are asked to bring reading materials or other activities to keep themselves occupied. Typically, patients remain inside the research study room since there are few other spaces spend their time and they are required to remain in the clinic. As a means to ensure their bodies are receptive to the study medicine or procedure, patients are encouraged to move about. The struggle some patients have is that the clinic is relatively small and the only place to move about is typically the circulation corridor of the clinic. The project proposes a space for day patients on the ground level that houses ten beds divided in semi-private bays, four more than the current clinic to recruit more patients for research. The day patient area is comprised of wooden slats to divide each bay with a solid wood wall encompassing the day beds for privacy. The slats are operable, pivoting like venetian blinds, allowing patients control over lighting exposure and level of privacy. The day patient space is adjacent to the walking test circulation track and integrates a vertical garden as a soft enclosure. An indoor water stream resonates just outside the day patient spaces on the north wing. The stationing of the wooden day patient spaces, along with vertical gardens and streaming water is intended to represent a moment for walking test patients to feel as though they have accomplished a certain distance. These types of moments will continue to circulate throughout the track.

figure 46. Ground Floor Plan 1:500

1 Entrance	6 Storage	11 Day Patient Space
2 Clinical/Research Reception	7 Examination Rooms	12 Open Courtyard
3 Contemplation Space	8 Enclosed Courtyard/Garden	13 Rehabilitation/Yoga
	9 Circulation Ramp/w aiting Area	14 Patient Cafeteria
5 Conversation Room	10 w alking Test Track	

Wellness + Rehabilitation Spaces

Complementary and functional medicine has been used as an approach that derives from a variety of traditions and practices, such as exercise, natural health or homeopathic products, meditation and spirituality.⁹⁴ Despite the significant advancements in emerging new disease-modifying drugs, pharmacological therapy in itself is not optimal care in MS.⁹⁵ It is important for patients with Multiple Sclerosis to engage in regular exercise to maintain functional abilities and general wellbeing. Studies have indicated that exercise interventions in people with MS provide promising evidence in halting the disability progression of MS and improving mood.⁹⁶ Many individuals utilize complementary and functional medicine as a method of managing their MS in addition to enhancing overall wellness.⁹⁷

Often times when patients experience a significant and debilitating “flare-up” or “attack”, they require physical rehabilitation exercise to return to an abled body state. The wait time in receiving care at the Ottawa Hospital Rehabilitation Centre is lengthy. In this thesis, the project proposes a rehabilitation and wellness space on the south wing of the ground level (fig. 47). This space is intended for MS patients that require rehabilitation, as well as for day patients to move about and exercise while at the clinic for long periods of time. The wellness space renders a spiritual area for yoga and meditation to help calm the mind of stress, depression and anxiety, while increasing emotional stability and memory.

figure 47. View of Rehabilitation + Wellness Space

Principle 3: Therapeutic walking and Meandering

Aspects of the project design will be based on the concept of a labyrinth while integrating the notion of neuro design (design for the mental and physiological well-being of occupants).

As part of monitoring mobility and disease progression, patients are required to perform two types of walking tests. These tests involve a short 8 meter distance to measure speed, as well as a long 500 meter distance to measure endurance. Depending on the progression of the disease this test may be seen as a daunting task and may evoke a stress response. The labyrinth concept offers sensitivity to the patients when they are required to complete their walking tests, as well as paves way for a meditative meandering throughout the building.

Currently, patients complete their walking test throughout the circulation corridor of the clinic (fig. 48). The distance to be completed, whether it is 8m or 500m, is marked with a

piece of tape on the ground. Therefore when undergoing the test, the focus is placed on the marking on the ground inviting one to look down at their own progression (or lack thereof), rather than upwards at something more inspiring. The project proposes a designated area for the walking test located East of the first level (fig. 49). Rather than having markings on the ground to note the distance traveled, a series of moments will be designed throughout the circulation corridor to indicate mile stone achievements when performing the test (fig. 50 & 51). Entering into these moments in space and time is intended to inspire hope, and provoke a positive mental attitude while accomplishing a task that may trigger anxiety. The walking circuit will need to be repeated twice to complete 500m. When the patient has successfully endured the test, they will re-experience the space and aura of their first moment when initiating their journey (fig. 50).

