

Healing through Architecture

by

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AUTHOR'S DECLARATION

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

ABSTRACT

How can spaces operate as active ingredients in the healing process to maximize the body's healing potential?

Numerous studies show evidence of the body's ability to "self-heal" when put into positive healing environments. This healing is enabled by the ability of the body to 'tap into our internal pharmacies' by activating the body's powerful neurochemicals such as endorphins.¹

The terms curing and healing are often used interchangeably but have distinct definitions. The term *curing* refers to the relief of the symptoms of a disease or condition. The term *healing* refers to the alleviation of a person's distress or anguish. In order to fully take advantage of the body's *healing* potential, environments hold the ability to stimulate the senses and become active healers themselves. This helps minimize negative effects of stress on the body, guiding a positive physical and psychological response to environments in ways that maximize the effectiveness of crucial medical treatments and procedures. In order to take advantage of the body's healing pharmacies, environments must prevent the body from weakening due to stress.

Stress is the body's biggest obstacle in healing, and many contemporary hospitals inflict so much stress on patients that it actually slows down healing, counteracting the medications and treatments patients receive. One of the

body's most effective ways of healing is through the means of releasing endorphins which can reduce pain and swelling, lead to feelings of euphoria, modulate appetite, and enhance the immune system's response. Endorphins are natural, not addictive (unlike many drugs) and often have the same effect as traditional drugs such as morphine and codeine.

This thesis explores the relationship between environments and the chemical reactions in the body that enable healing. The research reviews several healing spaces, comparing traditional healing spaces with contemporary ones, analyzing both positive and negative examples in terms of the architecture's ability to help augment healing. The research reviews the focus patient in cancer treatment, investigating their specific challenges and then finally introduces the site, Grand River Hospital in Kitchener, Ontario, in which the design development is situated. The proposed design interventions focus on how architecture can have a positive impact on patients receiving chemotherapy. In order to realistically move towards fully realized wellness, hospitals need to take a holistic approach to treat a patient's physical illnesses, psychological health, emotional hardships, and physiological response. "Ultimately it is the senses that need to be revitalized as it is an integral part of healing."²

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2) "Grandnm". "Healing Architecture." Scribd., last modified Apr 8, 2014, accessed Sept 24, 2014, <http://www.scribd.com/doc/216951537/HealingArchitecture>.

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I love you, Mom, my Angel.

Dedicated in loving memory to my amazing Mother

Sue Beggs

April 29, 1954

November 11, 2014



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Illustration by author. Information from:
"Average Weather for Toronto, Ontario, Canada." Weather Spark., accessed June 1, 2015,
<https://weatherspark.com/averages/28179/TorontoOntarioCanada>.

“ *If place can make you happy,
can it also make you well?* ”

Esther Sternberg



PART I: INTRODUCTION
Introducing thesis focus and design development goals

How can the architecture of healing space become an integral part of healing itself?

How can architecture have an active role in the healing process?

“Architecture has its own realm. It has a special physical relationship with life. I do not think of it primarily as either a message or a symbol, but as an envelope and background for life, which goes on, in and around it, a sensitive container for the rhythm of footsteps on the floor, for the concentration of work, for the silence of sleep.”¹

Spaces are good mediums for affecting emotions. In places where intense emotions run high, materials, sounds, smells, light, and colour have an enormous influence on how people perceive themselves and cope with their situations. In hospital healing spaces, the patient’s experience is often undervalued, overlooked by the functions and operations of the medical treatments and busy schedules.

The human body has an incredible ability to “self-heal” when put into positive healing environments. This healing is enabled by the ability of the body to ‘tap into our internal pharmacies’ by responding to the spaces around them.² One of the body’s most effective ways of healing is through means of releasing chemicals in the brain such as endorphins (dopamine) which have the ability to reduce pain and swelling, lead to feelings of euphoria, modulate appetite, and enhance the immune response. Certain elements in environments such as colour, light, and natural landscapes can contribute to the body’s ability to self-heal. This can

1) Zumthor, Peter*: Thinking Architecture, Boston: Basel, 1999.

*Peter Zumthor is a Swiss architect and winner of the 2009 Pritzker Prize and 2013 RIBA Royal Gold Medal.

2) Sternberg, Esther**, and Tippett, Krista. Esther Sternberg. The science of healing places. In On Being [database online]. 2013 [cited Sept 17 2014]. Available from <http://www.onbeing.org/program/the-scienceofhealingplaces/4856/audio?embed=1>.

**Esther Sternberg is an expert in neural-immune science.



increase one's chances of healing faster. Many contemporary healing spaces have become so function-oriented that they lack many of these aspects in their design. The following thesis focuses on cancer patients and the specific challenges they face from the built environment while in treatment and how architecture can help augment their healing.

HEAL VS. CURE

There is a distinction between the terms "heal" and "cure" although the two terms are often used interchangeably. *Healing* refers to alleviating a person's distress or anguish. *Curing* is the relief of the symptoms of a disease or condition. *Healing* encompasses alleviating emotional stress, improving the ability to cope and establishing a positive state of mind. One can heal without being cured, which is to say one can move through a healing process while still being affected by a disease. Healing may include acceptance by coming to terms with a life you may soon be leaving.³ "Healing may not be so much about getting better, as about letting go of everything that isn't you – all of the expectations, all of the beliefs – and becoming who you are. Not a better you, but a realer you."⁴ In terms of the healing of patients affected by cancer, architecture is an element with great potential to augment healing through the built environment.

3) Moyers, Bill. 1993. "Wounded Healers." *Parabola, the Magazine of Myth and Tradition*, 22.
4) Ibid. Page 28.

STRESS

Stress is often a large hurdle to handle when coping with a life threatening disease such as cancer. Stress is defined as the wear and tear on the body as it tries to deal with environmental stressors. The initial phase of a stress reaction is the alarm reaction. This is where the body begins to gather its defense mechanisms. The body typically experiences a *stress reaction*, essentially shutting down any systems that are not essential in the "fight-or-flight" mode and debilitates the immune system by releasing stress hormones.⁵ Long-term exposure to stress reduces the body's ability to fight diseases, infections, and mental illnesses such as depression. Hormones released during stress also directly take part in the development of degenerative diseases such as brain hemorrhages, kidney failure, peptic ulcers, and cancer, among others. Often people will experience a *stress reaction* where their body is weakened due to their body operating in a fight-or-flight mode, but this can be avoided by coping with stress in a positive way by having a *stress response* instead of a *stress reaction*. A *stress response* is an adaptive, healthy set of coping strategies. This will help one steer away from automatic reactions and maladaptive coping strategies.⁶ This is especially important for patients dealing with a disease like cancer which requires long-term treatment and recovery. Many people go to hospitals with extreme emotions such as fear, anxiety, and frustration. In many cases, one feeling

5) Malkin, Jain. 1992. Creating a healing environment. In *Hospital Interior Architecture*, 13-17.
6) Kabat-Zinn, Jon. 1990. "On Healing." Chap. 13, In *Full Catastrophe Living*, 264. New York, NY: Dell Publishing.

threatened may actually have more to do with one's state of mind on the situation more than the triggering of the event itself.⁷ The body has natural abilities reduce stress through the means of brain pharmaceuticals.

BRAIN PHARMACEUTICALS

One of the body's most effective ways of healing is through means of releasing chemicals in the brain such as endorphins (dopamine) which have the ability to reduce pain and swelling, lead to feelings of euphoria, modulate appetite, and enhance the immune response. Endorphins are natural and not addictive, unlike many drugs, and often have the same effect as traditional drugs such as morphine and codeine. These chemicals can be considered "brain pharmaceuticals," an integral part of the body's internal pharmacies.⁸ Stress is the body's biggest obstacle in terms of healing and brain pharmaceuticals can reduce stress, making healing more manageable. Holistic healing encompasses care of the mind and body which is crucial for optimal healing.

HOLISTIC HEALING

Patients are often treated as the *site of an illness*, and the person's emotional health is not taken into consideration. The description of a person with an illness goes further to represent the person as a whole who is going through an experience involving a disease. Holistic healing encompasses healing of both the body and the mind (including the

7) Kabat-Zinn, Jon. 1990. "On Healing." Chap. 13, In *Full Catastrophe Living*, 267. New York, NY: Dell Publishing.
8) Sternberg, Esther, and Tippett, Krista. Esther Sternberg. The science of healing places. In On Being [database online]. 2013 [cited Sept 17 2014]. Available from <http://www.onbeing.org/program/the-scienceofhealingplaces/4856/audio?embed=1>.

spirit) simultaneously. This approach views the patient as a whole person, not limiting healing methods to only the physical conditions. Brain pharmaceuticals have the ability to help rehabilitate a patient's physical and emotional health.

ENVIRONMENTS OF HEALING

The placebo effect is known as a "fake treatment" that does not hold any active substances itself. It helps the body heal simply by the mind's expectation that it will heal, and the brain then releases endorphins. Placebos can ultimately reduce swelling and pain, minimizing stress, which makes the body better able to receive medical treatments. Charles Jencks, designer of the Maggie's Centres (see Fig. 1.1) believes in the *architectural placebo effect*, and through his work shows the importance of environments of healing. Architecture has the power to indirectly boost the immune system.⁹ He used this philosophy to guide his design of the Maggie's Centres, a series of retreat centres for people dealing with cancer. There, people receive practical and social support for dealing with cancer in an environment that supports their emotional needs. William James, an American philosopher and psychologist, believed "the greatest revolution in our generation is the discovery that human beings, by changing the inner attitudes of their minds, can change the outer aspects of their lives."¹⁰

9) Rose, Steve. "Maggie's Centres: Can Architecture Cure Cancer?" The Guardian, accessed June 20, 2015, <http://www.theguardian.com/artanddesign/2010/may/06/maggiescentrescancerarchitecture>.
10) Levitt, Andrew. 2015. *The Inner Studio*. A Designers Guide to the Resources of the Psyche. Arch 641 Lecture.





FIG. 1.1. The first Maggie's Centre was built in Edinburgh and opened in 1996, designed by Charles Jencks.

POWER OF NATURAL LANDSCAPES

Natural landscapes play an enormous role in the design of the Maggie's Centres. Plants and natural landscapes have shown to have a powerful impact on people who are ill by creating soothing healing environments. A study performed by Roger Ulrich¹¹ found that a view of a park outside a patient's window helped patients recover faster, requiring less pain medication compared to patients who

viewed a brick wall.¹² Plants and elements of nature represent healing, growth, and hope. They offer an attitude of the mind. A plant can be a representation of how we can feel and how we can change how we see ourselves.

CANCER PATIENTS

Cancer patients bring very specific challenges to the hospital, such as severe fatigue, fear, and emotional vulnerability. Fatigue is one

of the biggest obstacles to overcome while undergoing chemotherapy. There is much anxiety and fear associated with the diagnosis of cancer, and often treatment plans are unclear and uncertain of the outcome. Cancer patients tend to spend a lot of time at the hospital for different treatments, procedures, and tests. The environments in which they are placed greatly affect their healing potential.

In order to realistically move towards fully realized wellness, hospitals need to take a holistic approach to treat a patient's physical illnesses, psychological health, emotional hardships, and physiological responses by considering the environments patients inhabit. Medical treatments and procedures need to operate in union with architecture; both have a vast impact on a patient's treatment and recovery of the mind and body. Healing is separate from the cure of an illness; it is important to recognize the value of healing and coping with stress in a positive way. The power of the mind has an incredible influence on one's ability to heal. Therefore, hospitals must leverage the healing possibilities that architecture can contribute to the environment. This will help produce the most advantageous opportunities for creating healing spaces, pushing architecture to hold an active part in the healing process.

"If a work of architecture consists of forms and contents which combine to create a strong fundamental mood that is powerful enough to affect us, it may possess the qualities of a work of art. This art has, however, nothing to do with interesting configurations or originality. It is concerned with insights and understandings, and above all with truth."¹³

11) Roger Ulrich was the co-founding Director at the Centre for Health Systems and Design at Texas A&M University.

12) Ulrich, Roger S. Effects of Healthcare Environmental Design on Medical Outcomes.

13) Zumthor, Peter: Thinking Architecture, Boston: Basel, 1999



THESIS STRUCTURE

PART I: INTRODUCTION

Healing through Architecture explores how the architecture of a healing space can become an integral part of healing itself and how it can have an active role in the healing process. Part I introduces the terms of healing and curing and defines the critical differences for setting up a framework to consider the following research. This thesis focuses on healing, recognizing the differing roles and potentials between medical doctors and architecture.

PART II: STRESS

Part II defines what stress is and examines what it specifically does to the body. This part addresses when and why a *stress reaction* takes place and why it is important to take preventative measures to prevent this *stress reaction* and channel a more positive and more productive *stress response*.

PART III: BRAIN PHARMACEUTICALS

Part III examines the different brain pharmaceuticals the body uses when responding to different environmental conditions, including stressful ones. Here, the thesis examines some key precedent projects to demonstrate the effects of different elements on the body, including Spilt Time Café (Philip Rahm) and the Japanese concept of Forest Bathing (Shinrin Yoku). The research presents the major influences that environmental elements can have on one's body and one's psychological state, including

colour, light, views, scents, etc. This part also explores the importance of holistic healing; treating the patient as a whole person, and not as the *site* of a disease. By stimulating certain brain pharmaceuticals, the power of the mind has much potential in healing.

PART IV: HEALING ENVIRONMENTS

Hospital environments play a crucial part in one's healing. Part IV compares traditional hospitals built in the 1800's with contemporary hospitals built Post-WWII and examines why a shift in design approach took place. Traditional hospitals typically had a high emphasis on incorporating natural healing into their designs, while contemporary hospitals are generally more function-oriented. Holistic healing is further discussed regarding the potential placebo effect relating to natural landscapes.

PART V: CANCER PATIENT

So far the thesis has discussed the effects of stress, the role of brain pharmaceuticals, the importance of holistic healing, and the role environments play in holistic healing. Part V reviews the focus patient undergoing chemotherapy and investigates the specific challenges one faces with cancer treatment.

PART VI: DESIGN SITE

The thesis has reviewed a variety of healing spaces, many of which showed positive health impacts. Part VI now presents the space where the design proposals take place

for cancer patients: the chemotherapy suite at Grand River Regional Cancer Centre. The design proposals aim to test a variety of strategies to address these questions:

- How can architecture of a healing space become an integral part of healing itself?
- How can architecture have an active role in the healing process?

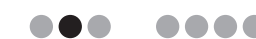
PART VII: DESIGN DEVELOPMENT

After examining many types of healing spaces and the site of intervention, this final part explores the design development and intervention proposals which aim to address the challenges of the chemotherapy suite, discussed in Part V and VI. The designs seek to help augment healing through environmental elements, by supporting the body's natural abilities to release immune-boosting brain pharmaceuticals. Assessments are conducted to evaluate the success of the designs, including their strengths and weaknesses. Additional spaces outside the chemotherapy suite are also examined to explore how these design systems can be integrated throughout a hospital.





PART II: EFFECTS OF STRESS
Effects of stress on the body

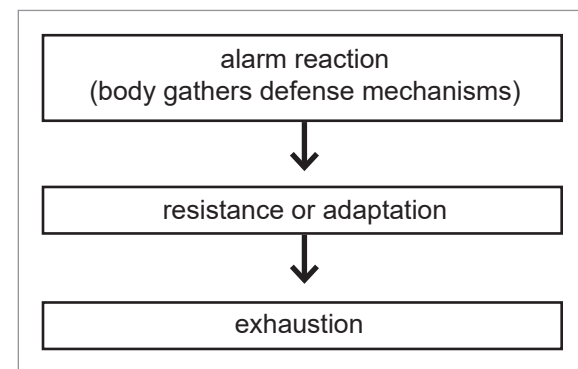


STRESS

A visit to the hospital could be more frightening than the ailment that brought one there to begin with. This has a lot to do with stress.

“People go to hospital in the hope of feeling better. But if patients are welcomed into a forbidding, institutional room with a strange bed, fluorescent lights and cold hard floor, what then?”¹ asks Michael Swan of The Catholic Register. Hospitals tend to do a very good job of making people feel worse before they feel better.

Many healthcare facilities inflict high levels of stress on patients, visitors, and staff members. What exactly is stress and why does it happen? Stress can be one of the most aggregating factors when people are dealing with illnesses. Stress is not so much an external factor, but rather it refers to the wear and tear on the body as it attempts to deal with environmental stressors.



ILL. 2.1. Alarm Reaction

Stress puts the body into a “*fight-or-flight*” mode, shutting off all systems unnecessary for the immediate potential danger.

The initial phase of a stress reaction is the *alarm reaction* where the body gathers its defense mechanisms. Next, the body either experiences *resistance or adaptation* to the situation and after some time the body experiences *exhaustion* as it wears down² (see Ill. 2.1).

Stress reaches two biological systems: the endocrine and the nervous systems. When under stress the body releases adrenocorticotrophic hormone (ACTH), a stress hormone, which stimulates the adrenal cortex to kill white blood cells which control allergic reactions and hypersensitivity. Essentially, stress *debilitates the immune system*. Long-term exposure to stress reduces the body’s ability to fight diseases, infections, and mental illnesses such as depression. Hormones released during stress also directly take part in the development of degenerative conditions and diseases including:

- brain hemorrhage
- hardening of arteries
- coronary thrombosis
- kidney failure
- peptic ulcers
- arthritis
- **cancer**

COPING WITH STRESS

One will often experience a stress reaction where the body is weakened from operating in a fight-or-flight mode, but this can be avoided by coping with stress in a positive way by having a *stress response* instead of a *stress reaction*. A stress response is an adaptive, healthy set of coping strategies. Mindfulness is one of the positive ways to recognize moment-to-moment awareness of oneself and one’s reactions to help maintain control on the flow of events that happen within the body during stress. This will help one steer away from automatic reactions and maladaptive coping strategies.³ Having mindful awareness is the start of gaining control of the situation. By the mind being conscious in the present, one is better able to recognize the thoughts, feelings, and sensations being experienced. Such self-awareness can result in inner calmness, acceptance, and openness. In many cases, one feeling threatened may actually have more to do with one’s state of mind about the situation than the triggering of the event itself.⁴ Jain Malkin⁵ argues that it is absolutely necessary to treat the mind and body simultaneously, as they both directly affect each other.⁶

“Stress exacerbates every known clinical condition”

- Roger Ulrich

THE WANDERING MIND

Living in the moment is crucial in order to fully cope with stress. It has been found through a study done at Harvard University in 2010 by Killingsworth and Gilbert that people who are depressed live in the past, thinking about what has already happened.⁸ Anxious people live in the future worrying about what may happen. The happiest people live in the current moment. It is estimated that 47% of our time is not spent in the present.⁹ “A human mind is a wandering mind, and a wandering mind is an unhappy mind. The ability to think about what is not happening is a cognitive achievement that comes at an emotional cost.”¹⁰ Patients receiving chemotherapy often live in the past, worrying about recent diagnosis and news on their treatments. They also live in the future worrying about upcoming treatments, possible symptoms, and potential negative outcomes. Some of the common worries of chemotherapy patients include those about money and possible time off work to attend hospital appointments. They worry about how to get home and what to make for dinner that night, new medications and how they will feel after taking them, and what to do if something goes wrong at home or at the hospital. In order to eliminate most of this anguish, it is important that they avoid worrying about things they cannot control, but rather think in the present moment to help with relaxation, cultivate mindfulness, and encourage happiness.

4) Ibid. Page 267.

5) Jain Malkin is the President of Jain Malkin Inc. and author of Hospital Interior Architecture.

6) Malkin, Jain. 1992. Creating a Healing Environment. In *Hospital Interior Architecture*, 13-17.

7) Hamilton, Kirk. 2010. “Role of Design in *Creating Therapeutic Environments*.” Chap. 10.4, In *Design for Critical Care*, 251. Burlington, MA: Elsevier Ltd.

8) Levitt, Andrew. 2015. *The Inner Studio*. A Designers Guide to the Resources of the Psyche. Arch 641 Lecture.

9) Ibid.

10) “Mind is a Frequent, but Not Happy Wanderer: People spend nearly half their waking hours thinking about what isn’t going on around them.” 2010.

1) Swan, Michael. 2015. “Bringing the Human Back into Hospital Design.” Catholic Register, 14 June 2015, 16.

2) Malkin, Jain. 1992. Creating a Healing Environment. In *Hospital Interior Architecture*, 13-17.

3) Kabat-Zinn, Jon. 1990. “On Healing.” Chap. 13, In *Full Catastrophe Living*, 264. New York, NY: Dell Publishing.



POORLY DESIGNED SPACES

IMPORTANCE OF DESIGNING WITH THE PATIENT IN MIND

Happiness requires a particular state of mind. Stress has an enormous impact on happiness and one's ability to heal and stay positive. The design of a healthcare facility is not only important for function and efficiency, but also has a vast impact on patients' well-being and ability to cope with stress. Many times patients walking into hospitals become stressed due to the stark-bright, white lights, cold floors, and hard walls along with the confusing way-finding.

Sarah Tan explains her experience accompanying her mother to her first oncology appointment. "Moving from room to room in the building was confusing, and long waiting periods weren't alleviated by soulless and crowded waiting areas" she describes. "Every time I go, I feel sick myself."¹¹

It's no wonder that people feel more sick the longer they spend in these depressing environments (see Fig. 2.1). When there is a lack of humble, human interactions and spaces to facilitate this energy, staff, doctors, patients, and visitors all become less able to cope properly with the stress they experience in these spaces. This is completely counter-intuitive to the whole purpose of a hospital, which is to help people who are ill, feel better. What hospitals tend to do is make people feel a lot worse before they feel better.



FIG. 2.1. Canadian emergency waiting rooms become uncomfortable and crowded.

Often, large hospitals will be programmed like a well-tuned machine in terms of how they register, process, and treat people. Registration staff, nurses, and doctors see so many people on a daily basis that the special attention and care for each individual patient is lost, which is what people so desperately crave, especially in a time of dire need.

My mother, Sue Beggs, was treated at the Odette Cancer Centre at Sunnybrook Hospital for approximately seven weeks in 2013. While I was impressed with the large triple-height atrium waiting space and the bright light that shone through the south-facing glazing, my Mom felt very differently about that space. I, as a healthy visitor supporting my Mom, was reminded of a large shopping mall in the way the space was designed. To me, this was relaxing and comforting. But I was not the patient. My Mom, on the other

hand, like many other patients, was tired, weak, and anxious. A large busy atrium was the last place she felt like spending time in. With so many radiation oncology machines, there were close to 50 people waiting in the atrium at one time, in addition to all the staff and others using that space to walk from one end of the hospital to the other. The Druxy's Deli is also located in the atrium, bringing people with lots of conversation to the already loud environment. Despite my positive first impression of the space, my Mom said she always "felt like a number, as though I am on an assembly line with no personal care."

OUTDOOR SPACES

Author Liliana Holtzman writes in her blog about the importance of having outdoor healing spaces in addition to soothing, indoor healing spaces: "After my treatments and surgeries for breast cancer I spent a lot of time in a hospital. Lying in an ugly, impersonal, noisy room I longed for beauty, color, quiet. But more than anything else, I longed for fresh air. The hospital had no balconies, gardens or outdoor spaces. I lay in my room looking at a closed window with a view of the parking lot imagining that I was sitting on a shady bench in a pretty garden."¹² Holtzman describes how outdoor healing spaces impacted her mother who faced Alzheimer's Disease while in a nursing home. Battling the disease, her mother didn't know who she was and didn't recognize family members. With her disease getting progressively worse, there

were hardly any more pleasures in life left to enjoy. Remembering how much she longed to be outdoors herself while in the hospital, Holtzman would take her mother for a walk everyday, and, although her Mom couldn't even remember who she was, she was still able to appreciate the sun and fresh air.¹³

When Holtzman asked the nursing home staff about the home's green space, she was told that staff were too busy to take residents outside. Knowing the positive impact a walk had on her mother, Holtzman volunteered to take other patients for walks in the green space. Holtzman describes her observations as she watched the nursing home residents explore the outdoors. "I will never forget as men and women slowly ventured outside through that open door. Alzheimer's Disease robs patients of smiling and displays of emotion but these people demonstrated their joy in other ways. Some walked around in wonder, stepping on shadows or looking at the sunlight. Some sat on the ground, delicately caressing blades of grass. Some held hands. Everyone was quiet." Holtzman was later told by the nurses that it was the quietest night the home had seen in a very long time. "Tired out from walking and breathing fresh air, the patients slept peacefully through the night" Holtzman related.¹⁴ Relaxing the mind is important for patients' well-being and good health.

11) Ong, Iiyas. "Healing Spaces." *Going Places.*, accessed May 2, 2015, <http://www.goingplacessingapore.sg/design/2014/HealingSpaces.aspx>.

12) Holtzman, Liliana. "Healing Spaces." *Gracious Living, Day by Day.*, accessed 4 May, 2015, <http://graciouslivingdaybyday.com/2013/01/14/calmspaces/>.

13) Ibid.
14) Ibid.



LIMITS TO MEDICINE

DEFINITION OF HEALTH

“Health is a state of complete physical, mental and social well-being, and not merely the absence of disease or infirmity.”¹⁵ At the stress reduction clinic at the University of Massachusetts Medical Center, healing is described as the experience of undergoing a profound transformation of view. Healing creates a sense of control over a situation from feeling helpless and pessimistic to a sense of acceptance and inner peace. “Healing is always a unique and deeply personal experience.”¹⁶

IATROGENIC DISEASES

Iatrogenic diseases, illnesses caused by a medication or physician, are of growing concern. “Medicalization frequently causes more harm than good.”¹⁷ The number of deaths caused from iatrogenic illnesses top deaths caused from heart disease and cancer. Over a 10-year project, numbers of deaths of iatrogenic illnesses (7.8 million) will surpass the number of American soldier deaths.¹⁸ Medicine causes the most illnesses through:

- medical technology
- diagnostic testing
- overuse of medical procedures
- **overuse of pharmaceutical drugs**

Patients need hospital environments to work with their individual needs when they are sick to maximize healing potential. Pregnant women have similar needs when it comes to personalized care during childbirth.

“PREGNANT IN AMERICA” DOCUMENTARY¹⁹ (SUMMARY)

In an online documentary filmed in the United States in 2008, married and expecting couple Steve and Mandy Buonaugurio explore the benefits and risks of giving birth at home rather than in a hospital. Although the norm today in the U.S. is to give birth at a hospital, they discover that the hospital’s way of moving a woman through childbirth in several ways goes against the natural process. They visited The Netherlands which has the highest home-birth rate in the western world and interviewed women about their experience with home births.

Hospitals tend to induce more stress in mothers, which can be dangerous for both mother and baby. Hospitals also contain a lot of air-borne illnesses and bacteria. The home is very calming; the family knows where everything is and has comforting personal belongings around them. Giving birth at home also allows the mother to choose the position and location in which she would like to give birth. It puts the mother in control of her own child’s birth. Some women choose birthing pools, or to sit, or to lie down. Many North American hospitals on the other hand are very inflexible with the way they allow mothers to give birth; they are designed to make the doctors’ work easier. In Germany, birthing centres offer many options for mothers to give birth (see Fig 2.2 & 2.3). “Some women like to be in a wide room, they



FIG. 2.2. Woman demonstrating different positions women can choose to use while giving birth to suit their own comfort in Germany. This physically and psychologically helps the mother through a comfortable birthing process.

need space with air and light, and there are other women who want it nice and cozy. If you let a woman move the way she feels like it (sic) she will find the position for herself that hurts her less and where she feels the baby moving well” says the Director of the Women’s Birth Center at Burger Hospital in Frankfurt, Germany. The typical North American birthing position of a woman lying on her back with her legs bent up to her arms creates a sharp turn for the baby to make around the pelvic bone. This can create more pain, stress, and possible complications for the mother and baby.

North American hospitals are also known for their heavy use of pain medications for child birth, specifically the epidural. The typical debate is *when* a woman should get her epidural, rather than *if* she will get one.



FIG. 2.3. Woman demonstrating different positions women can choose to use while giving birth to suit their own comfort in Germany. This physically and psychologically helps the mother through a comfortable birthing process.

The mother and baby are meant to work together during childbirth, yet the epidural drug impairs both parties. Dr. Michel Odent explains that, while giving birth, women are meant to release a natural, yet complex, flow of hormones, the main one being oxytocin as well as endorphins. Immediately following the birth, the mother experiences a rush of oxytocin, which is critical for the mother-baby bond. The epidural not only limits this effect but also has many negative health risks associated with it and has been linked to teenage drug use and suicide.

It is through physical comfort and having considerable control that mothers have the most comfortable birth possible. Hospitals can feel more like home by incorporating these concepts into their designs.

15) Awofeso, Niyi. “ReDefining ‘Health’.” World Health Organization. WHO, accessed 06 June, 2015, http://www.who.int/bulletin/bulletin_board/83/ustun11051/en/.

16) Kabat-Zinn, Jon. 1990. “On Healing.” Chap. 13, *In Full Catastrophe Living*, 168. New York, NY: Dell Publishing.

17) Riversong, Robert. Death by medicine. [cited Nov 1 2014]. Available from <http://riversong.wordpress.com/deathbymedicine/>

18) Ibid.

19) Pregnant in America. YouTube. Directed by Steve Buonaugurio and Mandy Buonaugurio. 2008. Accessed 03 November 2014, <https://www.youtube.com/watch?v=yEeYSMmJrw8>.



REDUCING STRESS IN HEALING SPACES

THEORY OF SUPPORTIVE DESIGN

Fostering comfort and control reduces stress, a critical factor in healing spaces because stress has a variety of detrimental psychological, physical, and behavioural effects.²⁰ Dr. Roger S. Ulrich has done extensive research on the importance of eliminating stress in healing spaces and argues the importance of eliminating stress in order to improve health outcomes. He developed guidelines for improving health environments in his Theory of Supportive Design (below).

1 - FOSTER CONTROL, INCLUDING PRIVACY

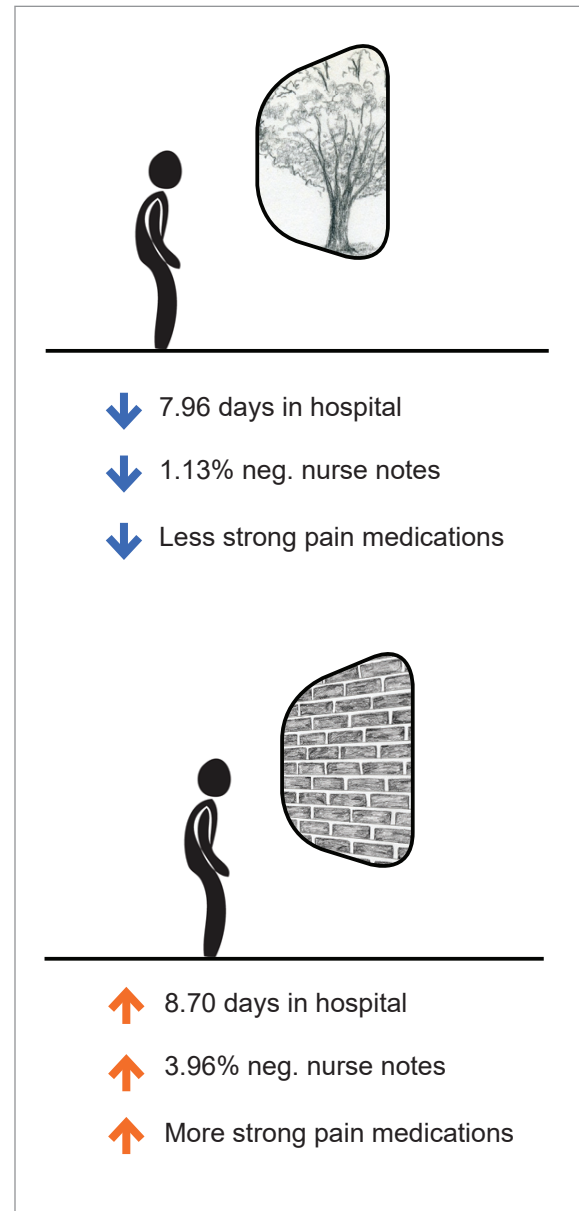
Providing actual or perceived control over stressors can help alleviate stress, including giving a patient control over light dimmers and privacy, providing personal choice of music, control over TV, and easy way-finding signs.

2 - PROMOTE SOCIAL SUPPORT

Studies show that social support helps mitigate stress and improve recovery rates. To encourage the presence of family and friends, hospitals can offer plenty of comfortable seating, access to food, telephones, overnight accommodations, and internet access.

3 - PROVIDE ACCESS TO NATURE

Studies have shown that viewing certain types of nature can significantly relieve stress, within five minutes or less, by lowering blood pressure and reducing heart rates.

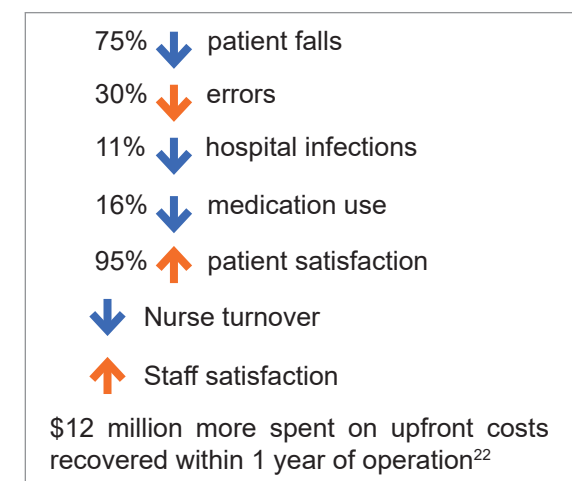


ILL. 2.2. View through a window may influence recovery from surgery [1984 study of patients recovering from gall bladder surgery].

VIEW THROUGH A WINDOW MAY INFLUENCE RECOVERY FROM SURGERY

Dr. Roger S. Ulrich performed a very influential study in 1984²¹ that examined the recovery outcomes between patient groups recovering from gall bladder surgery (see Ill. 2.2). Half of the group had a view of a park outside their window, and the other half saw a brick wall. The view of a park had very positive effects on the patients. They showed the need for less pain medication; they had less negative nurses' notes and, on average, were discharged a day sooner than the group with a brick wall outside their window. Viewing plants had a big influence on the body's healing process.

HEALTH BENEFITS IN BETTER HOSPITAL DESIGN



ILL. 2.3. Robert Wood Johnson Foundation report (2003) shows the benefits of "Better Hospital Design."

VIEWS OF NATURE

Dr. Roger S. Ulrich was a very influential figure in the movement to research the environment of healing spaces. Many other studies have also found that "seeing nature" helps to decrease the number and severity of negative health conditions. "Reducing stress, and distracting patients from their internal focus or their obsession on their own pain, reduces the pain," says Ulrich.²³

This result was shown in an experiment where post-heart surgery patients were bedridden and showed positive results when they viewed coloured pictures. Those patients who had an image of a nature scene with trees and water needed less pain medication compared to the patients who viewed an abstract image, or no image at all.²⁴

It is extremely important to reduce stressful conditions in hospitals in order to help reduce patient stress and promote sleep. Lack of good quality sleep has been shown to cause increased stress, impaired immune function, and difficulties with temperature regulation.²⁵

Stress reduction not only improves the patients' well-being, but also the staff's ability to handle stresses of work and even sleep better when they are home (see Ill. 2.3). "Less noise and better-lit environments also reduce clinician error."²⁶

20) Ulrich, Roger S. Effects of Healthcare Environmental Design on Medical Outcomes.

21) Ulrich, Roger S. Effects of Healthcare Environmental Design on Medical Outcomes.

22) Sternberg, Esther, and Tippet, Krista. Esther sternberg the science of healing places. in On Being [database online]. 2013 [cited Sept 17 2014]. Available from <http://www.onbeing.org/program/thescienceofhealingplaces/4856/audio?embed=1>.

23) Maddox, Lucy. "Can the Design of Hospitals Help Patients Recover Faster?" Gizmodo., last modified 25 November, accessed 09 December, 2014, <http://gizmodo.com/canthedesignof-hospitalshelppatientsrecoverfaste-1663083331>.

24) Ibid.

25) Ibid.

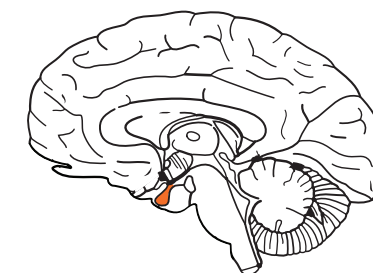
26) Ibid.



Part II examined stress and the harm it does to the immune system, making healing difficult. Stress reactions are negative ways for the body to deal with stress and damages physical, mental, and emotional health, and ultimately affects a patient's well-being. It is important to take preventative measures to avoid negative *stress reactions* and channel a more positive and more productive *stress response*. Stress is a common problem for patients visiting the hospital and many modern hospitals built after World War II are not always the most ideal spaces for healing. Two key studies including Ivan Illich's writings and the *Pregnant in America* documentary describe how stressful environments can create many medical complications. Strategies for reducing stress in healing spaces include the incorporation of nature by means of physical plants and views of parks from windows. A key study by Roger Ulrich discovered the overwhelming positive effects of viewing a park from a hospital patient room. Another study by the Robert Wood Johnson Foundation revealed many health benefits in better hospital design for user well-being, as well as economic advantages.

Part III examines the different brain pharmaceuticals the body uses when responding to different environmental conditions, including stress, and reviews several precedent projects both experimental and medical in nature.





PART III: BRAIN PHARMACEUTICALS

Investigating the body's own processes of healing

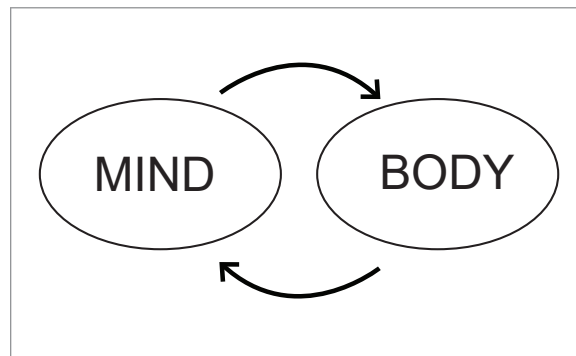


BRAIN PHARMACEUTICALS

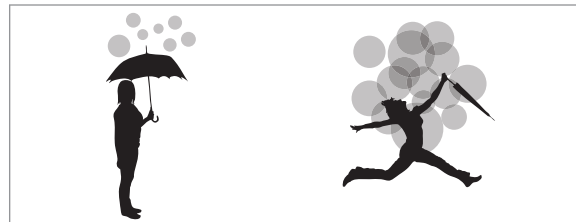
Numerous studies show much evidence of the body's ability to "self-heal" through its ability to 'tap into our internal pharmacies'.¹ One of the body's most effective ways of healing is through means of releasing chemicals in the brain, *brain pharmaceuticals*, such as endorphins (dopamine) which can help manage pain and swelling, promote feelings of euphoria, modulate appetite, and boost the immune response. Endorphins are natural and not addictive, unlike many drugs, and often have the same effect as traditional drugs such as morphine and codeine. These chemicals are an integral part of the body's internal pharmacies.

HOLISTIC HEALING

Holistic medicine is a form of healing that considers the whole person -- body, mind, spirit, and emotions -- in the quest for optimal health and wellness² (see Ill. 3.1). Holistic healing, for example, includes physical treatments alongside emotional support.



ILL. 3.1. Holistic Healing



ILL. 3.2. Passive (left) vs. Active (right) stress coping strategies

PASSIVE VS. ACTIVE COPING STRATEGIES

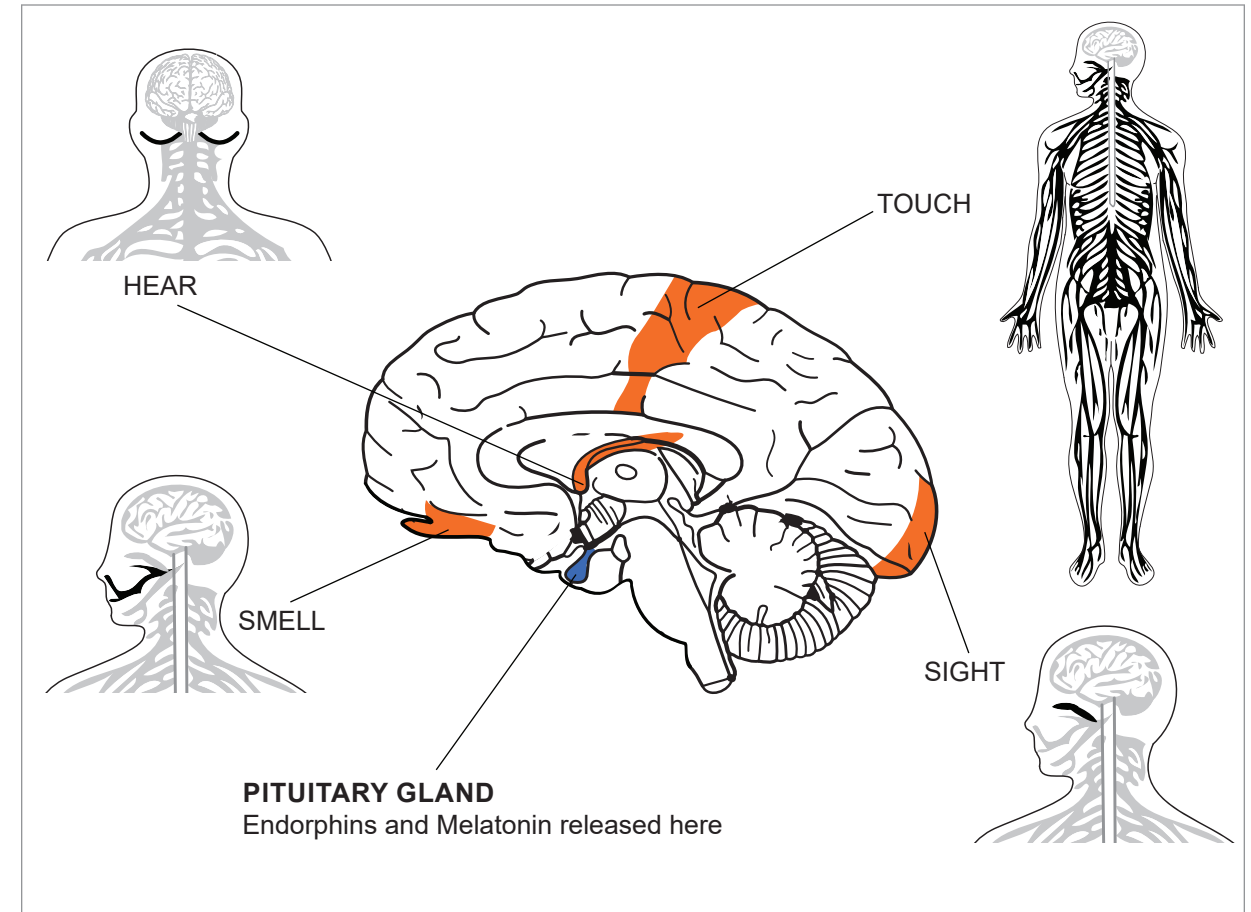
There are two main types of strategies for coping with stress: passive and active. They work in different ways, both ultimately trying to decrease the stress the body experiences (see Ill. 3.2). The design development of this thesis focuses on more active strategies.

Passive strategies eliminate environmental stressors to minimize the body's stress response which often debilitates the immune system and ultimately makes treatments harder for the body to accept.

Active strategies introduce psychological and sensory interventions to manipulate the mind and body's ways of perceiving and responding to environmental conditions.

“ Ultimately it is the senses that need to be revitalized as it is an integral part of healing.”

- Nancy Singh



ILL. 3.3. Brain Pharmaceuticals

HEALING THROUGH THE SENSES

Brain pharmaceuticals react to stimulations from different senses (see Ill. 3.3). The brain will respond to environmental relaxers or stressors and release chemicals in the brain that respond to the appropriate situation. Endorphins interact with opiate receptors of the brain to reduce our perception of pain.

They react similarly to drugs such as morphine and codeine (without the addiction). They also lead to feelings of euphoria, modulate appetite, release sex hormones, and enhance immune response.⁴ Melatonin is a hormone associated with the onset of sleep. Its release is often triggered by dense light wavelengths of such colours as yellow and orange.

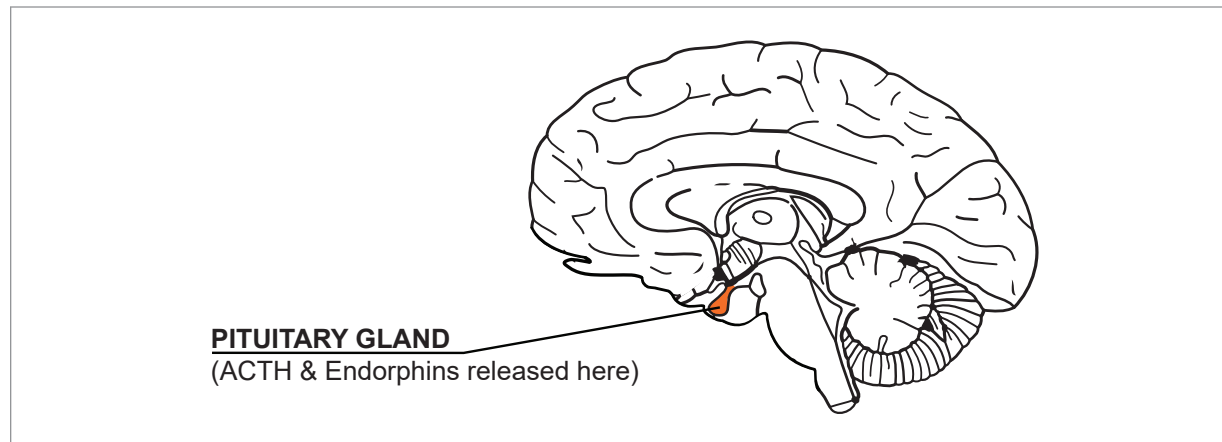
1) Sternberg, Esther and Tippett, Krista. "Esther Sternberg - the Science of Healing Places." On Being, last modified 2013, accessed Sept 17, 2014, <http://www.onbeing.org/program/the-science-of-healing-places/4856/audio?embed=1>.

2) "What is Holistic Medicine?" WebMD., accessed Dec 10, 2014, <http://www.webmd.com/balance/guide/what-is-holistic-medicine>.

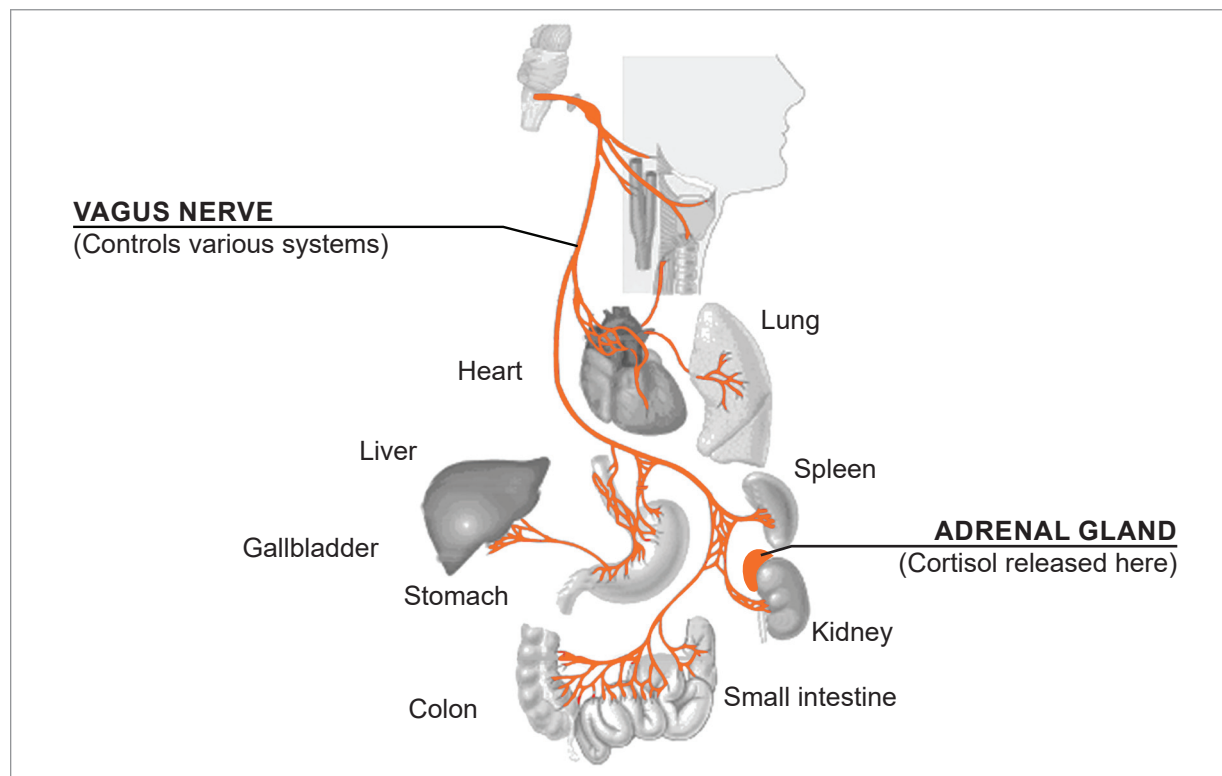
3) "Grandnm". "Healing Architecture." Scribd., last modified Apr 8, 2014, accessed Sept 24, 2014, <http://www.scribd.com/doc/216951537/HealingArchitecture>.

4) Stoppler, Melissa C. and Shiel, William C. "Endorphins: Natural Pain and Stress Fighters." MedicineNet.com., accessed Oct 10, 2014, <http://www.medicinenet.com/script/main/art.asp?articlekey=55001>.





ILL. 3.4. Pituitary Gland in Brain



ILL. 3.5. Vagus Nerve

PROMOTING CALMING

Esther Sternberg explains the importance of an environment's ability to promote a calming effect. It is vital that patients are as calm as possible when in a healing state so that their body's stress response isn't fighting the medical treatments. The body and the doctor's interventions must work together to maximize healing potential. When an environment is able to keep a patient calm, it lowers the body's stress response, and the vagus nerve, which carries a wide variety of signals from the brain to multiple organs, is able to improve systems in the body, such as heart rate variability, breathing, blood flow, etc., to improve recovery outcomes.

TYPES OF BRAIN PHARMACEUTICALS

Endorphins are natural chemicals in the brain released in the pituitary gland (see Ill. 3.4) that reduce the perception of pain and lead to feelings of euphoria. Endorphins boost the immune response making them very powerful "Brain Pharmaceuticals" that often have the same affect on the body as morphine and codeine without the dangerous side effects.⁵

Adrenocorticotrophic hormone (ACTH) and cortisol are both stress hormones released when the body experiences a stress reaction. They tell the body to debilitate the immune system in order to focus on the immediate danger.

The adrenal gland controls the release of cortisol, a stress hormone that places the body into the fight-or-flight mode, mentioned previously in Part II.

The vagus nerve responds to the body's stress reaction and carries a wide assortment of signals to and from the brain. It is responsible for a number of instinctive responses in the body such as heart rate and breathing (see Ill. 3.5). A stress reaction can result in variable blood pressure, irregular heart beat, and heavy breathing, among other negative effects.⁶

SUBCONSCIOUS HEALING

By stimulating the release of endorphins, the body is able to reduce the perception of pain and strengthen the immune system, aiding in the healing process without the use of potentially addictive drugs with possible negative side effects.

5) Stoppler, Melissa C. and Shiel, William C. "Endorphins: Natural Pain and Stress Fighters." MedicineNet.com., accessed Oct 10, 2014, <http://www.medicinenet.com/script/main/art.asp?articlekey=55001>.

6) "What is the Vagus Nerve?" wiseGEEK, accessed Oct 15, 2014, <http://www.wisegeek.org/what-is-the-vagus-nerve.htm#didyouknowout>.