figure 48. Circulation corridors of the MS research/clinic
photographed by: Cristina Ranalli

figure 49. Walking test track noted with a series of moments

moment 1 @ 37.5 m

moment 3 @ 112.5 m

moment 2 @ 75 m

moment 4 @ 150 m

figure 50. View of walking test track, moment 1 @ 37.5m, and the moment when patients complete the walking test after completing the 500m circuit

figure 51. View of walking test track, moment 2 @ 75m

Inpatient Rooms

Among the three hospital campuses that make up The Ottawa Hospital (Civic Hospital, General Hospital, Riverside Hospital), there are no inpatient wards with the specialization of Multiple Sclerosis. When a patient requires hospital assistance, they are directed to the Civic Hospital because the campus is more equipped and staffed with a Neurology and Neurosurgery team. Some research trials, such as the new clinical trial led by a bone marrow specialist and a world renowned neurologist at The Ottawa Hospital, required inpatient hospitalization.⁹⁸ The scientific and medical feat of this trial have been made public in media and published in *The Lancet* medical journal in June 2016. The "...high-risk therapy may stop the disease from progressing", but the procedure is often associated with fatality, which limits widespread use.⁹⁹ The results of this trial are impressive, since it is the first trial ever to have indicated complete suppression of disease activity for an extended period.¹⁰⁰ As patients undergo an intensive combination of chemotherapy and stem cell transplants, a twenty day hospitalization is protocol, and currently patients are housed in the bone marrow ward at The General Hospital.¹⁰¹ Hence, the project proposes a nine room inpatient bed ward on the second level of the facility, adjacent to the research laboratories. These types of

intensive trials must persist if Canadian doctors are going to make a breakthrough in finding a cure.

Research Laboratories

Currently, the clinic does not have its own designated lab for Multiple Sclerosis. The director of the clinic has a lab on the 2nd floor of the cancer care wing where he conducts research.¹⁰² The Ottawa Hospital is a teaching hospital that is, "Inspired by research. Driven by compassion."¹⁰³ This slogan is a driving force in establishing a larger MS research centre in conjunction with the clinical and therapeutic setting of the new design. The laboratories and research offices are located on the second level of the North West wing of the facility. Research will be conducted using state-of-the art cellular and molecular science, imaging resources and behavioural techniques. The facility proposed is intended to shape a novel type of infrastructure that supports an advanced machine workshop to allow the centre to stay rapidly abreast of a quickly moving field.¹⁰⁴ Three experimental research wet labs and one research dry lab will comprise the research wing. Spaces will be allocated for private research offices, multipurpose conference rooms, break-out spaces, and an MRI machine to help reduce wait time.

figure 52. Level Two Plan 1:500

1 | wet Laboratories

2 | Dry Laboratories

3 | Breakout Space

4 | Imaging

5 | Nursing Station

6 | In-Patient Bed ward

7 | Storage

8 | Conference/Multipurpose Space

9 | Roof Top Terrace

12 | Enclosed Courtyard

13 | Circulation Ramp

14 | Open Courtyard

figure 53. View of In-Patient Room

figure 54. View of a laboratory space

figure 55. Exploded Axonometric

Research Patient Accommodations

It is noteworthy to draw attention to the building on the top left corner of the aerial map (fig. 56). This is the Rotel, a non-for profit motel facility serving research patients and their families from out of town or province. It is situated across from the Children's Hospital of Eastern Ontario (CHEO), creating a large disconnect from the current MS Clinic and Research Centre located at the General Hospital. The Rotel resembles a cheap motel, where each room has either one or two large beds, a bathroom, and a small seating area. The spaces are not comforting and may cause stress responses to occupants. Patients entering research trials may have to undergo intensive and high-risk procedures. Multiple Sclerosis is already an unpredictable disease, and the anticipation of such procedures may stir

feelings of anxiety and fear. Hence, spaces must be designed to help alleviate negative feelings prior to entering to a research trial that has unknown disease response outcomes. Though this thesis does not indicate a fully designed program for research patient accommodations, it is noteworthy that the site does allude to the prospect for future developments along the south side (refer back to figure. 41 site plan). Maintaining close proximity to the new clinic and research centre is more convenient and offers a sensitivity to patients who are less mobile. Looking forward, the program of each unit will simulate individual apartments, allowing patients to claim their space for the period of their stay and feel as an integral part of the community.

figure 56. Ariel view of context + site noting the Rotel and TOH on the top left

Sections|

figure 57. Section A-A

figure 58. Section B-B

Elevations|

figure 59. West + North Elevations

4.0 | Conclusions

This thesis sought to explore and investigate the current world wide focus on modern disease epidemics, particularly the epidemic of neurological diseases such as Multiple Sclerosis. With the transformation in global healthcare, attention was placed on how the built environment has enormous influence on overall occupant well-being, especially within healthcare facilities. Marco Frascari stated in his *Eleven Exercises in the Art of Architectural Drawing*, “We make architecture, but architecture makes us” (Frascari, 66). Though research on the science of how architecture affects the human mind and body needs to be further investigated, it is conclusive that the built environment is associated with affecting health and wellbeing on a cellular and molecular level. It is crucial to understand that the mind and body, individual and the environment have reciprocal relationships. Architecture has the potential to be a platform that unifies these elements as a means of enriching human individuals and environmental fields to enhance occupant health and well-being.