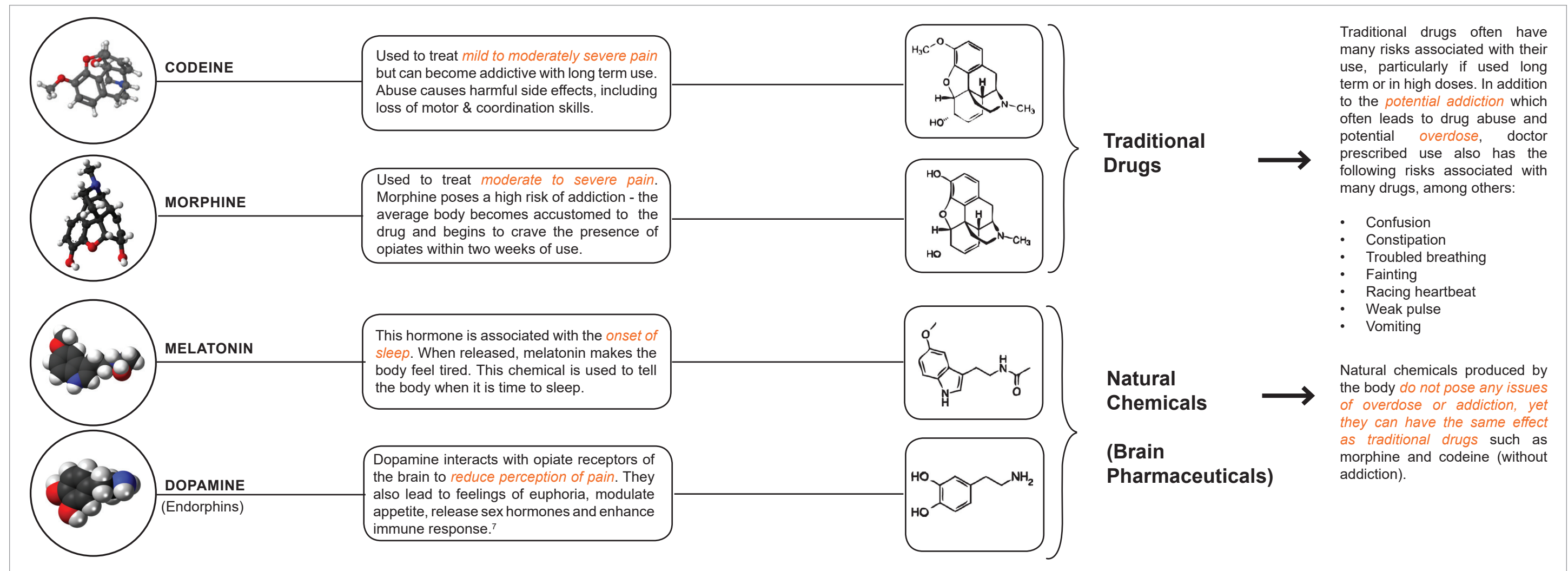
TRADITIONAL DRUGS VS. "BRAIN PHARMACEUTICALS"

There are significant differences between traditional drugs and brain pharmaceuticals. *Traditional drugs* are used to manipulate chemicals in the brain, including the control

of pain management but they have many dangerous risks associated with their use, particularly if used long term or in high doses (see Ill. 3.6).

Brain Pharmaceuticals are natural chemicals in the brain with the potential to have the same effect as traditional drugs, with additional healthy benefits. The thesis aims to study

environments that stimulate these chemicals through the use of brain pharmaceuticals.



ILL. 3.6. Traditional Drugs vs. Brain Pharmaceuticals

7) Stoppler, Melissa C. and Shiel, William C. "Endorphins: Natural Pain and Stress Fighters." MedicineNet.com., accessed Oct 10, 2014, <http://www.medicinenet.com/script/main/art.asp?articlekey=55001>.



THE POWER OF THE MIND



FIG. 3.1. Commonwealth Retreat Center, Pacific House

The mind has incredible power to heal the body. When the mind is relaxed, it influences the different systems in the body related to brain pharmaceuticals. Support groups have incredible impacts on people and are used to control stress and anxiety without heavy use of traditional drugs. David Spiegel performed a study that found people who were part of a support group tended to live longer, in some cases twice as long as other people not part of a support group. The conclusion was that people supporting people did tremendous things for the mind. “People just cared about people.” This study also supports the need to have care-givers well cared for, because they are the people in direct contact with the patients, and their mood has a phenomenal impact on those around them.⁸

Commonweal Retreat Centre is a retreat centre located just north of San Francisco, California, that offers integrative healing programs for people with cancer, health professionals, and the rest of us⁹ (see Fig. 3.1



FIG. 3.2. Commonwealth Retreat Center, Kohler House

& 3.2). At Commonweal there can be much laughter found in the hallways and rooms. “The laughter and the joy come mixed with very intense emotions of pain and sorrow and anger.”¹⁰ The ability to express fear creates room for joy. In a study by Fredericton, it was found that people need on average three positive experiences to survive each negative thought.¹¹ Considering how many ways there are in a hospital for a person who is ill to encounter fear, anxiety, shock, and discomfort, it is crucial to cultivate as many positive moments inside the hospital to make up for the negative ones. Many patients in the hospital are facing the possibility of death which is often a taboo term. Instead of denying the truth, patients can embrace their situation by focusing on living well, even through their suffering.

DEATH AND DYING WELL

“One of the toxicities of our culture [is] that it makes dying not okay.”¹² At Commonweal people learn to come to terms with dying

8) Moyers, Bill. 1993. “Wounded Healers.” *Parabola, the Magazine of Myth and Tradition*, 24.

9) “Commonweal Retreat Center.” Commonweal., last modified Jun 1 2015, accessed Feb 5, 2015, <http://www.commonweal.org/>.

10) Moyers, Bill. 1993. “Wounded Healers.” *Parabola, the Magazine of Myth and Tradition*, 25.

11) Levitt, Andrew. 2015. *The Inner Studio*. A Designers Guide to the Resources of the Psyche. Vol. Arch 641 Lecture.

12) Moyers, Bill. 1993. “Wounded Healers.” *Parabola, the Magazine of Myth and Tradition*, 27.

and that it is okay for them to die. Death is something that everyone will experience. It is part of being human and there is no shame in dying. Our modern focus has been on extending life with advanced medications and procedures. This, in turn, prolongs the suffering and people end up being sick for long periods of time at the end of their life.¹³ People may live longer, but is this lengthened suffering worth it? What kind of quality of life is this? “Extending life isn’t the high goal, because people can live miserable lives for long, long periods of time.”¹⁴ Rachel Naomi Remen¹⁵ supports this statement, saying “of course you want to live as long as you can, but don’t you want to live well?”¹⁶ Vertical gardens [as found in the Design Development in Part VII] represent healing, growth, cycle of life: trees lose their leaves, branches die, but the bush as a whole continues thriving. It is natural for people to live, thrive, and then let nature take its toll and put them to rest. Everyone has a different view on death, however. “For some people it’s never okay to die. They want to go out fighting, and that’s how they go out. But other people want to come to terms with death and perhaps see it as a process that might be interesting to experience.”¹⁷ No matter the perspective, many things are out of our control and people deal with situations, especially death or the possibility of dying, very differently. Architecture has the ability to speak to many people in many ways and allow each person to create their own mind-space that makes

13) Killing, Alison. “There’s a Better Way to Die, and Architecture can Help.” TED. TEDGlobal 2014, last modified Oct 2014, accessed Dec 5, 2014, https://www.ted.com/talks/alison_killing_there_s_a_better_way_to_die_and_architecture_can_help?language=en.

14) Moyers, Bill. 1993. “Wounded Healers.” *Parabola, the Magazine of Myth and Tradition*, 29.

15) Rachel Naomi Remen is the Medical Director at Commonweal

them feel the most comfortable.

POWER OF THE MIND

The study of psychoneuroimmunology, or PNI, suggests that the immune system is regulated in part by the nervous system which allows the whole body to function harmoniously as a unified system. There is an apparent connection between the brain, the mind, and the immune system; thus, the mind has incredible power over the immune system.¹⁸ It is extremely important to have a positive attitude when you are ill – you have cancer, cancer doesn’t have you. A study conducted by Dr. Robert Ader and Dr. Nicholas Cohen at Rochester University Medical School studied the power of the mind with rats. They gave rats immunosuppressing drugs (to lower the immune response), while exposing them to a sweetening chemical in their drinking water at the same time. After this simultaneous intervention of drugs, and sweetened drinking water, it was evident that their brain was conditioned to expect the immune suppressing drugs when they also received the sweetened water. Their brain became so accustomed to this that later when the rats were given the sweetened drinking water without the drug, their bodies still showed the signs of weakened immune functions; their immune system was actually affected by a psychological learning and reacted as though the drug had been present.¹⁹

16) Moyers, Bill. 1993. “Wounded Healers.” *Parabola, the Magazine of Myth and Tradition*, 29.

17) Ibid. Page 28.

18) Kabat-Zinn, Jon. 1990. “On Healing.” Chap. 13, *In Full Catastrophe Living*, 174. New York, NY: Dell Publishing.

19) Ibid. Page 175.



SUFFERING BEFORE DEATH

The way we suffer near the end of our lives has changed dramatically in the past century. One hundred years ago, people used to die of infections and diseases such as pneumonia that would kill one off very fast. Life expectancy was much lower, and people tended to die at home, surrounded by family. During a TED Talk in 2015 entitled *There's a Better Way To Die*, Alison Killing spoke about the way we die and how that has changed over the past 100 years.²⁰ Today, advances in medical technology, including large, expensive imaging machines, and larger medical teams have moved medicine to central facilities that we now recognize as hospitals. The 20th Century saw the rise of optimism as to what this new medical science could offer. The focus of medicine shifted from *how people died* to *extending life*.

Andre Picard²¹ feels strongly about the importance of doctors treating patients as people, rather than just treating the symptoms of their ailments. In his convocation speech to the graduating medical students he says: "We see death as a failure, instead of aspiring to make patients comfortable and at peace at the end of their life."²² We used to die very quickly but now with medical advances, North Americans are dying more from chronic diseases; the two most common being cancer and cardiovascular diseases. This means we will likely have a slow, painful struggle near the end of our lives while we endure these



FIG. 3.3. Nursing Homes can be the most unforgiving places to cope.

illnesses and most of this time is spent in hospitals, hospices, and care homes (see Fig. 3.3). Therefore, compared to the early 1900's, we are gaining several years at the end of our lives, but many years are spent in pain, with loss of independence, often leading to depression. A longer life does not necessarily mean a better life. As we watch this trend continue and more cases of chronic illnesses arise, the discussion of *where* and *how* we die has never been more important. This is where architecture can fill some voids. "Where we die is a key part of *how* we die," says Killing.

DETAILING TO EMPOWER

A deep understanding of users and users' specific needs is of utmost importance in the success of a space that is able to respond to the users on a deeply emotional level. In an essay by University Graduate student Timothy Wat entitled *Homes for Senior Citizens*, Wat reviews Peter Zumthor's Senior's Residence in Chur, Switzerland and the miniscule details that become extremely

empowering²³ (see Fig. 3.4). Three elements of the residence were carefully designed with the users in mind: monumental sliding windows, detachable planters and mobile awnings. The sliding windows were designed to allow them to be opened with minimal effort. Giving residents the ability to control their environment on their own is extremely empowering. They no longer have to rely on someone else to help them. "Detailing can directly empower and free a dignity for those who must so consciously feel their weakness."²⁴

In Zumthor's planning, he recognized the struggle that the elderly experience near the end of their lives as they watch their bodies deteriorate; they are losing their independence and are often too afraid to ask for help, fearing to admit their weaknesses and lack of ability to do things that once came so easily to them. To avoid embarrassment, many seniors often resort to silence. Coming to terms with their mortality is often more than they can handle. "They find themselves having to come to terms with unachieved hopes, goals, aspirations they may have once had."²⁵ Architectural details can help these frail individuals gain their dignity back. "The season of life for the elderly deserves to be one of life, hope, humour and vision."²⁶

EMPOWERING CANCER PATIENTS

Unlike many other diseases, cancer is often life-threatening, and the journey of a cancer



FIG. 3.4. Senior Residence, Peter Zumthor

patient is often unknown and treatments often get worse before they get better. "A diagnosis of cancer hits you like a punch in the stomach... Cancer does kill of course – but fear, compounded by ignorance and false knowledge – is a paralysing attack in its own right."²⁷ Cancer is bound to deeply affect even the strongest people. Many different emotions accompany patients, and few people truly understand the most painful struggles of cancer patients. "It is a difficult journey to walk. Sometimes it is overwhelming; sometimes filled with gratitude, sometimes filled with fear," Sue Beggs said of her battle with breast cancer. Like the senior citizens in Zumthor's Senior's Residence, cancer patients often must come to terms with losing their grasp of control, facing the realization that their future is very uncertain. Here, like Zumthor's Senior's Residence, elements that restore one's hope, one's dignity, and one's strength could have an enormous impact that only those who are struggling can fully appreciate.

20) Killing, Alison. "There's a Better Way to Die, and Architecture can Help." TED. TEDGlobal 2014, last modified Oct 2014, accessed Dec 5, 2014, https://www.ted.com/talks/alison_killing_there_s_a_better_way_to_die_and_architecture_can_help?language=en.

21) Andre Picard is a Globe and Mail health reporter and columnist, who received an honorary doctorate from the University of Manitoba in 2015.

22) Picard, Andre. "A Challenge for New Doctors: Focus on the Patient, Not just the Symptoms." The Globe and Mail. The Globe and Mail, last modified Jun 9 2015, accessed Jun 10, 2015, <http://www.theglobeandmail.com/life/health-and-fitness/health/a-challenge-for-new-doctors-focus-on-the-patient-not-just-the-symptoms/article24859080/>.

23) Wat, Timothy. 2014. "Moments of Spiritual Engagement in Architecture." *Masters of Architecture*, University of Waterloo. 6-26.

24) Ibid. Page 10.

25) Ibid. Page 13.

26) Ibid. Page 6.

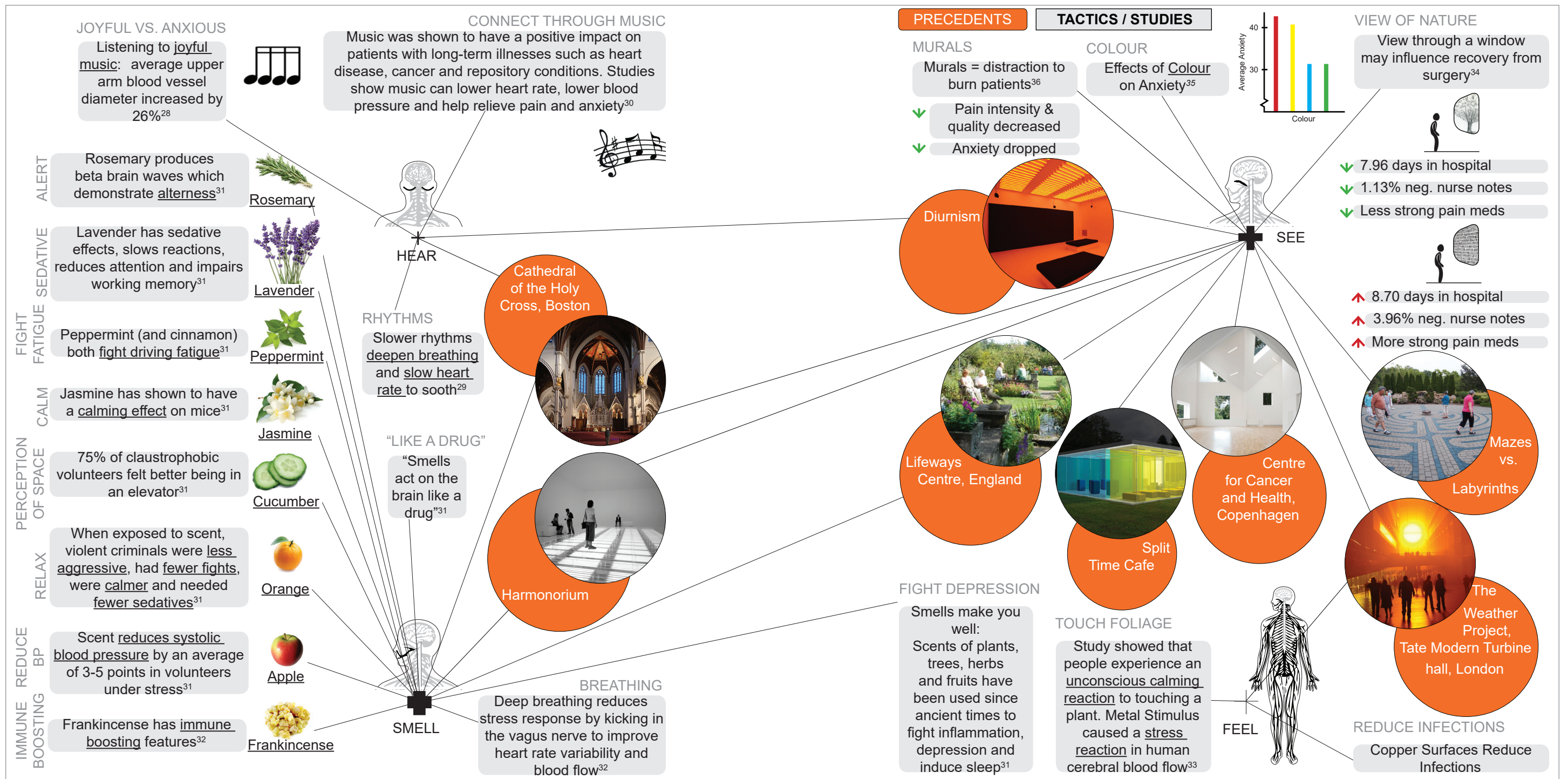
27) Jencks, Maggie Keswick. 1995. *A View from the Front Line*. Marcia Blakenham. 9.



FOUR SENSES, MINDMAP

The following *Four Senses Mindmap* explores several projects and studies that demonstrate bodily reactions and ways of responding to a variety of sensorial conditions (see Ill. 3.7). Organized into the senses that each project/study triggers (seeing, hearing, touching, smelling), the mindmap explores studies such as the influence of colour on anxiety levels, the role music plays on blood pressure, and different scents that affect fatigue, among others.





28) Seiler, Bill. "Joyful Music may Promote Heart Health." UMM. University of Maryland Medical Center, last modified Nov 11, 2008, accessed Sept 19, 2014, <http://umm.edu/newsandevents/newsreleases/2008/joyfulmusicmaypromotehearthealth>.

29) Shane, Simone. "The Calming Effect of Music." Serendip Studio. Serendip Studio, last modified Oct 5, 2008, accessed Sept 10, 2014, <http://serendip.brynmawr.edu/exchange/node/2486>.

30) Ramsay, Adam. "Health Benefits of Music." Netdoctor., last modified Nov 29, 2011, accessed Sept 20, 2014, <http://www.netdoctor.co.uk/healthyliving/wellbeing/healthbenefitsofmusic.htm>.

31) Bateson, Lynne. "Smells to make You Well." Daily Express Health. Daily Express Health RSS, last modified Dec 4 2012, accessed Sept 18, 2014, <http://www.express.co.uk/life-style/health/362320/Smells-to-make-you-well>.

32) Sternberg, Esther and Tippett, Krista. "Esther Sternberg - the Science of Healing Places." On Being, last modified 2013, accessed Sept 17, 2014, <http://www.onbeing.org/program/the-science-of-healing-places/4856/audio?embed=1>.

33) Koga, Kazuko and Yutaka Iwasaki. 2013. "Psychological and Physiological Effect in Humans of Touching Plant Foliage - using Semantic Differential Method and Cerebral Activity as Indicators." *Journal of Physiological Anthropology*.

34) Ulrich, Roger S. 1984. "View through a Window may Influence Recovery from Surgery." *Science* 224 (4647).

35) Jacobs, Keither W., and James F. Sues. "Effects of Four Psychological Primary Colors on Anxiety State." *Ammons Scientific* 41: Setp 15, 2014207210. doi:10.2466/pms.1975.41.1.207.

36) Hathom, Kathy and Nanda, Upali. "Guide to EvidenceBased Art." The Center for Health Design., last modified 2008, accessed Sept 19, 2014, <https://www.healthdesign.org/chd/research/guide-evidencebasedart>.

ILL. 3.7. Four Senses Mindmap

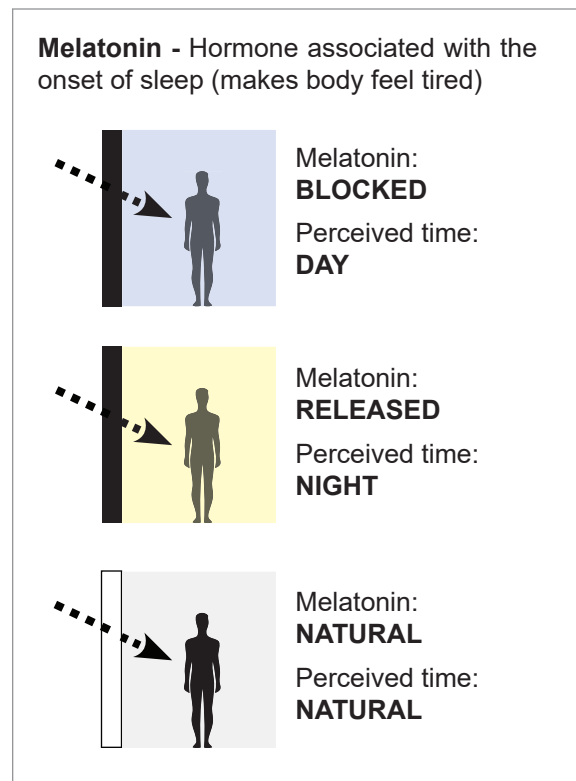


PROJECT STUDIES

Many of the projects and studies in the previous mindmap experiment with creating effects on the body without the use of medications. Studies covered a variety of effects from relaxation through the touch of a plant, promoting alertness by the use of scent, calming claustrophobic individuals while in tight spaces, reducing stress using scent from fruit, and helping control blood pressure by the use of music.

SPLIT TIME CAFE

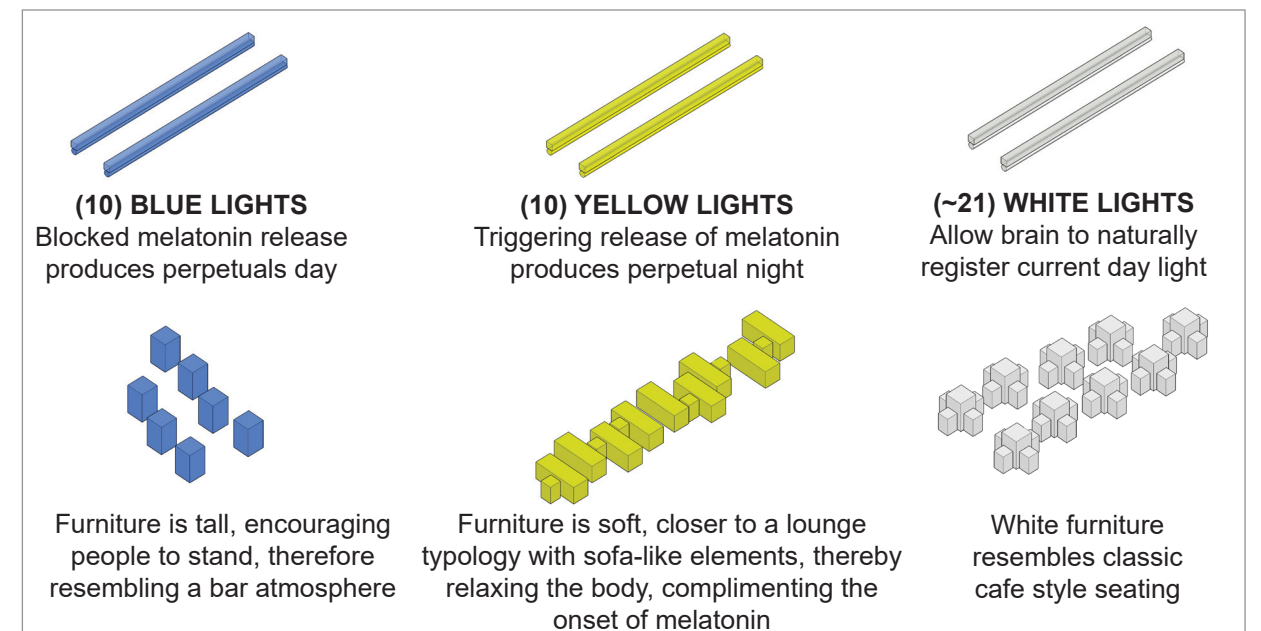
Designed by Philippe Rahm in 2007 in Lebring, Austria, Split Time Cafe illustrates the power of colour on the body.³⁷ Through the use of blue light, melatonin is blocked and people feel more awake. The yellow light in another room of the cafe has a long wavelength which triggers melatonin causing people to feel tired (see Ill. 3.8 & 3.9). A third room has no colour added to light, thereby allowing occupants to experience the effects of the natural time of day.



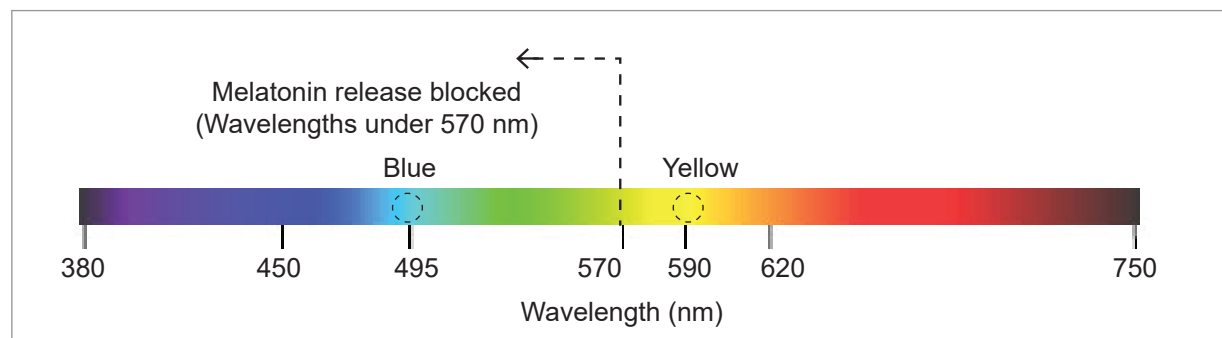
ILL. 3.9. The release of melatonin can manipulate the body into thinking it is a different time of day, making the body feel more tired or awake.



FIG. 3.5. Exterior render of Split Time Cafe



ILL. 3.10. Coloured lights and type of furniture help control the fatigue level in users.

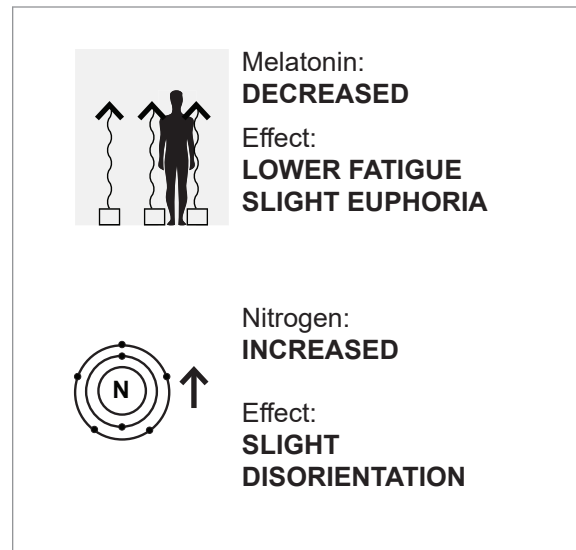


ILL. 3.8. Colours such as yellow, orange, and red make users feel more tired due to the presence of melatonin, whereas green, blue, and purple make people feel less tired.

37) "Split Time Café." Philippe Rahm Architectes., accessed Oct 1, 2014, <http://www.philipperahm.com/data/projects/splittimescafe/index.html>.

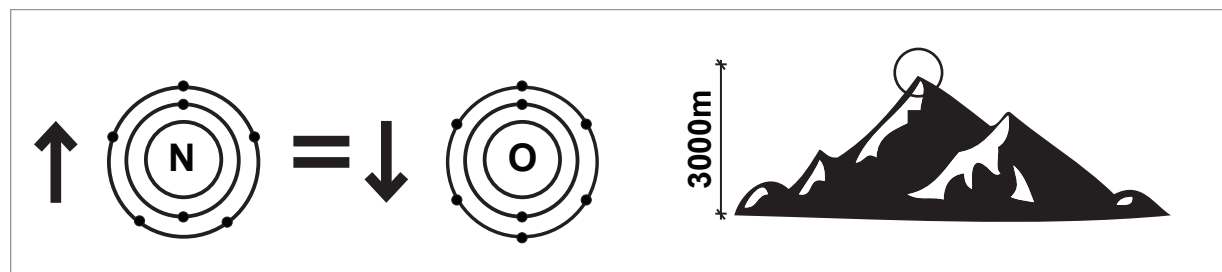
HARMONORIUM

After investigating the effect of coloured light on the body, we look at Philippe Rahm's exploration of the body's response to controlled oxygen levels paired with fluorescent lights. Designed by Philippe Rahm in 2002 for the 8th Biennale of Architecture (Swiss Pavilion) in Venice, Harmonorium was an installation that demonstrated the effect of oxygen levels and intense fluorescent white lights on users' energy levels. The space's nitrogen levels were increased, decreasing the oxygen levels from 21% to 14.5%. After about ten minutes of being in the space there was a measurable "natural" increase in erythropoietin (EPO) and hematocrit levels, as well as a strengthening of the cardiovascular and respiratory systems.³⁸ These protein hormones reach the bone marrow, where they stimulate the production of red blood cells, thus increasing the supply of oxygen to the muscles. This effect may improve the body's physical capabilities by up to 10%. With this boost in oxygen to the muscles, users feel a



ILL. 3.12. The environmental elements of the installation decrease the amount of melatonin released in the brain, making people feel less fatigued. The increase nitrogen creates a slight disorientation in users.

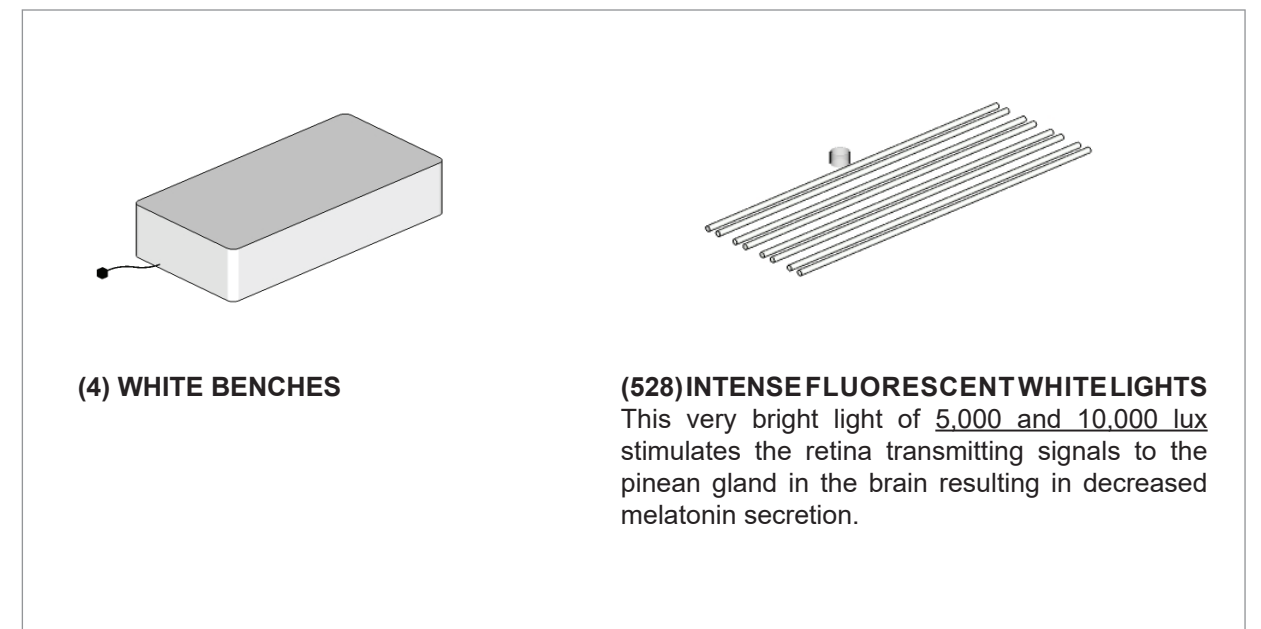
rush of new energy stimulated by the space and created by the body using its own brain pharmaceuticals (see Fig. 3.11 & 3.12).



ILL. 3.11. Increasing the level of nitrogen reduces the oxygen level from 21% to 14.5%, which is found at altitudes of about 3000m.



FIG. 3.6. Harmonorium Installation



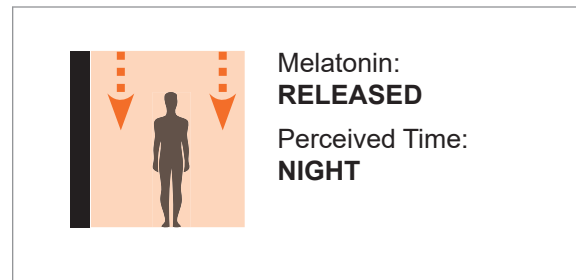
ILL. 3.13. The intense lights and lack of oxygen make people feel euphoric and less tired.

38) "Hormonorium." Philippe Rahm Architectes., accessed Sept 27, 2014, <http://www.philipperahm.com/data/projects/hormonorium/index.html>.



DIURNISM

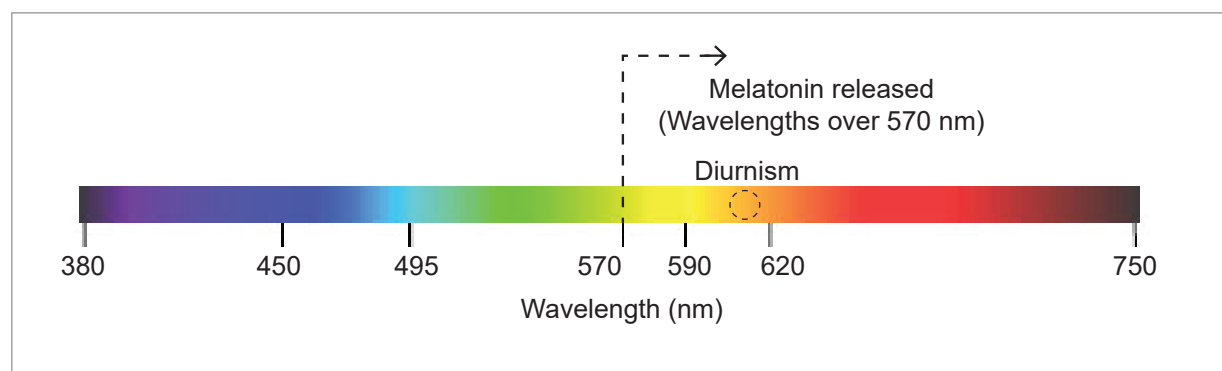
The effects of yellow and blue coloured light were examined in Split Time Cafe (see Ill. 3.14 & 3.15). Similarly, the Diurnism installation explored the effect of a coloured light, paired with soft music. Designed by Philippe Rahm, Diurnism was an installation for the Airs de Paris exhibition that consisted of a room with yellow and orange lights (creating a orange glow), a sound absorbing board, two soft cushioned benches, and speakers playing reversed *nocturnes for the piano*.³⁹ The soft material on both the sound absorbing board and the benches helped to create a quiet, calming atmosphere. Orange light has a long wavelength, triggering the release of melatonin, making people feel tired. During the exhibit, visitors were found sleeping on the benches, demonstrating the powerful effects of their environment.



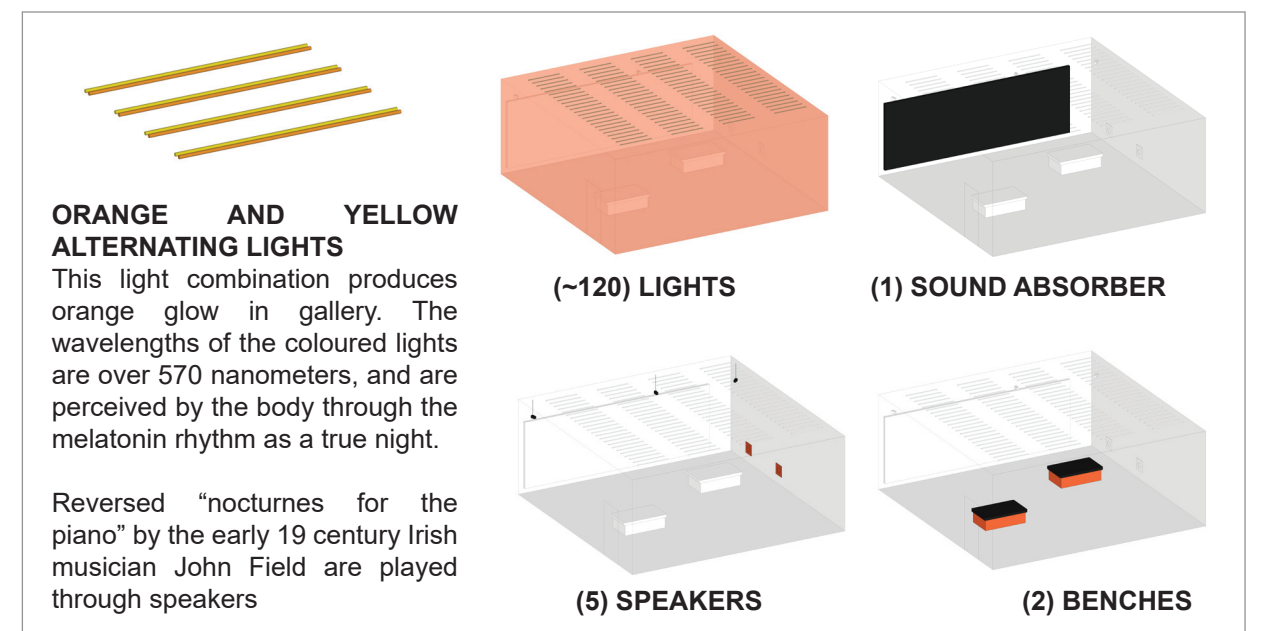
ILL. 3.15. The orange triggers the body to release melatonin making people feel fatigued.



FIG. 3.7. Diurnism Installation



ILL. 3.14. Orange has a wavelength of over 570nm; therefore, the colour triggers the brain to release melatonin, causing the body to feel tired.



ILL. 3.16. The orange light and music from speakers makes people feel very fatigued.

39) “Diurnism.” Philippe Rahm Architectes., accessed Oct 1, 2014, <http://www.philipperahm.com/data/projects/diurnisme/index.html>.



FIG. 3.8. The Rain Room installation enables people to walk amidst the water without getting wet.

Split Time Cafe, Harmonorium, and Dirunism show how colour can affect the senses. The following four projects are reviewed for their ability to affect the senses in other ways.

RAIN ROOM

Rain Room is an installation created in 2012 that responds directly to the user's physical position in the space, allowing them to walk amidst water falling from the ceiling without ever getting wet. In a 100 square-metre area, water valves above create a light rainfall from the ceiling of the room over a grated floor (see Fig. 3.8). As the user begins to enter into this zone, the installation detects where the person is and blocks the water from falling onto them. As the user moves through the gentle rain from the ceiling, sensors continue to monitor this movement allowing the user to walk about, seeing, smelling, and hearing the water all around without ever getting wet.⁴⁰

40) "Rain Room." RANDOM., accessed 30 December, 2014, <http://randominternational.com/work/rainroom/>.



FIG. 3.9. Nocti Vagus Restaurant in Berlin is a restaurant completely in the dark.

NOCTI VAGUS

Nocti Vagus is a restaurant in Berlin that creates a unique experience of dining in the dark. Restaurant owner Simone Glosch was inspired by a similar experience she came across in Hamburg where blind people would guide a sighted group around a dark city, and no one could see where they were going. There, sighted-people would begin to understand a world without sight. Inspired by this experience, Glosch decided to create her own experience, where she could eat in the dark and also enjoy a theatre performance while in the dark, and thus was born, Nocti Vagus. When visitors arrive, they first order their dinner before proceeding down the stairs where a staff member guides them through the dark to their table. The darkness forces people to relax, and move slowly (see Fig. 3.9). To compensate for the lack of light, feeling the table and listening to people becomes much more important.⁴¹

41) *Report about Dark Restaurant NOCTI VAGUS (Berlin)*. YouTube. Directed by YouTube User anike1990. 2012.



FIG. 3.10. Light Therapy at bus stops has been shown to decrease stress in Sweden.

BUS STOPS IN SWEDEN

Seasonal Affective Disorder (S.A.D.) is a type of depression that is related to the change of seasons. Typically, the winter months bring on more depression with the short amount of daylight hours. In Sweden, this issue is even more magnified in comparison to Toronto, Canada, due to its more northern latitude. In order to help fight this winter depression, bus stops in Umeå, Sweden have been installed with bright UV lights to help make up for the lack of daylighting received during this time of year. The utility company replaced the normal bus stop lamps with specially designed phototherapy tubes (see Fig. 3.10). The city of Umeå, approximately 300 miles north of Stockholm, receives about four hours of sunlight a day during the month of December. "Winter is in many ways a fantastic season, with the darkness and the cozy atmosphere. But when the sun appears as a minimum, [we] need the energy the most," Umeå Energi explains.⁴²

42) Boyle, Rebecca. "To Fight Winter Blahs, Sweden Offers Light Therapy at the Bus Stop." *Popular Science*, last modified Nov 29 2012, accessed Oct 25, 2014, <http://www.popsci.com/technology/article/2012-11/fight-winter-doldrums-swedish-electrical-company-showers-bus-stations-uv-light>.



FIG. 3.11. NASA Light Bulb helps promote sleep.

NASA LIGHT BULB

The NASA Light Bulb helps promote sleep by the light it emits. Typical light bulbs emit more blue light with a short wavelength which suppresses the release of melatonin, the sleep promoting hormone (see Fig. 3.11). The NASA Light Bulb reduces the amount of blue light emitted by approximately 50% to help promote sleep. The creators recommend having the light bulb on for approximately 30 minutes before bed to help you fall asleep faster in order to get a better night's sleep.⁴³

This light bulb has been so successful that it is used by astronauts in space to help them sleep and maintain their natural circadian rhythm.

43) "The NASA Sleep Promoting Light Bulb." Hammacher Schlemmer., accessed Jan 19, 2015, <http://www.hammacher.com/Product/Default.aspx?sku=86494>.



PRECEDENT PROJECTS



FIG. 3.12. Commonweal Retreat Center, Pacific House

The following projects illustrate how environments have been designed to help people cope emotionally with the disease they have and the suffering they endure.

COMMONWEAL

Sand is used for therapeutic reasons, as it is pleasant to the touch. It is used to sculpt representations of one's hopes or fears in the unconscious. The staff at Commonweal fully recognize you cannot separate a disease, condition or tumor from the person. The person and the tumor itself are all part of one body. "People often associate their identification with the disease and with being a 'cancer patient'".⁴⁴ This label itself only makes the person feel worse. The right perspective and a shift of thinking can turn this around. If people believe cancer doesn't have them, they hold much power over the disease, and they gain the ability to not allow the illness to control all of their conscious thinking.

44) Kabat-Zinn, Jon. 1990. "On Healing." Chap. 13, *In Full Catastrophe Living*, 174. New York, NY: Dell Publishing.



FIG. 3.13. Commonweal Retreat Center, Kohler House

TREATING THE WHOLE PERSON

The "tradition of western medical science, tend[s] to regard illness as a kind of mechanical breakdown that afflicts our bodies and requires a mechanic under the hood, replacing the parts, rewiring the connections, cleaning the carburetor".⁴⁵ In describing a patient, the person is often referred to as "the site" of where a disease is situated. The description of a person with an illness goes further to represent the person as a whole who is going through an experience involving a disease. "Healing is a matter of meaning, not mechanics... here [at Commonweal Retreat Centre for people with cancer] it is not the patient who is healed, but the person."⁴⁶ Holistic healing encompasses healing of both the body and the mind (including the spirit) simultaneously (see Fig. 3.12 & 3.13). This approach views the patient as a whole person, not limiting healing methods to only the physical conditions.

45) Moyers, Bill. 1993. "Wounded Healers." *Parabola, the Magazine of Myth and Tradition*, 22.
46) Ibid.



FIG. 3.14. Maggie's Centre, Nottingham, Communal Space in Kitchen

MAGGIE KESWICK JENCKS

Maggie Keswick Jencks was diagnosed with breast cancer and died in 1995. She wrote extensively about her experience in various articles, focusing on the lack of social and psychological support she had at the hospital. As many others do, she explains the diagnosis of cancer as a *kick in the stomach*. "Maggie got her diagnosis [of cancer]... in her 20-minute slot with the consultant, who then said 'I'm really sorry, I know it's terrible news, but I've got another patient to see.'"⁴⁷ Although healthcare does require time, money, and a schedule in order to operate properly, there are very sensitive moments when patients are so completely overwhelmed, hardly able to process what is being told to them, that they should never have to worry about logistics of the hospital's system. What Maggie needed was a more comforting, more pleasant, "more human place to absorb what was happening."⁴⁸ She then worked alongside her husband to create Maggie's Centre.

47) Maddox, Lucy. "Can the Design of Hospitals Help Patients Recover Faster?" Gizmodo., last modified Nov 25 2014, accessed Dec 9, 2014, <http://gizmodo.com/can-the-design-of-hospitals-help-patients-recover-faste-1663083331>.
48) Ibid.



FIG. 3.15. Maggie's Centre, Dundee, Scotland (Space to spend quiet time alone)

MAGGIE'S CENTRE

Maggie's husband, Charles Jencks, was an architect who listened to Maggie's wishes, turning her ideas into what is now a series of 15 locations of Maggie's Centres around the world, with many new centres planned. Maggie's Centre is a retreat for cancer patients to seek comfort with their illness and come to terms with what they are facing while experiencing support from others. Karen Verrill, Head of the Newcastle Maggie's, says: "When you're having routine treatment for a life-threatening illness like cancer, that's when the environment make more of a difference."⁴⁹ All Maggie's Centres have a kitchen and a garden to stimulate socialization for those who desire it, but also offer many private areas for those wanting to spend time on their own (see Fig. 3.14 & 3.15). Areas reveal themselves as one explores the spaces to keep people alert and interested. It lends itself to what people need. It is "somewhere safe we can retreat to or hide if necessary."⁵⁰

49) Ibid.
50) Ibid.



CENTRE FOR CANCER AND HEALTH

Similar in use to Maggie's Centres, the Centre for Cancer and Health is a recovery and retreat centre for patients dealing with cancer. Designed by Nord Architects in 2011 in Copenhagen, Denmark, light was very important in the design of the building. Northern Europe doesn't receive a lot of light during the day in the winter months. To allow as much light as possible into the space, almost all of the roofs host skylights and a variety of different shaped windows line the



FIG. 3.16. View of the interior courtyard at the Centre for Cancer and Health

walls (see Fig. 3.16 & 3.18). The goal for this design was to create a space that people could come to for support without feeling as if they were in a medical facility. The lack of institutional materials and confusing signage in this building typology helps visitors forget about cancer when they enter the building (see Fig. 3.17). "A human scale and a welcoming atmosphere can help people to get better... If we want people to get better at our hospitals, we need to deinstitutionalize and create a welcoming healthcare."⁵¹

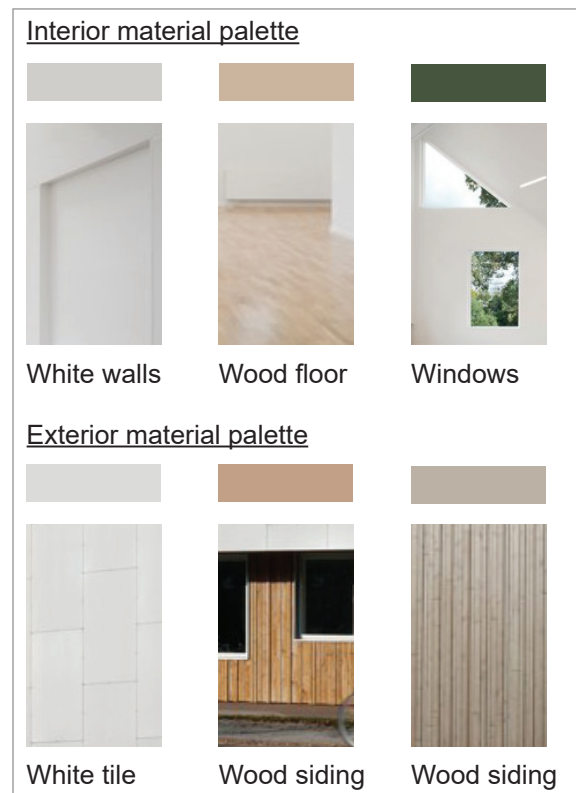
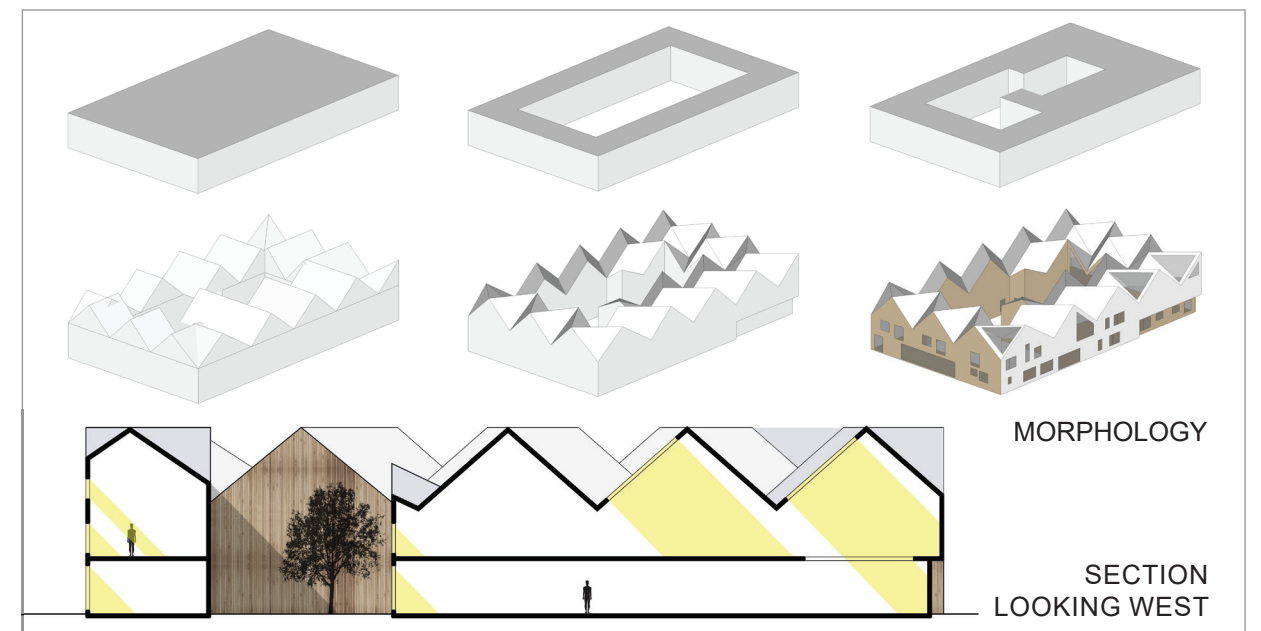


FIG. 3.17. Materials of the Centre for Cancer and Health are very neutral and soothing.



FIG. 3.18. Interior view of the Centre for Cancer and Health



ILL. 3.17. Spatial Qualities of the Centre for Cancer and Health

51) "Center for Cancer and Health Danish Architecture Centre." Danish Architecture Centre., accessed Oct 2, 2014, <http://www.dac.dk/en/daclife/copenhagenxgallery/cases/centerofcancerandhealth/>.





FIG. 3.19. Southdown Institute

SOUTHDOWN INSTITUTE

Being able to put suffering aside and focus on a positive mindset is crucial for healing. Southdown Institute is a retreat centre in East Gwillimbury, just north of Newmarket, Ontario, for men and women with addictions and mental health issues (see Fig. 3.19). This new haven opened in December 2013, surrounded by nature. The centre takes advantage of the beautiful location, offering “soothing nature, comfort, and privacy” says Chief Executive Officer Dorothy Heiderscheit. It was designed with the specific users in mind, who, while dealing with addictions and mental health issues, need as much encouragement and comfort as possible to be able to relax and “do the inner work that they [need] to do,” says Heiderscheit. During an especially difficult journey to heal, community and support from others in similar situations are key. The centre has 22 beds and is located in a very secluded area. “What I notice dramatically is the community is closer together here,” which Heiderscheit attributes to the smaller space.⁵²

52) Remy, Ruane. 2014. “Southdown has Right-Sized.” Catholic Register, Sept 14, 2014, 13.

THORNCROWN CHAPEL

Thorncrown Chapel, designed by E. Fay Jones, is located amongst the woods just outside of Eureka Springs, Arkansas (see Fig. 3.20). The chapel consists of 6000 square feet of glass to allow the exterior of the building to be part of the interior experience.

“Light, shadows, and reflections play a major role in Thorncrown’s ambience. Because of the chapel’s elaborate trusses and the surrounding trees, constantly changing patterns of light and shadows appear during the day.”⁵³



FIG. 3.20. Thorncrown Chapel, Arkansas

53) “Architecture.” Thorncrown Chapel., last modified 2015, accessed Jun 4, 2015, www.thorncrown.com/architecture.html.

SHINRIN YOKU - FOREST BATHING

Southdown Institute and Thorncrown Chapel both emphasize the connection with nature. *Shinrin Yoku* is the art of letting Mother Nature in through all of your senses.

We humans have spent more than 99.99% of our evolutionary history in “natural” environments, and, therefore, it is believed that we are essentially nature adaptive. However, more and more people are living in an urban and artificial society, while our physiological functions are still adapted to nature.⁵⁴ Dr. Marc Berman performed a study that found urban environments inflicted much more stress on the body due to the level of attention that these environments demanded (see Ill. 3.18).

Our bodies are rarely in the “expected” state of our natural well-being. The ultimate comfort comes from the harmonization of rhythm between human beings and the environment.



ILL. 3.18. Attention Restoration Theory by Dr. Marc Berman

54) “The Nature of Things with David Suzuki, Dreams of the Future, Science of Natural Therapy.” CBC. CBC, last modified 2014, accessed Oct 10, 2014.