On a global scale, Canada has the highest prevalence of individuals affected with Multiple Sclerosis. Yet, with the stacking numbers, there are few facilities nationwide to support the treatment and research of patients affected by this chronic disease. Based on the analysis of existing research on neuroscience, hospital architecture, as well as the symbiosis between conventional and holistic medicine, this thesis

proposed a project that asserts itself as a National Centre for MS research, treatment, and recovery in Ottawa.

The site, Lynda Park, was specifically chosen for the facility to be in relation with nature, yet in close proximity to the Ottawa hospital General Campus. Three guiding principles shaped the execution of the project. Firstly, to ensure that awareness is drawn towards the profound impact MS has on Canadians, as well as the profound discoveries Canadian scientists, doctors, and other health practitioners have completed in disease treatment and reversal. Secondly, the design idea suggests a facility in which patients, staff, and visitors enter into a place of well-being that is guided by a contemplative experience, rather than entering into a machine-like hospital dominated by diagnostic and disease treating technologies. The program is divided into two levels, housing treatment and wellness spaces on the ground level, as well as research and discover spaces on the second level. Lastly, the notion of therapeutic walking and meandering was of crucial importance since mobility may be a source of anxiety for some patients, depending on their disease progression. A designated walking area, emphasized in plan by its rounded geometry, is designed to provide an uplifting space for patients to embark on their walking journey. The track is compartmentalized by a series of moments, indicating a milestone achievement for the distance travelled. The test may be difficult for some patients; thus,

the space is designed to be less test like and more of a meditative experience that helps alleviate anxiety. By having an MS research and treatment facility embedded within the community allows for a sense of inclusion for patients, making a space for them to retreat and garner the support and treatment required to manage their disease.

The image of a hospital as the principal place for health and cure-all place is outdated. Therapeutic architecture is emerging as places for well-being in which the relationship of the individual to the environment is becoming the center of design strategies. Both architecture and medicine have scientific components in practice, however, they are ultimately moral practices in which architects and physicians must exercise a duty of care to the public. Architects have the unbounded potential to shape spaces that influence the mind and body. Instead of providing healthcare spaces that solely administer drugs and specialist treatments, the response should be the development of design strategies in response to environmental and human health concerns, aiming to satisfy patient and staff needs for overall well-being.

Endnotes

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Appendix One

History of Architecture + Health

Appendix Two

Design Process

Conceptualizing a meandering experience
sketched by: Cristina Ranalli

Reconstructing spaces, the free open plan
sketched by: Cristina Ranalli

Sketch of walking test
corridor perspective + plan
by: Cristina Ranalli

Collage/sketch of patient performing 500 m walking test

by: Cristina Ranalli

Sketch of circulation with courtyard views perspective + plan
by: Cristina Ranalli

Collage/sketch of circulation with courtyard views

by: Cristina Ranalli

Sketch of day patient room plan + perspective
by: Cristina Ranalli

Collage/sketch of day patient room
by: Cristina Ranalli

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CERTIFICATION OF INSTITUTIONAL ETHICS CLEARANCE

The Carleton University Research Ethics Board-B (CUREB-B) has granted ethics clearance for the changes to protocol to research project described below and research may now proceed.

CUREB-B is constituted and operates in compliance with the *Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans* (TCPS2).

Ethics Clearance ID: Project # 106042

Principal Investigator: Federica Goffi

Co-Investigator(s) (If applicable): **Federica Goffi (Primary Investigator)**
 Cristina Ranalli (Student - MA student)

Project Title: Making Space for the EASE of Multiple Sclerosis Treatment and Research [Cristina Ranalli]

Funding Source:

Effective: **April 28, 2017**

Expires: **January 31, 2018.**

Please email the Research Compliance Coordinators at ethics@carleton.ca if you have any questions or if you require a clearance certificate with a signature.

CLEARED BY:

Date: April 28, 2017

Andy Adler, PhD, Chair, CUREB-B

figure 60. Collage: Portal to Peace illustrated by Cristina Ranalli