PHYTONCIDES IN THE FOREST

Phytoncides are chemicals or vapours released from wood and other plants. These vapours, which are natural to the forest setting, decrease brain activity when inhaled and therefore lower stress response. The inhalation study of fragrances given off by wood chips of *sugi* and *hiba* or *asunaro* showed lower systolic blood pressure, and brain activity was subdued. Interestingly, when the test subjects of a study in Japan found the fragrances unpleasant, their body still showed no signs of stress.⁵⁵

10 minute walk in forest vs. urban setting

- Sympathetic nervous activity (represents state of stress) is low when looking at nature, and stress is suppressed in forest.
- HR is about 12 beats/minute lower in forest.
- Brain activity lowered in forest.

55) Ibid.



The body uses a variety of brain pharmaceuticals to respond to environmental conditions. Certain environmental qualities such as colour, light, and scent have the ability to stimulate brain pharmaceuticals and can be used to trigger different body reactions. This can include stress reduction, which is beneficial to avoid the use of traditional drugs, which can be very harmful and potentially highly addictive. Spilt Time Café (by Philip Rahm) and the Japanese concept of Forest Bathing (Shinrin Yoku) demonstrated strategies to trigger brain pharmaceuticals without the use of dangerous medications. Several medical treatment spaces such as Commonweal Retreat Center and Maggie's Centres have taken the approach of holistic design, which can be used as precedents for hospital design.

The research presents the major influences that environmental elements can have on one's body and one's psychological state, including colour, light, views, scents, etc. Further in this regard, the power of the mind has much potential in healing, as well as with the coping of suffering. This part has explored the importance of holistic healing, treating the patient as a whole person, and not as the *site* of a disease.

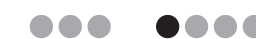
As understood in Part III, while taking a holistic approach of healing, we must consider environments because they play such a crucial part in one's healing. Part IV

compares traditional hospitals built in the 1800's with contemporary hospitals built Post-WWII and examines the shift away from natural healing and how this affects patients. Holistic healing is further discussed in this section, looking at the effects of the placebo effect relating to natural landscapes.





PARTIV: HEALING ENVIRONMENTS
Examining the conditions of current healing spaces



HISTORY OF HEALING SPACES

*A summary of Heather Burpee's "History of Healthcare Architecture"*¹

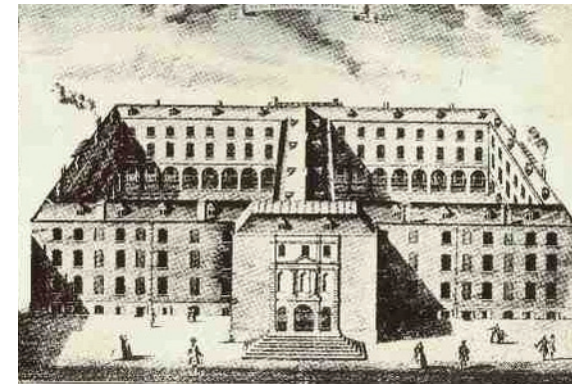


FIG. 4.1. Thomas Guy's Hospital was designed around a central courtyard in London, opened in 1726.



FIG. 4.2. Hôpital Lariboisière, Paris, opened in 1854.

Western hospitals have been transformed drastically in their form and use throughout history. Healing used to take place in the home, next in the church then in central hospitals. The role of architecture has changed immensely, recently emphasizing the value of function and technology, causing environmental qualities to be neglected.¹

CENTRAL, NATURE-ENCOMPASSING HOSPITALS

When central hospitals were first built, they were run by religious orders, but they maintained a very distinct civic role within the city. Hospitals were often structured around large central courtyards, such as Thomas Guy's Hospital, which opened in 1726 (see Fig. 4.1). This building style of the urban hospital landscape carried throughout the 19th Century.²

The recognition of healthy agents such as clean air and hygienic conditions prompted new health standards to be implemented for the basic formation of hospitals. This was prompted by Louis XV in Paris. The pavilion building typology became very influential. The first hospital of this new typology was Hôpital Lariboisière in Paris, built between 1839 and 1854, designed by M.P. Gauthier (see Fig. 4.2).

Florence Nightingale (1820-1910) was very influential following the Crimean war (1854) and has been lauded as the mother of modern nursing. She recognized that there was a correlation between a hospital's cleanliness and patient survival rates. After observing this she was able to reduce the death rate of wounded soldiers from 60% to 2% within six short months.³ In addition to her discoveries about hospital hygiene practices, she wrote

1) Burpee, Heather. 2008. "History of Healthcare Architecture." 1.
2) Ibid. .

3) Ibid.
4) Ibid..



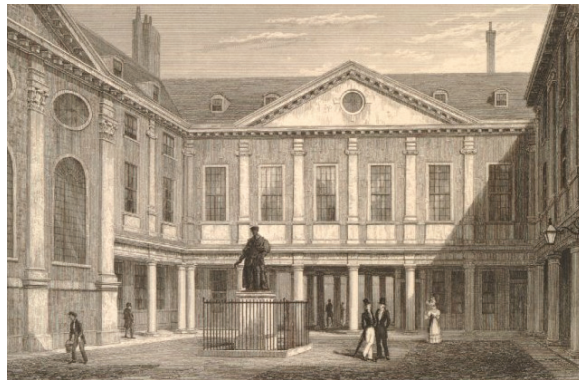


FIG. 4.3. St. Thomas Hospital in London built between 1861 and 1865.

about her approach for creating a healing environment, which not only encompassed the physical surroundings, but also the important of natural light, fresh air, landscape, and attention to diet.⁴

In her book, *Notes on Hospitals* (1863), she wrote: “[light is] quite perceptible in promoting recovery, the being able to see out of a window, instead of looking against a dead wall; the bright colors of flowers; the being able to read in bed by the light of a window close to the bed-head. It is generally said that the effect is upon the mind. Perhaps so; but it is no less so upon the body on that account⁵.”

Nightingale’s principles were first implemented in St. Thomas’ Hospital in London, England, built between 1861 and 1865, designed by H. Currey. Nightingale’s insight on hospitals and patient health

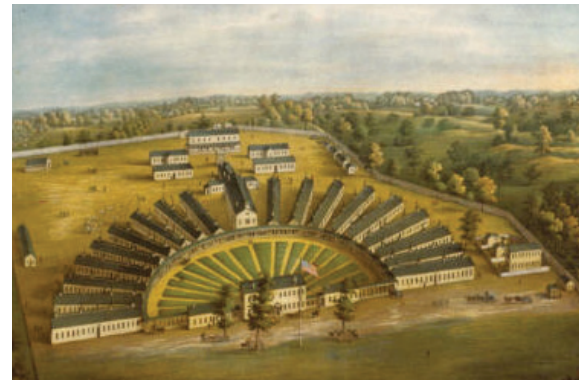


FIG. 4.4. Hicks U.S. General Hospital, Baltimore

continued to influence hospital design for the next hundred years (see Fig. 4.3).

Hicks U.S. General Hospital in Baltimore was built during the civil war and was designed to fill the need for isolation to prevent infectious diseases from spreading. Heavily influenced by Nightingale’s writings, the hospital wings allowed for ample natural light to penetrate through all patient rooms, enabled cross ventilation through the spaces, and created views of the gardens between the building crenellations (see Fig. 4.4).

SHIFT TO EFFICIENT, MACHINE-LIKE HOSPITALS

Following World War II, Nightingale’s original concept of hospitals with fresh air, plenty of light, and views was replaced with a “podium on a platform” typology that consisted of tall buildings with deep plans to prioritize efficiency.⁶ Advanced

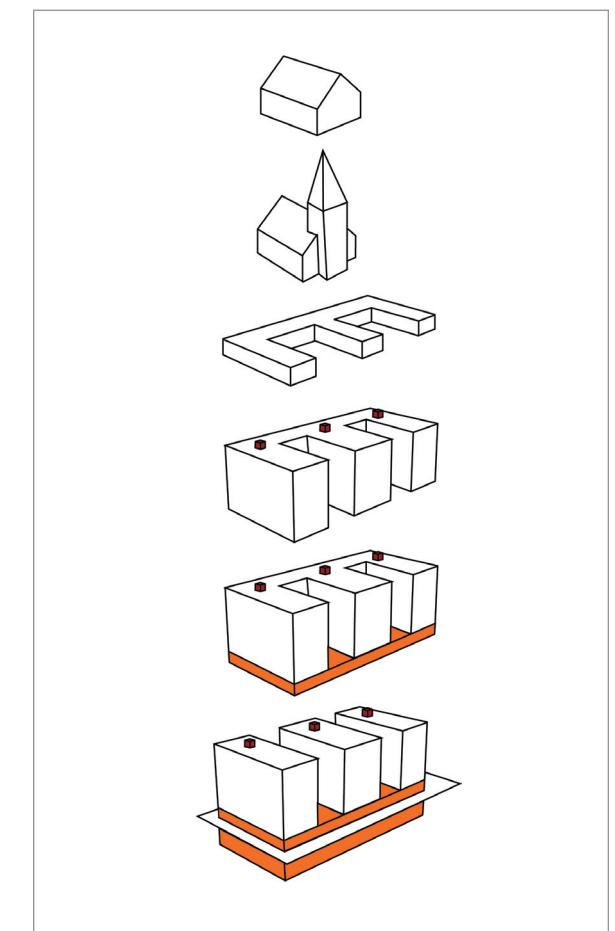
building technology encouraged the use of mechanically ventilated interior spaces and elevators to move people vertically. Circulation became very confusing with little external cues as to where you were. Nurses spent 40% of their time traveling from one place to another.⁷ The hospital turned into more of a well-tuned machine and became the precedent for future “mega-hospitals”⁸ (see Ill. 4.1), completely limiting access to the air, light and views that Nightingale had so carefully attributed to her patients’ well-being.⁹

RE-EXAMINATION OF HOSPITALS

In the 1980’s, Northern Europe began a movement to re-examine the hospital typology and its downfalls as it existed. Many new hospital designs changed the typical form to allow more access to daylight and exterior spaces to occupants.

Emerging in the 1980’s, Evidence Based Design research is a relatively new field of research that studies the correlation between indoor building environments and human health and productivity. Dr. Roger S. Ulrich, conducted a study in 1984 to determine if certain views out of the window in a hospital room would have any affect on a patient’s recovery from gall bladder surgery.¹⁰ The study, entitled “View through a window may influence recovery from surgery,” found that patients who had a view of a green park were more likely to recover faster, have better

behaviour, and need less pain medication than those patients who had a view of a brick wall outside their window. Ulrich says: “the capability for healthcare to help improve outcomes in patients is directly related to their ability to reduce stress and promote buffering and coping.”¹¹



ILL. 4.1. Evolution of healthcare from home to the ‘Podium on a Platform’

5) Burpee, Heather. 2008. “History of Healthcare Architecture.” 1.

6) Ibid. Page 2.
7) Ibid. Page 2.
8) Ibid. Page 2.

8) Ibid. Page 2.
9) Ibid. Page 2.
10) Ulrich, Roger S. 1984. “View through a Window may Influence Recovery from Surgery.” *Science* 224 (4647).

11) Ibid.



ARCHITECTURAL PLACEBO EFFECT



FIG. 4.5. Maggie's Centre, Edinburgh

Stress is ultimately the largest hurdle to deal with to overcome illnesses. The placebo effect is known as a *fake treatment* that does not hold any active substances itself but helps the body heal simply by the mind's expectation that it will heal and allows the brain to activate anti-pain pathways releasing endorphins (dopamine). Placebos can ultimately reduce swelling and pain and, in turn, reduce stress which makes the body better able to receive medical treatments, providing the best opportunity for the brain to heal the body.¹² In the study conducted by Dr. Robert Ader and Dr. Nicholas Cohen at Rochester University Medical School [previously mentioned in Part III in *Power of the Mind*] tests involved giving rats immunosuppressing drugs while exposing them to a sweetening chemical in their drinking water. Their brains became so accustomed to this combination that their

immune system was actually affected by a psychological learning and reacted even when the drug had not been present.¹³ In a way, the sugar water in the experiment with the rats acted as a placebo by tricking the mind into thinking it was receiving some kind of drug that would suppress the immune system, but the body began doing that on its own. This can also work in the opposite way, tricking the mind into using its own chemicals to get positive results that are able to reduce stress.

“ Environmental variables are really important. They're affecting the brain's stress response and the brain's relaxation response.¹⁴ ”

Esther Sternberg

13) Kabat-Zinn, Jon. 1990. "On Healing." Chap. 13, *In Full Catastrophe Living*, 175. New York, NY: Dell Publishing.

14) Sternberg, Esther and Tippett, Krista. "Esther Sternberg - the Science of Healing Places." On Being, last modified 2013, accessed Sept 17, 2014, <http://www.onbeing.org/program/the-science-of-healing-places/4856/audio?embed=1>.



FIG. 4.6. Maggie's Centre, Nottingham

ARCHITECTURAL PLACEBO

Environments can *act similar to placebos*. Placing patients in environments where the stress response isn't activated encourages the brain to release natural, stress fighting chemicals.

Charles Jencks was inspired, after watching his wife's struggle with breast cancer to design retreat centres for those dealing with cancer (see Fig. 4.5, 4.6 & 4.7). He believes in the architectural placebo effect. He fully supports taking great care of the care givers. Improving the mood of the care givers translates over to the patients with positive results. He used this philosophy to guide his design of the Maggie's Centres, a series of retreats for people dealing with cancer with over 15 locations in the United Kingdom and around the world. There, people receive practical, emotional, and social support for



FIG. 4.7. Maggie's Centre, Glasgow

dealing with cancer. Many describe these spaces as an oasis; a place to meet people or sit quietly alone with a cup of tea. The centres are flexible and allow people a variety of different things to do to relax and help them cope with their conditions. By providing a space for people to come to when they need support, it allows them to relax and focus on being in the present moment. From the carefully designed interiors to the supportive social network, the compassionate staff members and the incredible natural views out of all the windows, the entire project is geared towards reducing stress to aid people in strengthening their state of mind. William James, the American philosopher and psychologist, believed that "the greatest revolution in our generation is the discovery that human beings, by changing the inner attitudes of their minds, can change the outer aspects of their lives."¹⁵

15) Levitt, Andrew. 2015. *The Inner Studio*. A Designers Guide to the Resources of the Psyche. Arch 641 Lecture.



PLANTS AND NATURAL LANDSCAPES

Plants and natural landscapes have a very powerful impact on those who are ill. Roger Ulrich's study, *A View Through a Window*, tested post-surgery patients recovering from gall bladder surgery, dividing them into two groups; one group viewed a park outside of their hospital window, and the other group saw a brick wall. It was found that patients with a view of the park needed less pain medication, had less negative nurse notes, and, on average, were discharged a day sooner.¹⁶ It has been shown in other studies that paintings or photographs of nature have the same positive effect on patients. Plants and elements of nature represent healing, growth, and hope. "If only we, like de Hooch, knew how to recognize the value of ordinary routine, many of our burdens would be lifted. His painting [of an ordinary linen closet] suggests that the big theme of life – the search for prosperity, happiness, good relationships – are always grounded in the way we

approach things."¹⁷ It is not just a picture or a view that is important, but an attitude of the mind. A plant is not just a plant, but a representation of how we can feel and how we can change how we see ourselves. Plants and calming environments have the ability to allow delicate forms and delicate people to thrive. It is okay to be fragile, especially during times of struggle.

REHAB CENTRE, SWITZERLAND

Rehab Basel, a rehabilitation centre by Herzog and De Meuron, incorporates nature into its design. Here, patients come to recover from head and spinal cord injuries. The centre focuses on improving the quality of life for those with life-changing injuries, often leaving them paralyzed.¹⁸ Each room receives light from both a skylight above and from an outside balcony. The natural materials of the architecture as well as the natural landscape surrounding the centre help with relaxation and reduction of stress during their recovery (see Fig. 4.8, 4.9, 4.10, 4.11 & 4.12).



FIG. 4.10. Rehab Centre, Courtyard



FIG. 4.8. Rehab Centre, Aerial View



FIG. 4.9. Rehab Centre, Courtyard



FIG. 4.11. Rehab Centre, Walkway



FIG. 4.12. Rehab Centre, Pool

16) Ulrich, Roger S. 1984. "View through a Window may Influence Recovery from Surgery." *Science* 224 (4647).

17) De Botton, Alain. 2013. "Art for Life's Sake." *Wall Street Journal*, 84.

18) "Rehab Basel." MIMOA; Mi Modern Architecture., last modified 2015, accessed Jan 2, 2015, www.mimoa.eu/projects/Switzerland/Basel/REHAB%20Basel.



FIG. 4.13. Two of Joana Johnston's images, part of her exhibit exploring institutional architecture.

IMPORTANCE OF HUMAN SPACES

As hospital procedures and medical testing becomes more advanced and machine-controlled, so does the care that hospitals provide. In a space where many are facing life-threatening illnesses, the more they are treated like an object, the less they may feel cared for.

Photographer Joanna Johnston (daughter of a healthcare architect) says: "There's no design in the hospital. There's design for clinical function. There's design for safety. But there isn't design for humans to actually be humans."¹⁹ In June 2015, Johnston set up a photography exhibition to not only document the interior of hospitals, but to critique "how hospital design works against the healing mission of the institution"²⁰ (see Fig. 4.13).

As part of her project, Johnston interviewed seven patients to find out how they feel as they enter the hospital, and where they felt the most comfortable. "Unsurprisingly, none of the volunteers for Johnston's photography project named the hospital as their safe and comforting place. Almost all chose their homes and private bedrooms, often describing the view out their windows."²¹

In his convocation speech, Andre Picard speaks to the graduating medical students and shares some of his insights on healthcare. He says: "Sadly, most doctors don't put patients first."²² His point here is that, with advancing medical technology and the focus on so many new drugs and ways of testing for different conditions, doctors often focus on the symptoms and forget that they are

working with a human being who is looking for some personal care. Picard says that "with our desire to cure, we over-treat."²³

On a more personal note, I [Jennifer Beggs] watched my Mom battle through cancer treatment. New drugs or new tests didn't mean much to her. She didn't know what these fancy medical terms meant and certainly didn't understand all of the medications the doctors would speak about. Like most average patients, she didn't fully understand what all the doctors were doing, but she had to place her trust in them. What made her happy was when the doctor held her hand when giving her the news of tests, or gave her a hug when the news wasn't good. That's what made the difference when she was in her most vulnerable moments at the hospital. "You know what people really long for? Personal Medicine, not personalized medicine. They crave human connection. Not just care, but caring," Picard says.

SCHEDULING AROUND DOCTORS

"We have built ourselves a sickness system rather than a health system. We have designed that system for the convenience of practitioners, not patients," says Picard. In the online documentary "Pregnant in America" discussed in Part II, as expecting couple Steve and Mandy Buonaugurio explore the benefits and risks of giving birth at home rather than in a hospital, they discover that today many child birth procedures and schedules are organized

around the doctors, not expectant mothers. The number of cesarean sections (C-Sections) in the last 10 years have skyrocketed and are often scheduled between 9a.m. and 5p.m., Monday to Friday. Therefore, baby birthdays are being determined and planned around the doctors' social calendars, instead of nature. Robbie Davis-Floyd²⁴ explains that C-Sections are easy to predict and control. Once it is scheduled, you know when the doctors are needed, and it makes it easier to control staffing requirements. Yet C-Sections can be quite dangerous, can introduce more complications to giving birth, and have long recovery periods of approximately six weeks.

As discussed in Part II, North American hospitals are also known for their heavy use on pain medications for child birth, specifically using the epidural to artificially induce labour. The typical debate is *when* a woman should get her epidural, rather than *if* she will get one. From 1990-2000, the number of inductions increased from 10% to 20%, doubling in just 10 years. This trend demonstrates that more and more doctors are encouraging women to get an epidural, because it speeds up the labour process. This isn't necessarily better for the mother or baby, but it saves time waiting around for the natural birthing process to take its natural course.

19) Swan, Michael. 2015. "Bringing the Human Back into Hospital Design." Catholic Register, 14 June, 16.

20) Ibid.

21) Ibid.

22) Picard, Andre. "A Challenge for New Doctors: Focus on the Patient, Not just the Symptoms." The Globe and Mail. The Globe and Mail, last modified Jun 9 2015, accessed Jun 10, 2015, <http://www.theglobeandmail.com/life/health-and-fitness/health/a-challenge-for-new-doctors-focus-on-the-patient-not-just-the-symptoms/article24859080/>.

23) Ibid.

24) Robbie Davis-Floyd, PhD, is a Medical Anthropologist at the University of Texas



EXISTING HOSPITALS - POSITIVE EXAMPLES

CAN THE DESIGN OF HOSPITALS HELP PATIENTS RECOVER FASTER?

There are many positive examples of hospitals where the environments help support the patients, mentally, and emotionally. Consider the Dyson Centre for Neonatal Care in the Royal Hospital in Bath, England, designed by Feilden Clegg Bradley Studios, Architects. Its light, airy, and spacious environments don't resemble the typical hospital. With natural woods and soothing green colours, it feels more like a Scandinavian Spa.

NEONATAL ICU AT DYSON CENTRE

The Neonatal Intensive Care Unit (ICU) is designed in the shape of a horseshoe, darker at one end for the high-dependency babies and then progressively brighter with fewer machines and bigger, healthier babies (see Ill 4.2). This progressive design is for the babies' comfort at different stages of development and allows the parents to recognize the progress and development their babies are making, as they move around the horseshoe when they grow and become healthier. This gives parents a great sense of hope.

The design sketches of the hospital show "the building like a hug, its arms enveloping a baby. 'The whole point...was to provide a secure base.'"²⁵ In this way, the building is acting like a nurse, a caregiver (see Fig. 4.14).

Typically, hospitals tend to make patients and staff more stressed with the bright lights

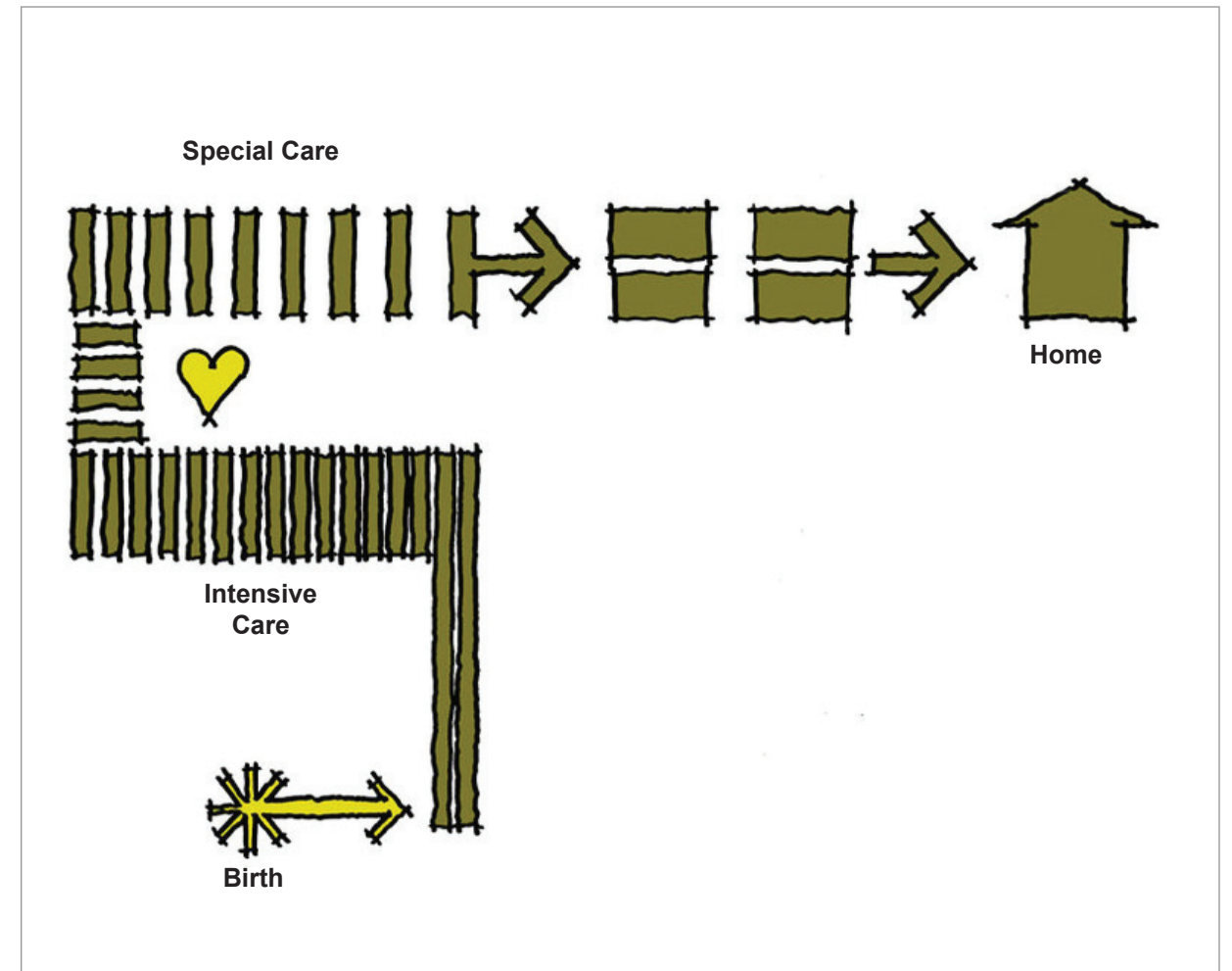


FIG. 4.14. Dyson Centre for Neonatal Care in the Royal Hospital in Bath, England designed by Feilden Clegg Bradley Studios, Architects which opened in July 2011.

and white walls. Surfaces reflect sound, and privacy is almost non-existent. James Dyson, who finished and funded part of the Dyson Centre, believes that "good design can make people get better more quickly".²⁶

The design of the Neonatal ICU has shown to have had positive effects, not only psychologically, but also in babies' development and growth. Babies in the centre sleep for 20% longer than those in the old unit,³ which is crucial for the development of babies who are so young.²⁷ Dr. Bernie Marden, a consultant neonatologist, explains that sleep for premature babies is "when all the brain development gets done."²⁸

The architecture of the space also had an effect on adults. It was observed that parents spent



ILL. 4.2. Conceptual plan of the Dyson Centre for Neonatal Care in the Royal Hospital in Bath, England designed by Feilden Clegg Bradley Studios, Architects which opened in July 2011.

an average of 30 minutes longer visiting in a day. Visitors and staff both reported "feeling less cramped and less stressed that those in the old unit."²⁹ It was also observed that 90% of babies were breastfed, compared to

64% of those in the old unit.³⁰ Breastfeeding has been observed to lower the risk of many negative health outcomes for both the mother and infant.

25) Maddox, Lucy. "Can the Design of Hospitals Help Patients Recover Faster?" Gizmodo., last modified Nov 25 2014, accessed Dec 9, 2014, <http://gizmodo.com/can-the-design-of-hospitals-help-patients-recover-faste-1663083331>.

26) Ibid.
27) Ibid.
28) Ibid.

29) Ibid.

30) Ibid.



FIG. 4.15. Still under construction, this is what an inpatient room may look like at HRH.

HUMBER RIVER HOSPITAL

Humber River Hospital (HRH), located in Toronto, is currently under construction (as of 2015) and will be the first “fully digital” hospital in North America. This new digitalization will assist with diagnostic testing, blood samples, and communication between doctors and lab results, in addition to the user friendly features that were designed

with patients in mind.³¹ Like the Dyson Centre, Humber River was designed for ease of use as well as to eliminate the spread of infections on surfaces such as door handles. Doors at HRH will open with a simple wave of the hand in front of a button, and lights will be motion-sensitive to avoid having to touch light switches.³²

31) Christie, Nathan. “Touring the Huge New Humber River Hospital, Part Two.” Urban Toronto., last modified Apr 1 2015, accessed May 5, 2015, urbantoronto.ca/news/2015/04/touring-huge-new-humber-river-hospital-part-two.
32) Ibid.



FIG. 4.16. Exterior view of the “View Dynamic Glass,” which carefully controls light penetration.

Patient rooms have also been carefully designed. There has been an emphasis placed on giving control to patients to allow them to take charge of their environments. A TV screen allows patients to watch television programs, as well as FaceTime or to “Skype” loved ones and call one of the nurses, who will all have hand-held devices for this purpose (see Fig. 4.15). Patients can also use their TV to view any medication charts or test results that the doctor would like to share with them.³³ Patients will also have control of the room temperature from their bed and the ability to change the opacity of windows. Using “View Dynamic Glass” tiny rods can change how much light penetrates through the glass, and windows can change from being completely transparent to opaque without the need of curtains (see Fig. 4.16

33) Ibid.



FIG. 4.17. “View Dynamic Glass” can stop light from penetrating through by the touch of a button, without the use of curtains.

& 4.17). Handing over control to the patient helps ensure they are comfortable and gives back some authority that they desperately have been seeking ever since coming into the hospital.³⁴ Also, patient control of many aspects of the room will decrease the amount of time nurses are called to do simple things that don’t require a nurse’s expertise, such as closing curtains or changing the room temperature. This frees time for the nurses to attend more critical situations. A comfortable room also encourages loved ones to visit, which also helps the patient feel supported. HRH will offer visiting hours 24 hours a day to encourage people to visit whenever it is convenient for them.

34) Ibid.



HOSPITALS IN ONTARIO THAT OFFER CHEMOTHERAPY

There are approximately 115 hospitals in Ontario that offer chemotherapy (see Ill. 4.3), 14 of which are Regional Cancer Centres which typically offer a wider variety of treatments and help set standards for cancer care.³⁵ While new cancer-care facilities will continue to be built, there is a vast need for design interventions that can be implemented in existing hospital spaces. The aim of this thesis is to study existing healing environments and the possible interventions that can be undertaken to retrofit existing spaces.

The following pages compare five different chemotherapy suites from around the world:

- Royal Cornwall Hospital (U.K.)
- Northern Devon District Hospital (U.K.)
- Asian Breast Centre (Philippines)
- Mary Dow Centre for Cancer Care (Maine, USA)
- Tom Baker Cancer Centre (Alberta, Canada)

These pages explore the layout of each chemotherapy (chemo) suite, comparing the amount of space each cancer patient has, as well as how much privacy each patient has by evaluating how many people are in direct sightline of the patient during treatment (see Ill. 4.4). There is a very common design aspect in these five layouts; typically, chairs are placed around the perimeter of the room, all facing the centre where the nurses typically are located.

Grand River Regional Cancer Centre

Cambridge Memorial Hospital
Guelph General Hospital
Grand River Hospital
Groves Memorial Community Hospital
Louise Marshall Hospital
North Wellington Health Care Corp.
St. Mary's General Hospital

Windsor Regional Cancer Program

Bluewater Health
Chatham Kent Health Alliance
Hotel-Dieu Grace Hospital
Leamington District Memorial Hospital
Windsor Regional Hospital

London Regional Cancer Program

Alexandra Hospital
Alexandra Marine and General Hospital
Grey Bruce Health Services
Hanover & District Hospital
Huron Perth Healthcare Alliance
Listowel Memorial Hospital
London Health Sciences Centre
Middlesex Hospital Alliance
South Bruce Grey Health Centre
St. Joseph's Health Care, London
St. Thomas - Elgin General Hospital
Tillsonburg District Memorial Hospital
Wingham & District Hospital
Woodstock General Hospital

Juravinski Cancer Centre

Brant Community Healthcare Alliance
Hamilton Health Sciences
Joseph Brant Memorial Hospital
Niagara Health System
Norfolk General Hospital
St. Joseph's Healthcare Hamilton

Carlo Fidani Peel Regional Cancer Centre

Halton Healthcare Services Corporation
Headwaters Health Care Centre

Trillium Health Centre
William Osler Health Centre
Odette Cancer Centre
Princess Margaret Cancer Centre
Mount Sinai Hospital
St. Joseph's Health Centre
St. Michael's Hospital
Toronto East General Hospital
Women's College Hospital
Stronach Regional Cancer Centre
Humber River Regional Hospital
Markham Stouffville Hospital Corporation
North York General Hospital
Southlake Regional Health Centre
Stevenson Memorial Hospital
York Central Hospital
R.S. McLaughlin Durham Reg'l Can Ctr
Campbellford Memorial Hospital
Lakeridge Health
Northumberland Hills Hospital
Peterborough Regional Health Centre
Ross Memorial Hospital
Rouge Valley Health System
The Scarborough Hospital
Cancer Centre of Southeastern Ontario
Kingston General Hospital
Hotel Dieu Hospital
Brockville General Hospital
Perth and Smiths Falls District Hospital
Quinte Health Care
The Ottawa Hospital Cancer Centre
Arnprior and District Memorial Hospital
Cornwall Community Hospital
Deep River and District Hospital
Hawkesbury and District General Hospital
The Montfort Hospital
Pembroke Regional Hospital
The Queensway Carleton Hospital
Renfrew Victoria Hospital

Winchester District Memorial Hospital
Simcoe Muskoka RCC/Royal Victoria Hspl
Collingwood General and Marine Hospital
Huron District Hospital
Muskoka Algonquin Healthcare (Bracebridge & Huntsville)
Orillia Soldiers Memorial Hospital
Hôpital Régional de Sudbury Reg'l Hspl
Blind River District Health Centre
Chapleau General Hospital
Kirkland Lake and District Hospital
Manitoulin Health Centre/Mindemoya
Muskoka Algonquin Health Care
Lady Minto Hospital – Cochrane
North Bay General Hospital
Sault Area Hospital
Sensenbrenner Hospital - Kapuskasing
St. Joseph's General Hospital - Elliot Lake
Temiskaming Hospital - New Liskeard
Timmins and District Hospital
West Nipissing General Hospital
West Parry Sound Health Centre
Northwest at Thunder Bay Reg'l Health Sciences Centre
Atikokan Regional Hospital
Dryden Regional Health Centre
Geraldton District Hospital
Hornepayne Community Hospital
Lake of the Woods District Hospital
Manitouwadge General Hospital
McCausland Hospital (Terrace Bay)
Nipigon District Memorial Hospital
Notre Dame Hospital (Hearst)
Red Lake Margaret Cochenour Mem. Hpl
Riverside Health Care Facilities (Fort Frances)
Sioux Lookout Meno Ya Win Health Centre
Thunder Bay Regional Health Sciences Ctr
Wilson Memorial Hospital (Marathon)

ILL. 4.3. There are 115 hospitals in Ontario that offer chemotherapy

35) "Regional Cancer Programs." Cancer Care Ontario., last modified Nov 3 2009, accessed Dec 10, 2014, www.cancercare.on.ca/cms/one.aspx?portalId=1377&pageId=8958.



EXISTING CHEMOTHERAPY SUITES

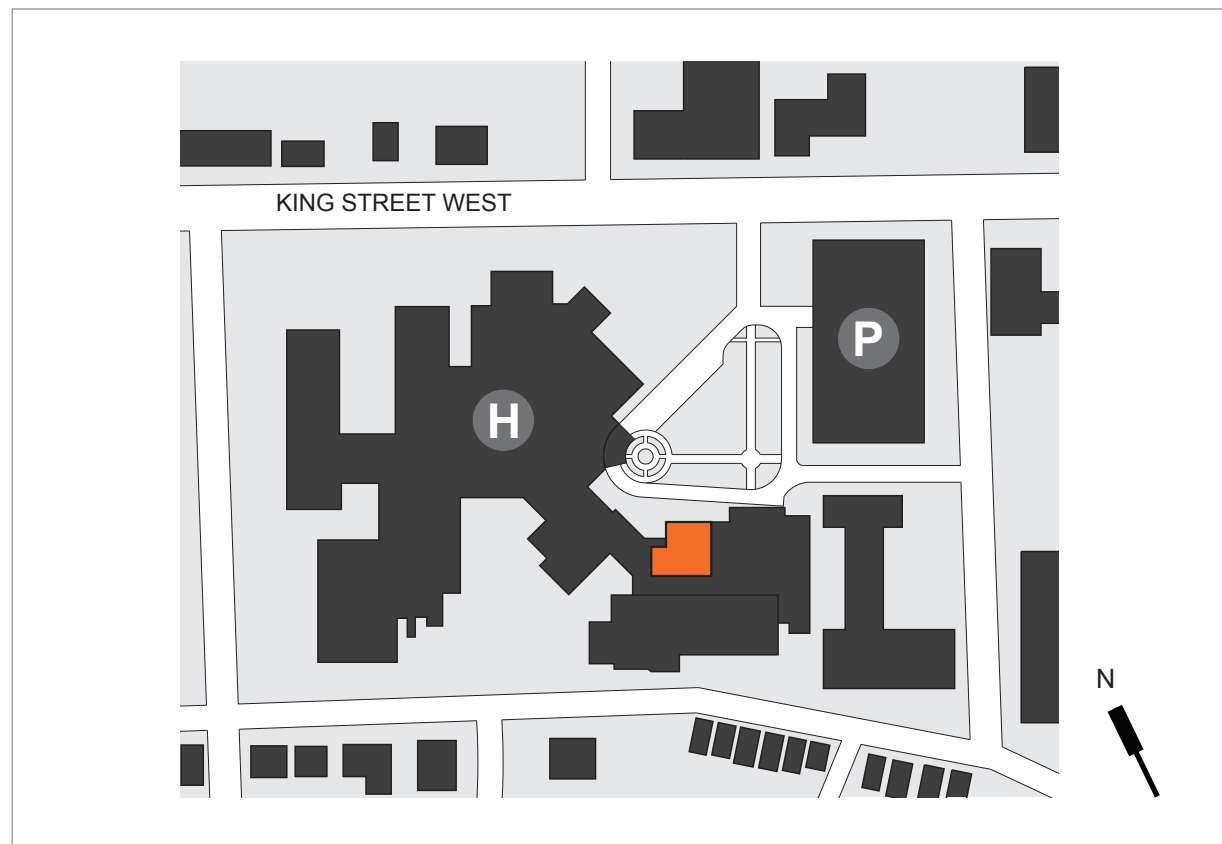


ILL. 4.4. Comparison between five chemotherapy suites from around the world

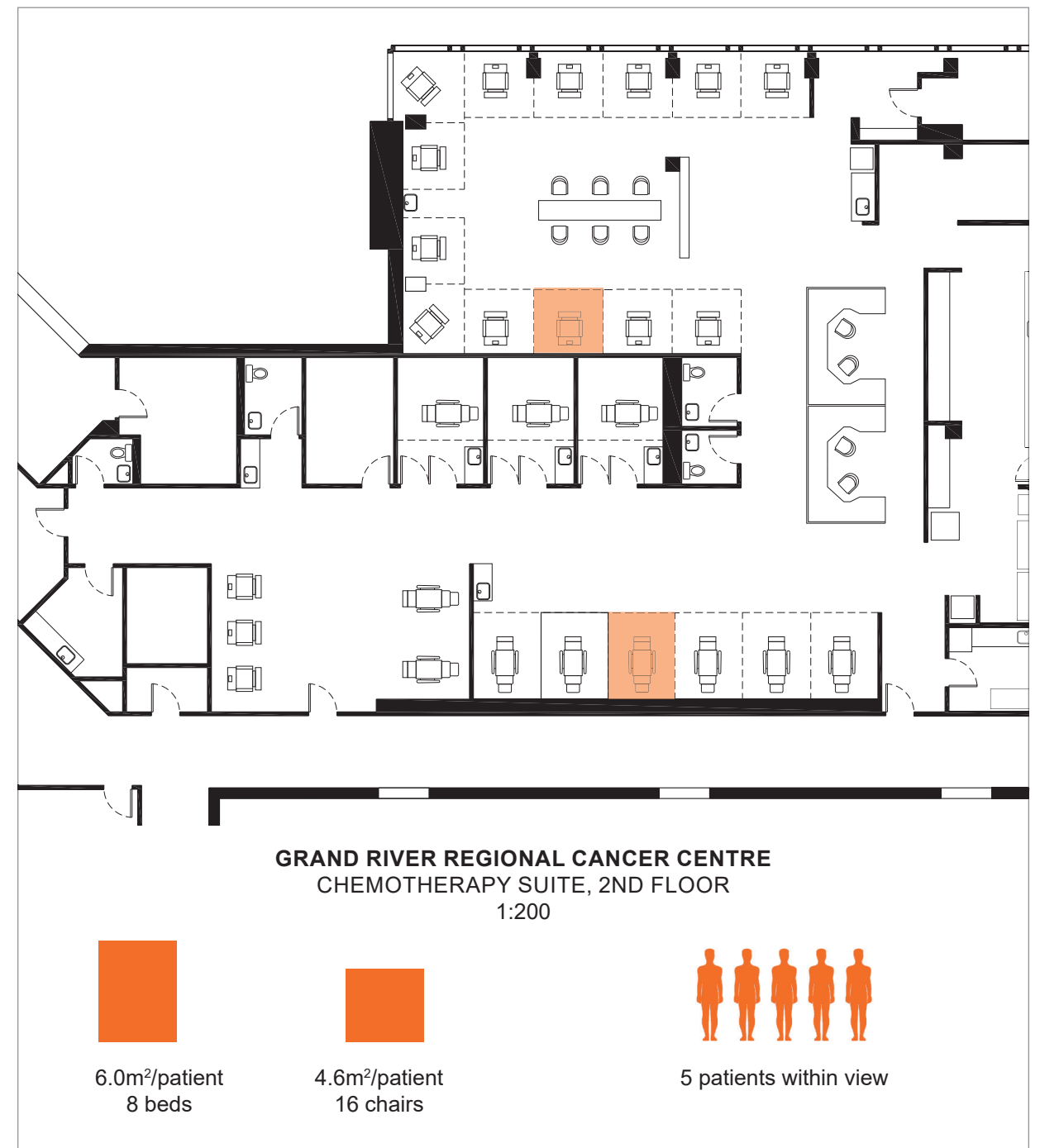
GRAND RIVER REGIONAL CANCER CENTRE

After examining some chemotherapy suites around the world, the thesis now examines Grand River Regional Cancer Centre (GRRCC), which opened in 2003, located in Kitchener Ontario. This will be the location of the Design Development in Part VII. As a Regional Cancer Centre, it serves residents from the Waterloo Region, Wellington County

and the surrounding areas. The Cancer Centre wing is on the east side of the site, attached to the main hospital (see Ill. 4.5). It offers specialized care in chemotherapy, radiation therapy, clinical trials, supportive care, inpatient oncology, and palliative care.³⁶ The chemotherapy suite is located on the second floor and can hold approximately 24 patients at one time (see Ill. 4.6).



ILL. 4.5. Site plan of Grand River Hospital, Kitchener, Ontario, 1:2000



ILL. 4.6. Evaluating Grand River Regional Cancer Centre's chemotherapy suite

36) "Cancer Program." Grand River Hospital., accessed Mar 3, 2015, <http://www.grhosp.on.ca/CANCERPROGRAM>.



Many chemotherapy suites become very crowded and have little to no privacy (see Fig. 4.18). Patients spend long hours in the chemotherapy suite while they receive their treatments. A typical chemotherapy session could take several hours and might take

place every week. The medications often make patients feel nauseous and weak, while having to sit in one chair for hours in a tense environment can be very uncomfortable.



FIG 4.18. Existing chemotherapy suites

The GRRCC chemotherapy suite was built in 2003. A relatively new space, the environmental qualities are quite good compared to many older hospitals (see Fig. 4.19). Half of the patients are located near windows providing natural light, and wood

materials are used throughout the space. The space, however, still presents itself as very institutional, with bare white walls and harsh bright white lights. It still heavily resembles a hospital space, breeding negative emotions of fear, anxiety, and worry.



FIG 4.19. Existing chemotherapy suite at the Grand River Regional Cancer Centre (2015)

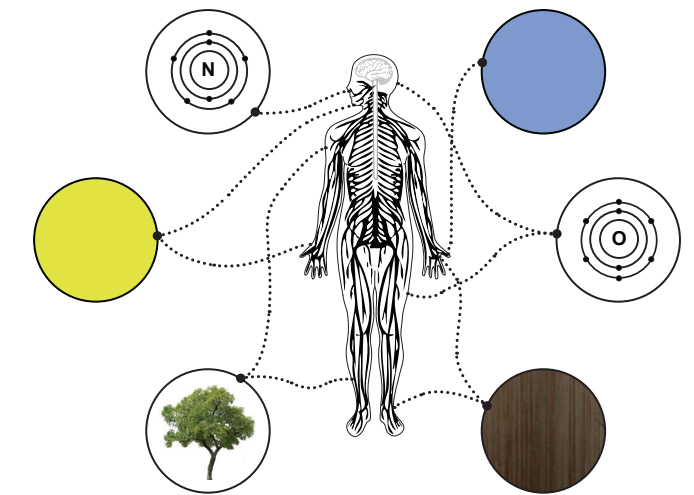


While taking a holistic approach of healing we must consider environments because they play such a crucial part in one's healing. Traditional hospitals built in the 1800's had a much greater emphasis on natural light and fresh air. Contemporary hospitals built Post-WWII show a shift in design, placing a high emphasis on function-oriented design.

Part IV revisited the Maggie's Centres projects to study the architectural placebo effect, which has a positive, calming effect on the body. Several chemotherapy suites revealed the crowded and privacy-lacking spaces that currently exist. Grand River Regional Cancer Centre in Kitchener, Ontario, was introduced as the site for Design Development, discussed further in Part VII.

Part V reviews the focus patient undergoing chemotherapy and investigates the specific challenges they face with cancer.





PART V: CANCER AND THE FOCUS PATIENT

About Cancer and examining patients undergoing chemotherapy

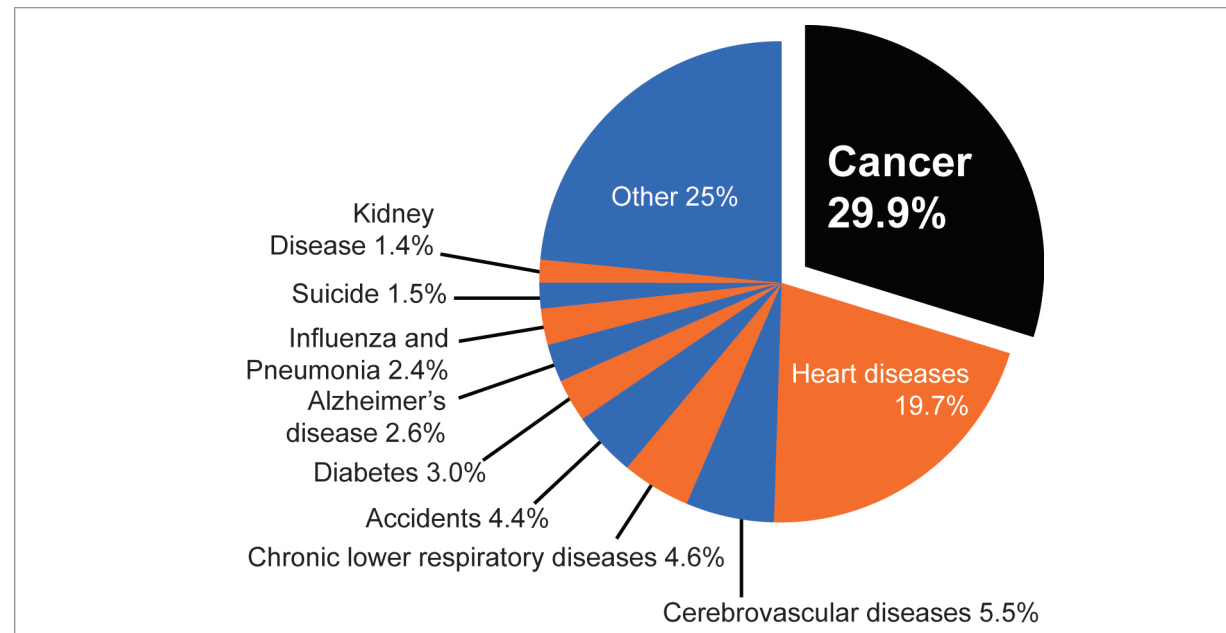


ABOUT CANCER

CANCER

Cancer is currently the leading cause of deaths in Canada with a projected estimate of 77,532 new cases of cancer in Ontario alone¹ (see Ill. 5.1 & 5.2). As the number of cancer cases continues to rise, hospitals will need to prepare for the growing demand for cancer

care. The most common cancers are prostate cancer for men, and breast cancer for women (see Ill. 5.3). The following page describes specific challenges that cancer patients face during treatment, including the effects of chemotherapy.

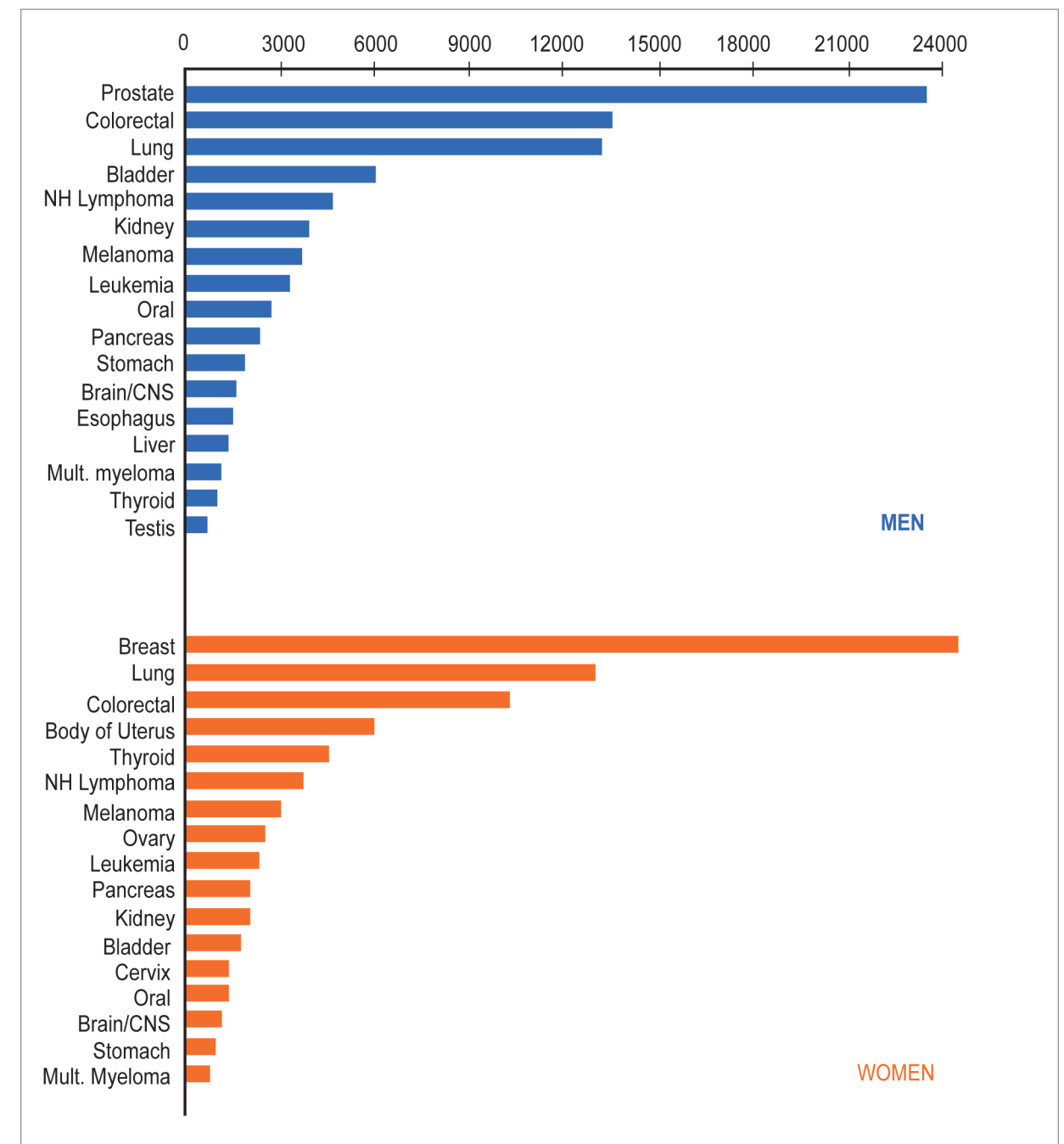


ILL. 5.1. Causes of Death in Canada, 2011

| | Total Population | % of pop. over 50 | Projected new cancer cases | Projected # of deaths |
|-----------------|------------------|-------------------|----------------------------|-----------------------|
| Waterloo Region | 784,778 | 33% | 3,940 | 1,528 |
| Ontario | 13,761,605 | 36% | 77,532 | 26,760 |

ILL. 5.2. Stats projected for 2014

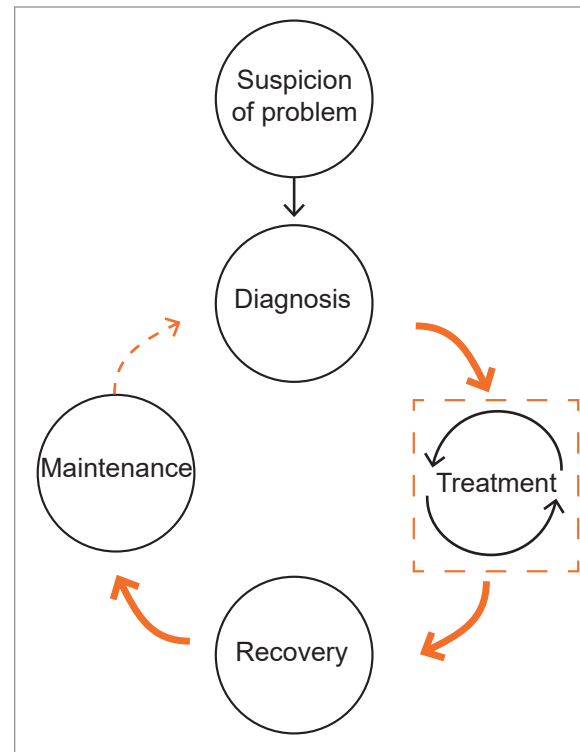
1) "Cancer Statistics." Waterloo Wellington Regional Cancer Program., last modified 2014, accessed Apr 4, 2015, www.ww-rcp.on.ca/cancerstatistics/.



ILL. 5.3. Estimated new cases of cancer, Canada 2014

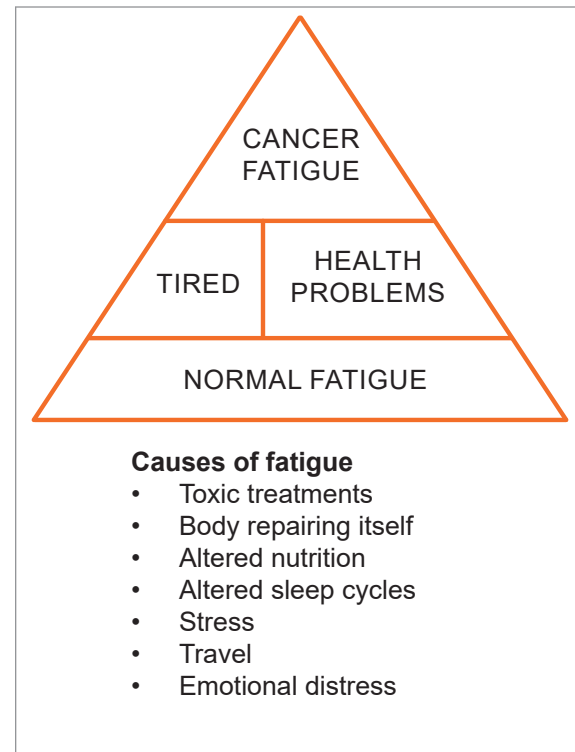


FOCUS PATIENT UNDERGOING CHEMOTHERAPY



ILL. 5.4. Typical cycle for patients receiving chemotherapy (typically cancer patients)

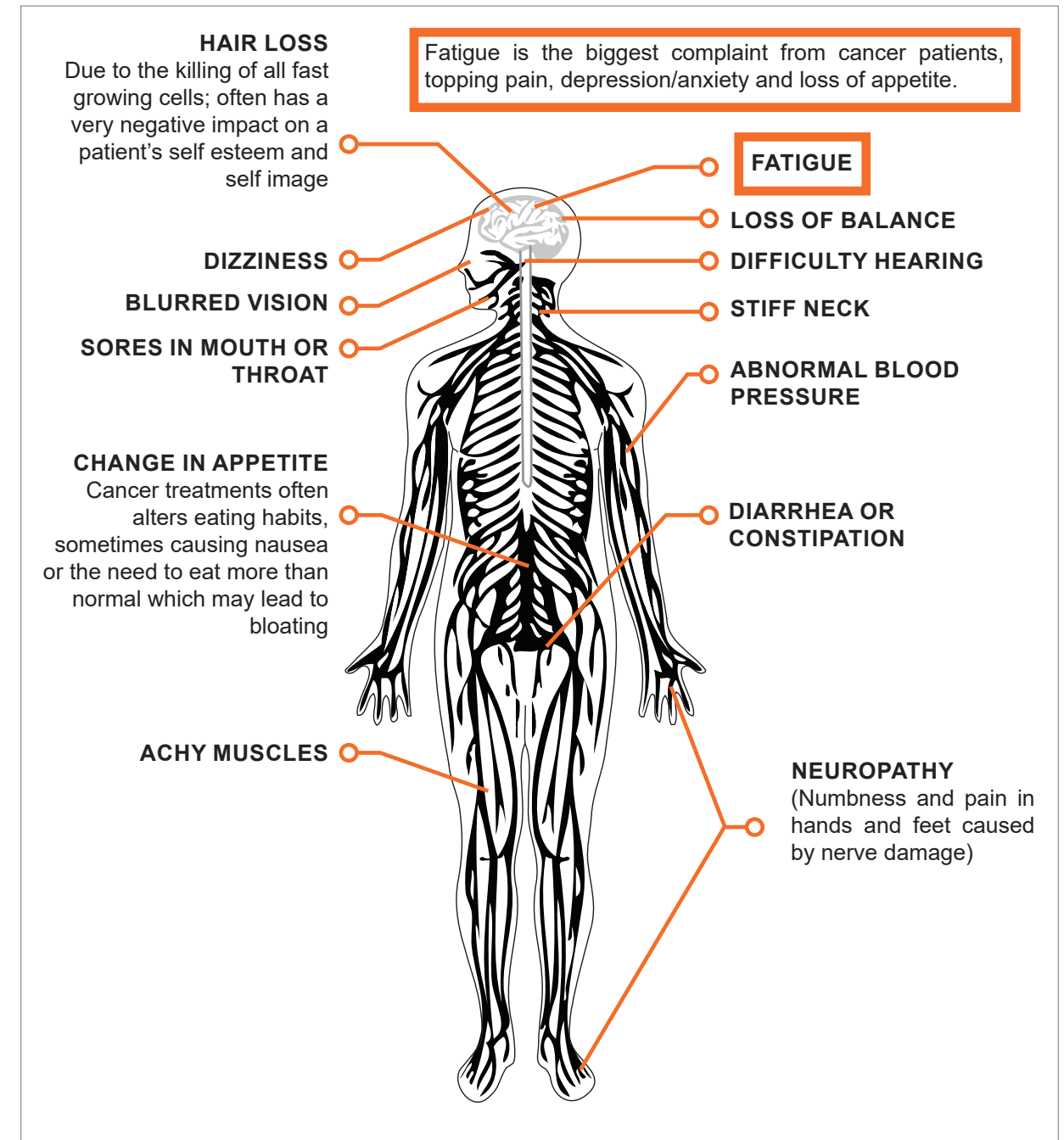
After diagnosis, patients usually begin treatment immediately, which can last anywhere from two months and beyond depending on the severity of the disease, prognosis, and progress as treatment takes place (see Ill. 5.4). The treatment plan can change significantly as time progresses. Unfortunately, many cancer patients recover only to find the cancer has spread. At this time, they typically resume treatment, either similar or different from before. Treatments widely vary by person and by stage.



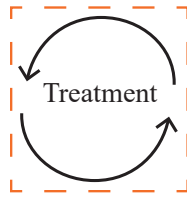
ILL. 5.5. Cancer Fatigue

Cancer Fatigue is one of the most difficult challenges cancer patients face and is not often treated because it cannot be directly measured, and patients often do not bring it to the attention of their caregivers.² Among other symptoms such as nausea, dizziness, and hair loss (see Ill. 5.6), *cancer fatigue*, more severe than regular fatigue, tends to get worse with more chemo and radiation treatments (see Ill 5.5). *How many of these symptoms and deaths could be avoided by minimizing stress from healing spaces?*

²) Evans, Dr M. "Cancer Related Fatigue." Sunnybrook., accessed Nov 1, 2014, <http://health.sunnybrook.ca/cancer-fatigue-content/video/>.

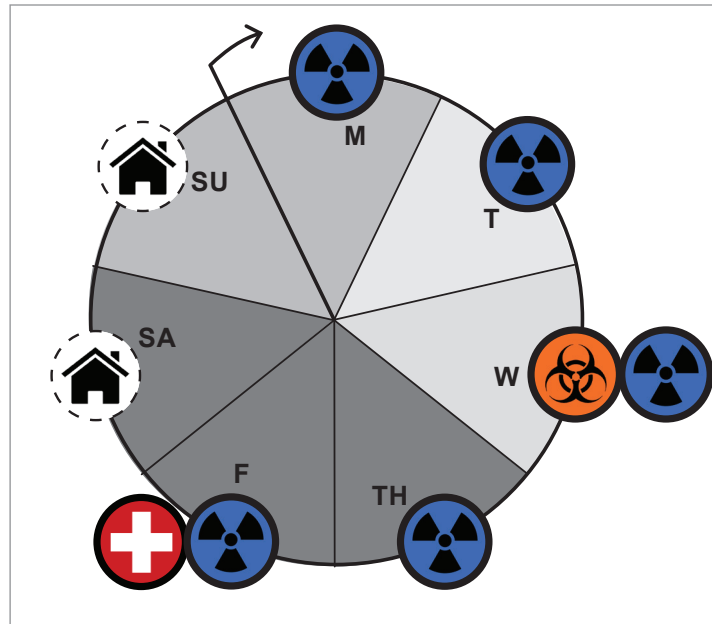


ILL. 5.6. Common Symptoms of Chemotherapy

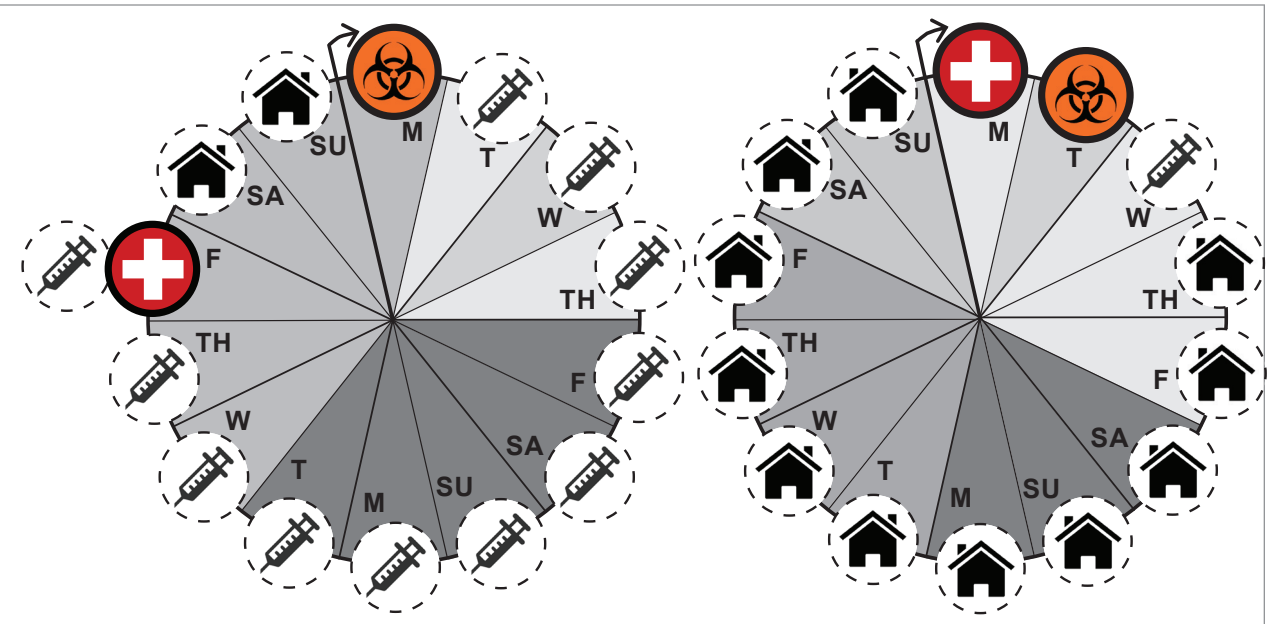


TYPICAL TREATMENT CYCLES

Cancer treatment plans vary depending on the patient's specific condition and disease. The following three examples (see Fig. 5.7, 5.8 & 5.9), were taken from an example patient with Locally Advanced Inflammatory Breast Cancer. A combination of chemotherapy, radiation, and injections are often used in 7 or 14 day cycles that repeat for several months.



ILL. 5.7. 7-DAY TREATMENT CYCLE
Chemotherapy/Radiation (x12 Repeat)



ILL. 5.8. 14-DAY TREATMENT CYCLE
Chemotherapy, Neupogen (x8 Repeat)

ILL. 5.9. 14-DAY TREATMENT CYCLE
Chemotherapy, Neulasta (x8 Repeat)

HOSPITAL



CHEMOTHERAPY (Hospital)

Chemotherapy is a treatment for cancer by the use of powerful chemicals injected into the body via intravenous to kill fast-growing cells in the body.



RADIATION THERAPY (Hospital)

Radiation therapy uses high-energy radiation to shrink tumors and kill cancer cells. X-rays, gamma rays, and charged particles are types of radiation used for cancer treatment. It is commonly delivered by a machine outside the body (external-beam radiation therapy).³



TESTS / DOCTOR'S VISIT (Hospital)

Various tests must be performed throughout cancer treatment to monitor the body's conditions, including blood levels, heart conditions, and scans to determine cancer growth, among other things.

HOME



INJECTIONS (Home)

Injections are administered to chemotherapy patients in between chemotherapy treatments to help the body restore itself after the harsh effects of the chemotherapy drugs destroy important systems needed for the body's recovery.

NEUPOGEN® (FILGRASTIM)

Neupogen is used to treat neutropenia, a condition where the body makes too few neutrophils, a white blood cell important in the body's fight against infection.⁴

NEULASTA® (PEGFILGRASTIM)

Neulasta's use is similar to Neupogen but the different medications are used in different combinations depending on the specific chemo treatment a patient is receiving.



REST DAY (Home)

No treatment unless problems arise.

3) "Radiation Therapy for Cancer." National Cancer Institute., last modified June 30, 2010, accessed January 9, 2015, <http://www.cancer.gov/aboutcancer/treatment/types/radiationtherapy/radiation-factsheet>

4) "Neupogen.", last modified 2014, accessed Nov 1, 2014, <http://www.neupogen.com/>.



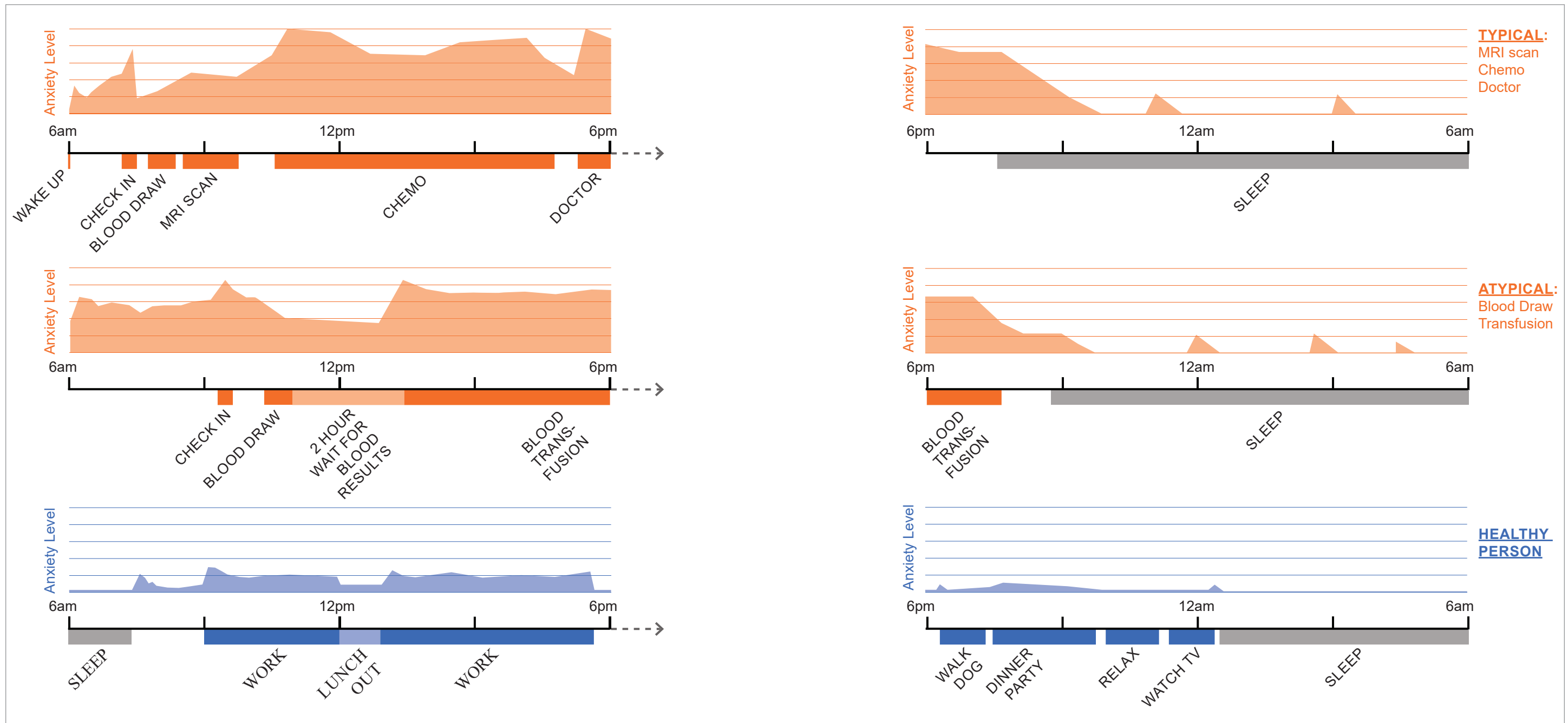
SAMPLE TIMELINES

Cancer treatments alone often cause a great deal of damage to the body. This creates a lot of stress on top of the stress of dealing with

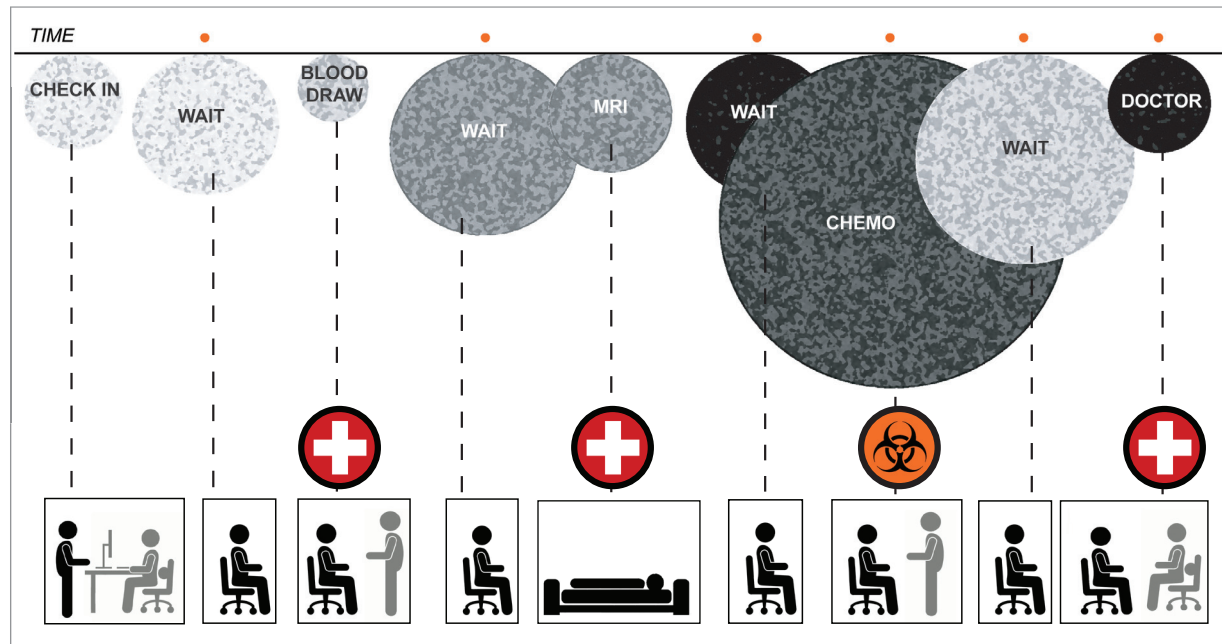
the disease. Ill. 5.10 shows sample timelines for a *typical day as a cancer patient*, an *atypical day as a cancer patient* (when a blood transfusion is needed due to low,

white-blood-cell counts from treatments), and a *typical day for a healthy person* who is not undergoing cancer treatment. Stress and anxiety levels tend to be much higher in

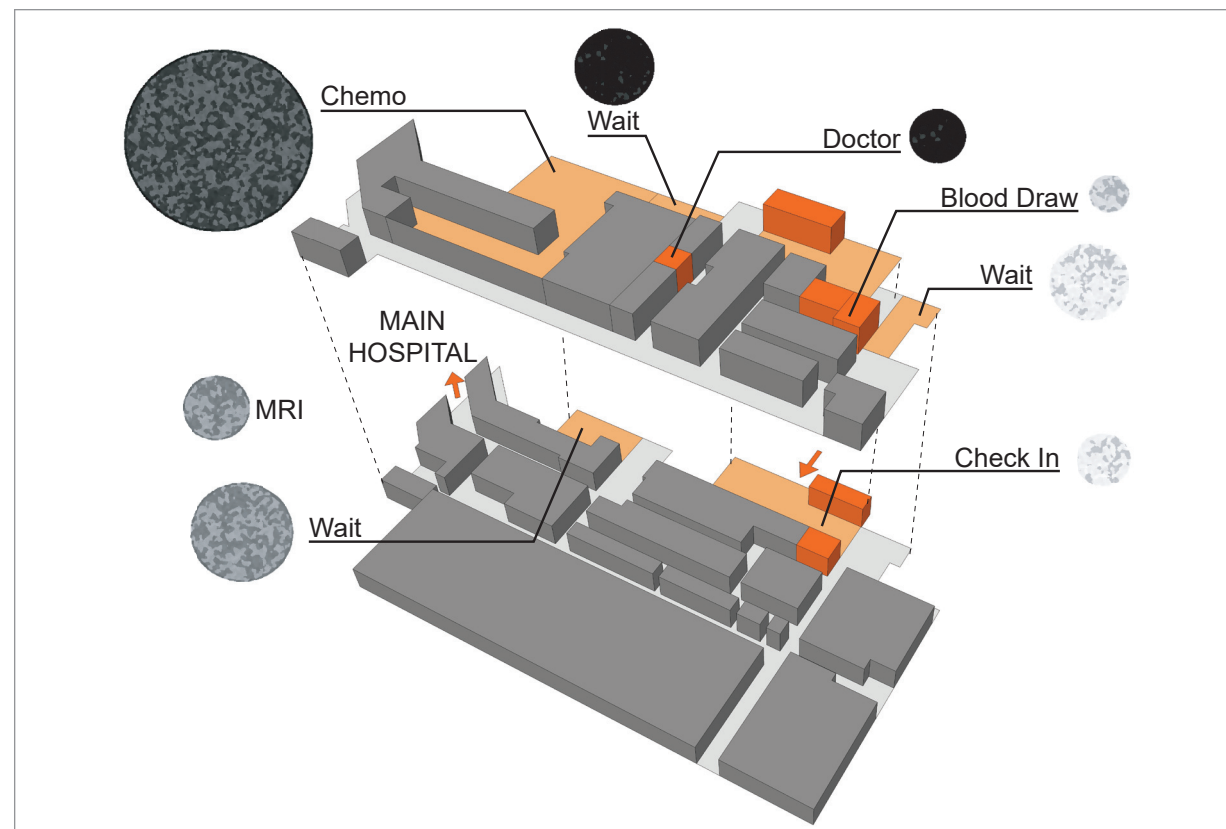
patients who are frequently at the hospital, and they suffer from uncomfortable symptoms from the medications. This weaker condition makes it harder to cope with this stress.



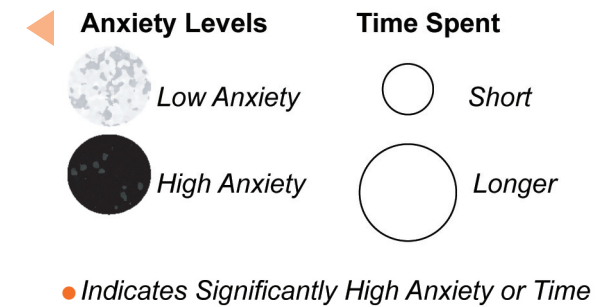
ILL. 5.10. Comparing Schedules and Anxiety Levels: Chemo Patient vs. Healthy Person



ILL. 5.11. Time and Role of Patient



ILL. 5.12. Axo, Grand River Regional Cancer Centre



WAITING TIME

Much of a patient's time at the hospital is spent waiting. Ill. 5.11 explores the different phases patients experience during a visit to the hospital and compares the amount of time spent in each portion, as well as the typical anxiety levels associated with each period. Ill 5.12 maps out where each of these stages are located in the Grand River Regional Cancer Centre. Often, patients will have several appointments in one day, including tests, treatments, and doctor examinations, yet most waiting spaces neglect to meet the need for patients to heal. Even while receiving chemotherapy treatments via intravenous, patients sit and wait for several hours while the treatments takes its course.

“An old-fashioned ladies’ room – not a partitioned toilet in a row – with its own hand basin and a proper door in a door frame – supplies privacy for crying, water for washing the face, and a mirror for getting ready to deal with the world outside again.”

- Maggie Jencks

Waiting time could be used in an effective way to help people heal, emotionally and psychologically from one treatment, while they gear up for the next. Natural light and a view of plants and birds offer the opportunity to relax and temporarily take one's mind off the immediate worries. An inviting space that calms the worried mind could offer opportunities for people to talk and lean on each other for support.

5) Jencks, Maggie Keswick. 1995. *A View from the Front Line*: Marcia Blakenham. 21.



There is an enormous prevalence of cancer in Canada, and the disease is currently the top cause of death. One of the many challenges cancer patients face is fatigue, yet many hospitals do not address this concern in their design. Waiting rooms are uncomfortable, and patients spend long days at the hospital, adding to their discomfort and fatigue.

The thesis has reviewed a variety of healing spaces, including many which showed positive health impacts. Part VI now outlines the space in which the design proposals take place for cancer patients: the chemotherapy suite at Grand River Regional Cancer Centre. The design proposals aim to test a variety of strategies to address these questions: how can architecture of a healing space become an integral part of healing itself? How can architecture have an active role in the healing process?





PART VI: INTERVENTION SITE

Identifying opportunities for interventions



IDEAL VS. PRACTICAL

| FOREST SETTING Natural | | | URBAN SETTING Built up | | |
|--|---------------------------------|---|--|---|---|
| | | | | | |
| | | | | | |
| Trees release phytoncides, lowering brain activity | Soft ground cover absorbs noise | Natural light controls circadian rhythm | Artificial lights produce <i>eternal day</i> (Philippe Rahm) | People and vehicles produce disturbing noises | Sign pollution can be distracting and stressful |
| | | | | | |

ILL. 6.1. Comparing elements of a forest to an urban centre

| | | | | |
|---|---|---|---|--|
| | + | | = | |
| Ideal setting to maximize potential for psychological healing | | Logical location for a healing centre, accessible to many | | |
| | | | | |

ILL. 6.2. Thesis Focus

An ideal healing space would incorporate many natural elements: trees releasing phytoncides, soft ground cover absorbing noise, and natural light. For practical reasons, hospitals are often built in dense urban locations for easy access and to be in close proximity of other hospitals and resources needed for their medical care (see Ill. 6.1).

How can a healing space balance the need for medical equipment and still be able to integrate design strategies to tap into the senses and the body's natural healing abilities? The architecture of a healing space

can contribute to the treatments and needs of a patient in such a way to not only facilitate but to also enhance the healing process. Architecture can act as a placebo, holding healing qualities in the nature of the design itself.

The focus of this thesis is to determine how to blend the aspects of an ideal setting with a logical location, typically, far removed from natural surroundings (see Ill. 6.2). The two key elements of interest are coloured light and scent.

HOSPITAL INTERIOR ARCHITECTURE

Goals of a healthcare facility include balancing the emotions of those who come for treatment. Healthcare architecture should provide protection and privacy, security and independence. Patients need to feel cared for yet, not trapped, connected to people while also having their own personal space.

Healing gardens have many benefits, and when they cannot be incorporated into a design, plants, water and other natural elements with restorative qualities can take their place. Hospitals are often disorienting and confining. Patients are often under a constant reminder of their illness with the various protocols and equipment. Plants (especially entire gardens) reduce the feeling of isolation.¹

In a study at the Graduate School of Horticulture in Chiba Uni, Kazuko Koga and Yutaka Iwasaki studied the effect on humans when touching foliage. They showed that people experience an unconscious calming reaction when touching a plant. In contrast, metal stimulus caused a stress reaction in human cerebral blood flow.²

Hospitals have a lot of metal surfaces for sanitary reasons; metal is easier to clean than many other materials. It seems that is the main driving force when designing the hospital, but if it creates a stress reaction in patients, is this not creating a problem while solving another?

Light is extremely important in a hospital. Daily light patterns affect the circadian rhythm, which is the body's way of keeping track of day and night. The circadian rhythm also regulates body temperature, heart beat, hunger, and sleep.³ When a patient is in a hospital ward where there are no windows and the lights are always on, it is disorienting to the body, as it cannot tell when the cycle of day ends and night begins. Prolonged time in environments such as these can lead to depression which compromises the immune system. Sunlight is extremely important for the body. In addition to helping stabilize the circadian rhythm within the body, the body also needs vitamin D which is absorbed through the skin and helps promote bone formation, aids the immune systems, and boosts one's mood.⁴

In addition to providing patients with proper light, it is extremely important that they feel comfortable which often translates into having enough privacy. Single occupancy rooms are more expensive and take up more space but they have many positive effects on people's psychological, mental, and physical health. Private rooms reduce unwanted noise and provide an environment that patients have more control over. Noise from people talking, nurses walking in the hallways, announcements over the intercom can disturb sleep, raise blood pressure, slow wound healing and, ultimately increase one's length of stay in the hospital.⁵

Donald McKahan, an architect and Health Facility Planner, further explores what makes people feel uncomfortable in hospitals. A survey showed that a patient's greatest fear is sleeping in the same room as a stranger. As previously mentioned, multiple-occupancy rooms are prone to more noise and lack privacy. Erie Chapman, CEO of Riverside Hospital in Ohio, finds many similarities between hospitals and prisons (see Ill. 6.3). In both facilities, patients and inmates are given a number, assigned a uniform, put into a room, often bleak and white, usually given a "cell-mate," and handed limited food choices. In both scenarios, people are stripped of their freedom and control. "Hospitalization radically alters the contacts and the context of patients' daily lives," McKahan remarks.⁶

There is much evidence to suggest that people's comfort and happiness have a great effect on their ability to cope and ultimately recover faster. Key studies led by Roger Ulrich have shown that pleasant views and connection to nature not only have positive impacts on patients, but on staff and visitors as well. Now that these types of Evidence Based Design (EBD) studies are becoming widely available, architects have a responsibility to act on this knowledge. Knowledge creates a moral obligation.⁷ Some people believe that EBD is so complicated that it is not possible to design based on how people feel. Logistics, time, money, and location often



ILL. 6.3. Hospitals and prisons both have one thing in common: lack of control.

distract people from seeing the many studies that show how advantageous EBD can be and that results can be measured by patients' stress responses, personal mood, and rate of recovery. Good design must consist of a combination of art and science. Success is based on craft being paired with strong research.⁸ Architect Anne Underhaug states, "People need to look out, they need daylight. You don't need a book on evidence-based design to know that."⁹

WHERE CAN ARCHITECTURE OFFER HEALING?

To explore where hospitals can offer the most beneficial healing spaces, an examination is presented on the following page. Ill. 6.4 presents questions to further the discussion on the critical points in a patient's hospital visit, where stress levels are frequently at their peak. Ill. 6.5 maps out the phases of the typical visit to the hospital, illustrating how much travel is required to move to each appointed space. Patients are often extremely exhausted, and traveling and way-finding can be overwhelming.

1) Komiske, Bruce King. 2013. In *Designing the World's Best Children's Hospitals* 3. 3rd ed., 187: Images Publishing Dist Ac.

2) Koga, Kazuko and Yutaka Iwasaki. 3013. "Psychological and Physiological Effect in Humans of Touching Plant Foliage - using Semantic Differential Method and Cerebral Activity as Indicators." *Journal of Physiological Anthropology*.

3) Hazlewood, Kelsey. "Light, Color, Sound." College of Design and Walter Cronkite School of Journalism and Mass Communication, Arizona State University, last modified 2008, accessed Oct 12, 2014, <http://cronkite.zine.asu.edu/healing/environments/banner.html>.

4) Ibid.

5) Ibid.

6) McKahan, Donald. "Healing by Design." Sandow Media LLC, last modified 1993, accessed Oct 14, 2014, <http://www.interiordesign.net/>.

7) Hamilton, Kirk. 2006. "Evidence Based Design and the Art of Healing." In *The Architecture of Hospitals*, 271-280: NAI Publishers.

8) Ibid. Page 267.

9) Rosenfield, Karissa. "Can Well-Designed Hospitals Shorten Recovery Times?" Arch Daily., last modified Nov 25 2014, accessed Dec 29, 2014, <http://www.archdaily.com/572185/can-well-designed-hospitals-shorten-recovery-times/>.



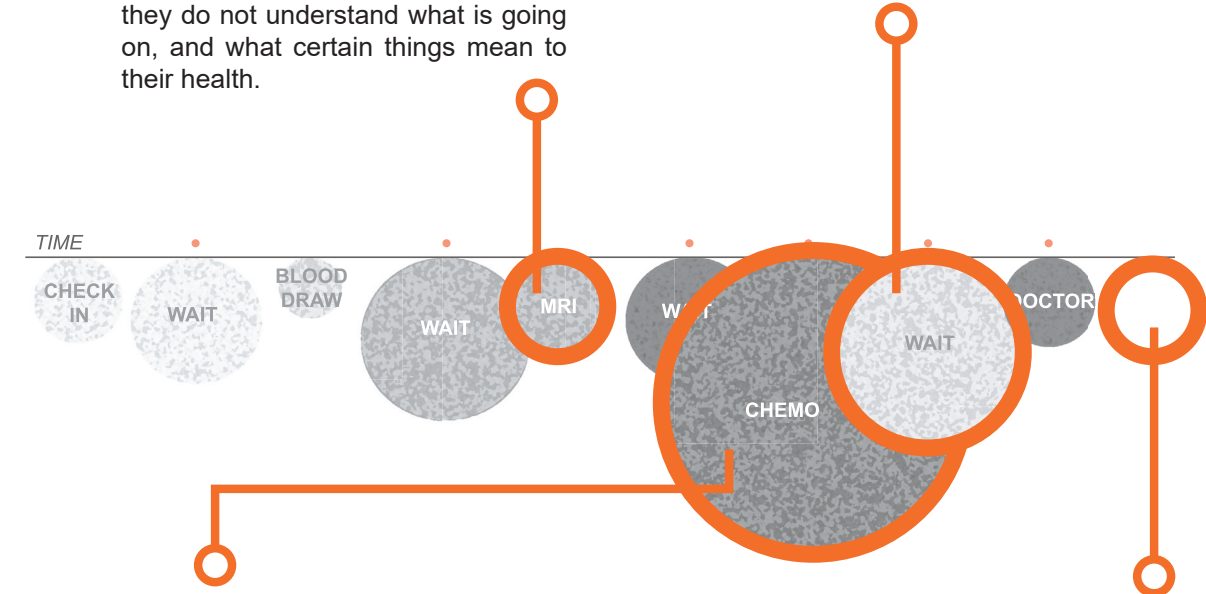


WHAT HAPPENS DURING TESTS?

How does the body deal with stress during a test that may perhaps be painful or uncomfortable? How does the body respond to the anxiety of anticipating the results? Tests are often very complicated, and patients can become especially worried when they do not understand what is going on, and what certain things mean to their health.

WHAT HAPPENS IN BETWEEN TREATMENTS?

How does the body handle stress and how does the body prepare for the upcoming treatments? Esther Sternberg writes about the importance of relaxation in order to open up the body to accept much needed treatments and medication to maximize healing potential.



WHAT HAPPENS DURING LONG TREATMENTS?

Chemotherapy through intravenous can take anywhere from 30 minutes to four hours to administer. How do patients manage the psychological stress of these chemicals damaging one's body and the physical symptoms of the drug itself?



WHAT HAPPENS AFTER MEDICAL TREATMENTS?

What happens at the end of a patient's day at the hospital? A stress response can be measured for hours after a stressful event. Just because a patient has finished receiving chemotherapy does not mean their body has recovered from the stress the experience generated. A patient needs a 'buffer zone' after treatment to fully recover from the day.

ILL. 6.4. Where Architecture can offer Healing?

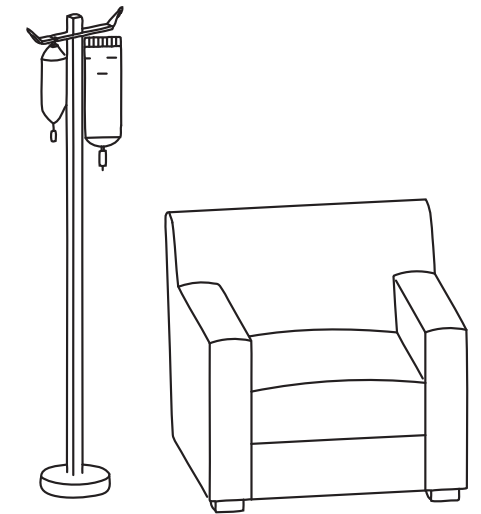
ILL. 6.5. (Opposite page) Areas visited at the hospital during typical visit



The goal of this thesis is to translate as many of the advantages of the ideal healing setting into the design of modern hospital spaces.

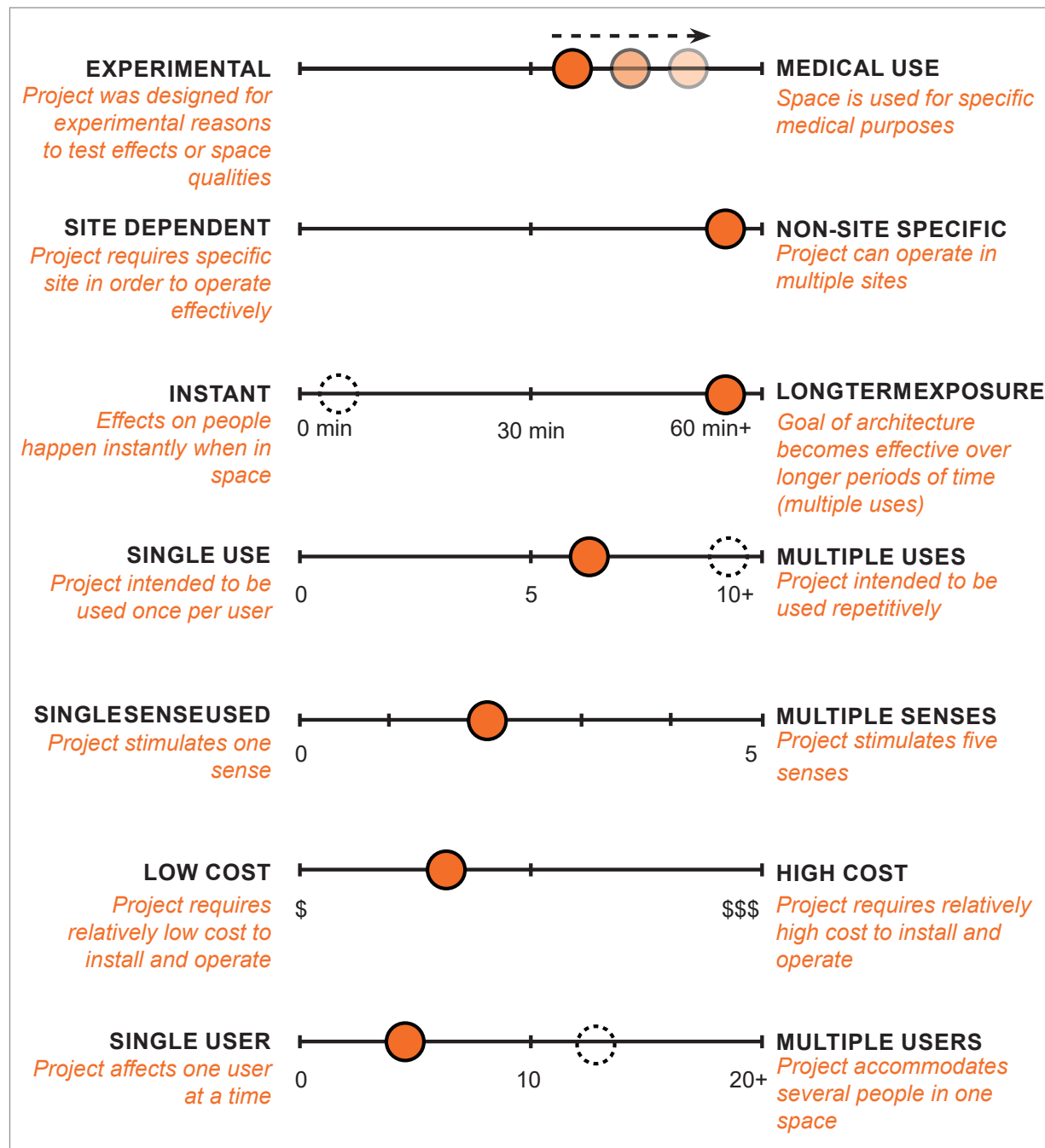
This final part explores the design development and intervention proposals which aim to address the challenges of the chemotherapy suite. The design development will focus specifically on the chemotherapy suite at Grand River Hospital. The designs seek to help augment healing through environmental elements, by supporting the body's natural abilities to release immune boosting brain pharmaceuticals. Assessments are conducted to evaluate the success of the designs, including their strengths and weaknesses. Additional spaces outside the chemotherapy suite are also examined to address some of the questions raised in Part VI, and to explore how these design systems can be integrated throughout a hospital.





PART VII: DESIGN DEVELOPMENT
Responding to the needs of cancer patients and proposing interventions

DESIGN DEVELOPMENT GOALS



ILL. 7.1. Design Development Evaluation Guidelines

Part VII explores three design development iterations. In order to begin design work, objectives were established by referencing many of the influential projects reviewed throughout the thesis. In order to better evaluate and compare projects to one another, evaluation guidelines were determined. The assessment presented in the Design Development Evaluation Guidelines (see Ill. 7.1) indicate the intentions for the design intervention. The following page shows a comparison of key projects, evaluating them according to these sliders.

EVALUATION CRITERIA

Experimental vs. medical use: Evaluates projects based on their purpose. Many projects are studies or installations that are experimental in nature; others were designed for a medical facility use.

Site-dependent vs. non-site specific: Some projects are highly dependent on their site in order to function properly, while others can be placed anywhere without any disadvantages.

Instant vs. long-term exposure: Some projects affect the user instantly, such as a calming walk through a forest, whereas other projects require longer periods of time in order for the full effect to sink in.

Single use vs. multiple use: Projects are typically designed to either be visited once or multiple times. Installations, for example,

typically get people coming only once. Hospitals, on the other hand, have many patients visiting over and over and require different stimulating elements to keep the experience fresh.

Single sense used vs. multiple senses used: Projects will often aim to stimulate a particular sense (hearing, seeing, touching, tasting or smelling) and some projects aim to stimulate more than one.

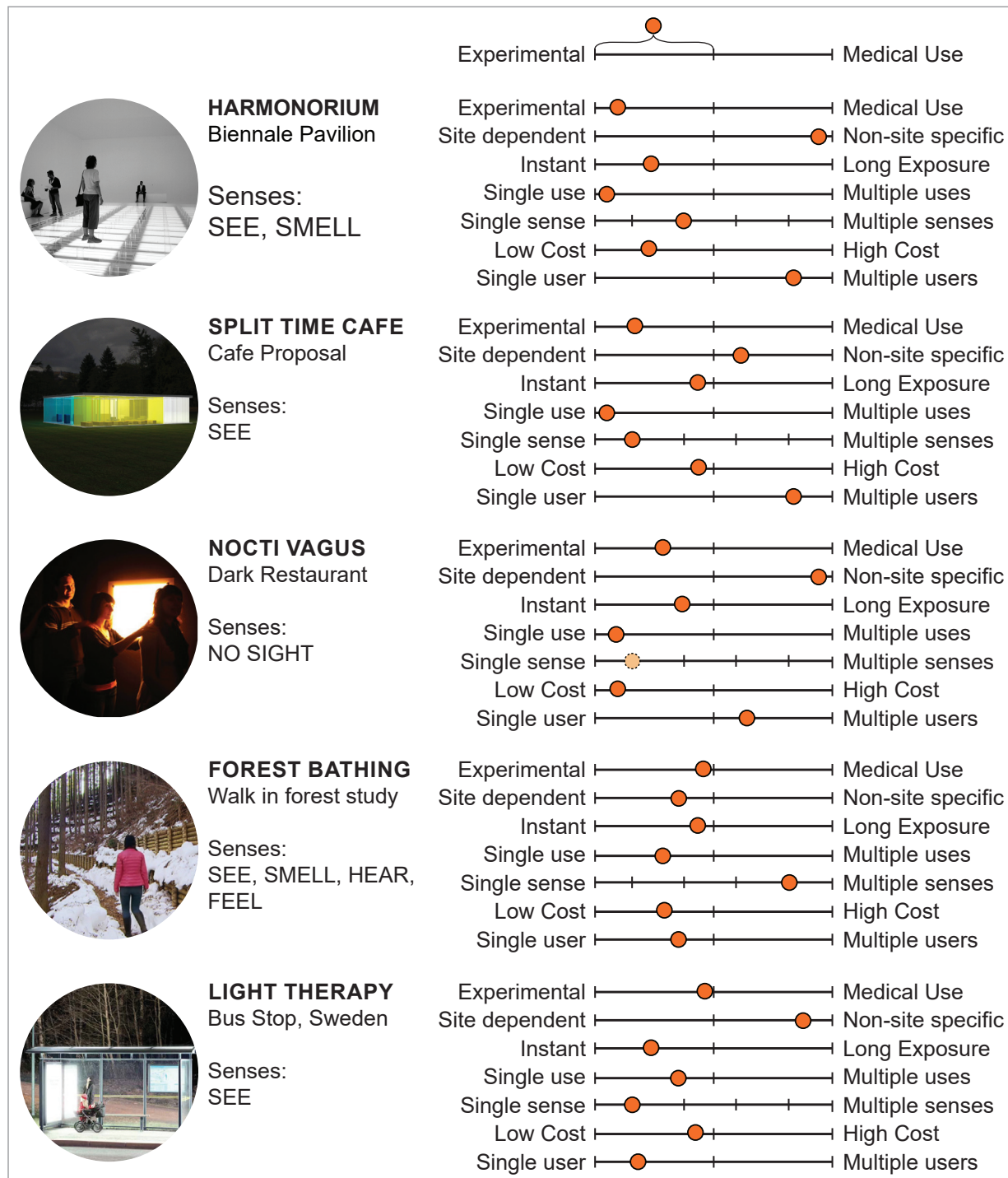
Low cost vs. high cost: Projects will vary in the expenses they require to set up and operate.

Single user vs. multiple users: Some projects are intended for one user at a time in the space, whereas others will be designed for multiple people using it at the same time, including patients, nurses, doctors, and visitors.

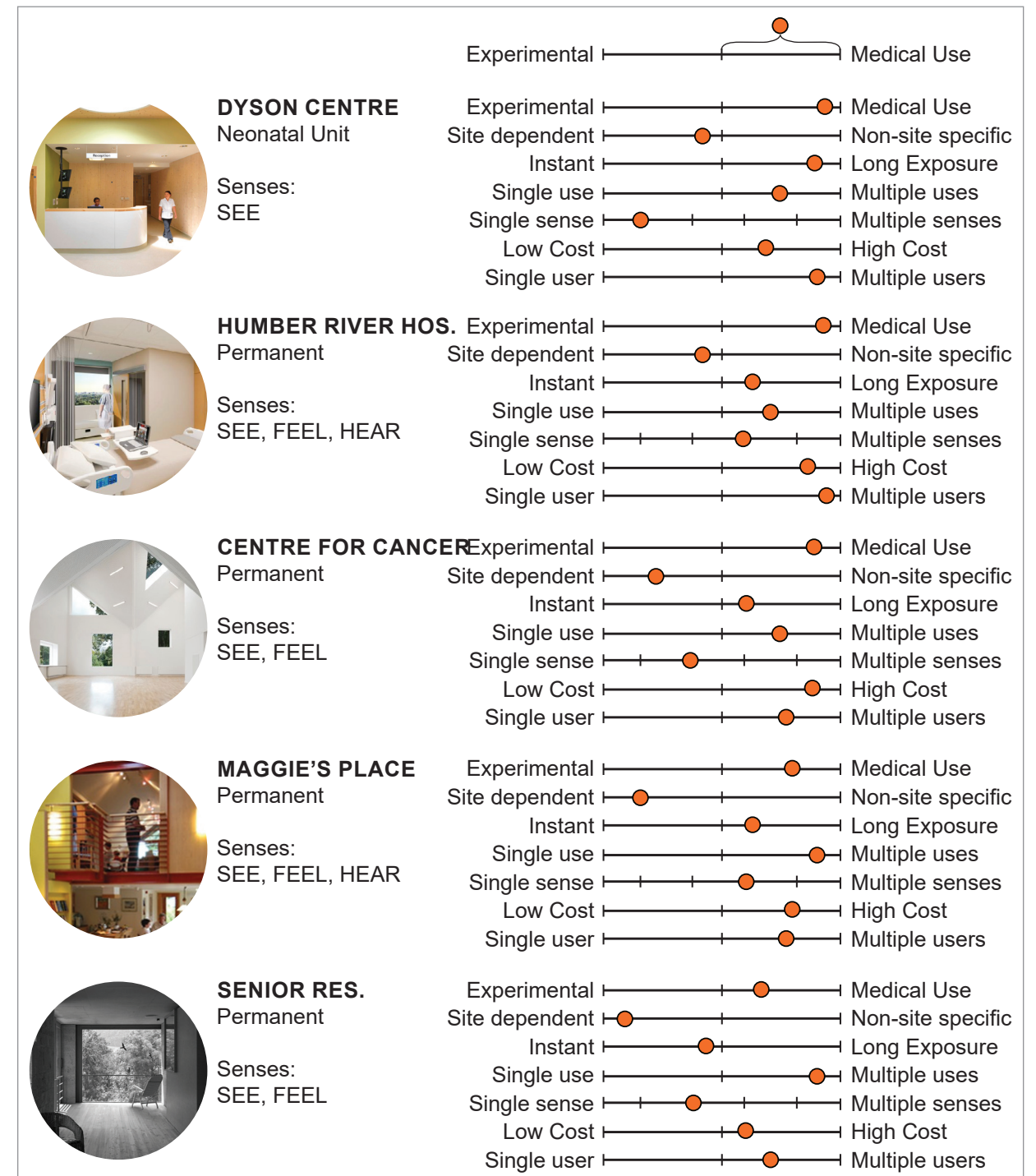
EVALUATIONS

The evaluations on the following page analyze some of the significant projects mentioned previously in this thesis (see Ill. 7.2 & 7.3). This provides a method of contrasting and comparing projects with each other and with the intended evaluation criteria set out for the design development of the proposed chemotherapy suite. Projects are grouped as those that are experimental in nature and those with specific medical uses.





ILL. 7.2. Project Evaluations - Experimental Projects



ILL. 7.3. Project Evaluations - Medical Projects



OBJECTIVES FOR DESIGN DEVELOPMENT

The following three objectives are outlined to address the specific needs of the chemotherapy suite and its users in the design developments to follow.

 **ADAPTABLE**
per patient

ADAPTABLE

In order to address the needs of each chemotherapy patient, the design should be adaptable for each patient. People come into the hospital for treatment with many different needs and tolerances. Some people desire to be social while being awake and alert throughout their treatment. Other people may feel ill or prefer more privacy and would rather have a nap during treatment. People's needs can change person to person and day to day, and the design of the space should be able to accommodate and address a variety of needs at the same time.

 **FLEXIBLE**
for installation in any chemo suite

FLEXIBLE


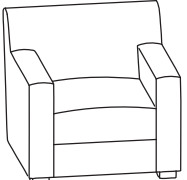


There are approximately 115 hospitals in Ontario that offer chemotherapy. While a new design approach for chemotherapy suites would be beneficial to aid the design of brand new facilities, there is a need for existing chemotherapy suites to be retrofitted in order to improve the quality of care at these hospitals. Therefore the following design development has an emphasis on flexibility for installation in existing chemo suites.

 **LOCALIZED**
effect to be controlled to affect intended patient

LOCALIZED

As mentioned previously, every patient has unique needs for designs incorporating scent and light, the effects must be controlled so as not to interrupt treatment spaces for which they are not intended.



INTRAVENOUS

Intravenous is the common method of receiving chemotherapy. A needle is placed in a patient's vein, and the entire session can last up to 4 hours.

CHAIR

While a patient receives chemotherapy, they need a place to sit for the duration of the treatment. They may get up periodically to use the bathroom.

Approx. size: 1m (H) x 0.8m (W) x 0.9m (D)

MEDICAL CART

Nurses often use a medical cart to move around equipment needed for chemotherapy. This cart generally holds needles, blood pressure and heart pulse monitors, and any extra bandages or cotton.

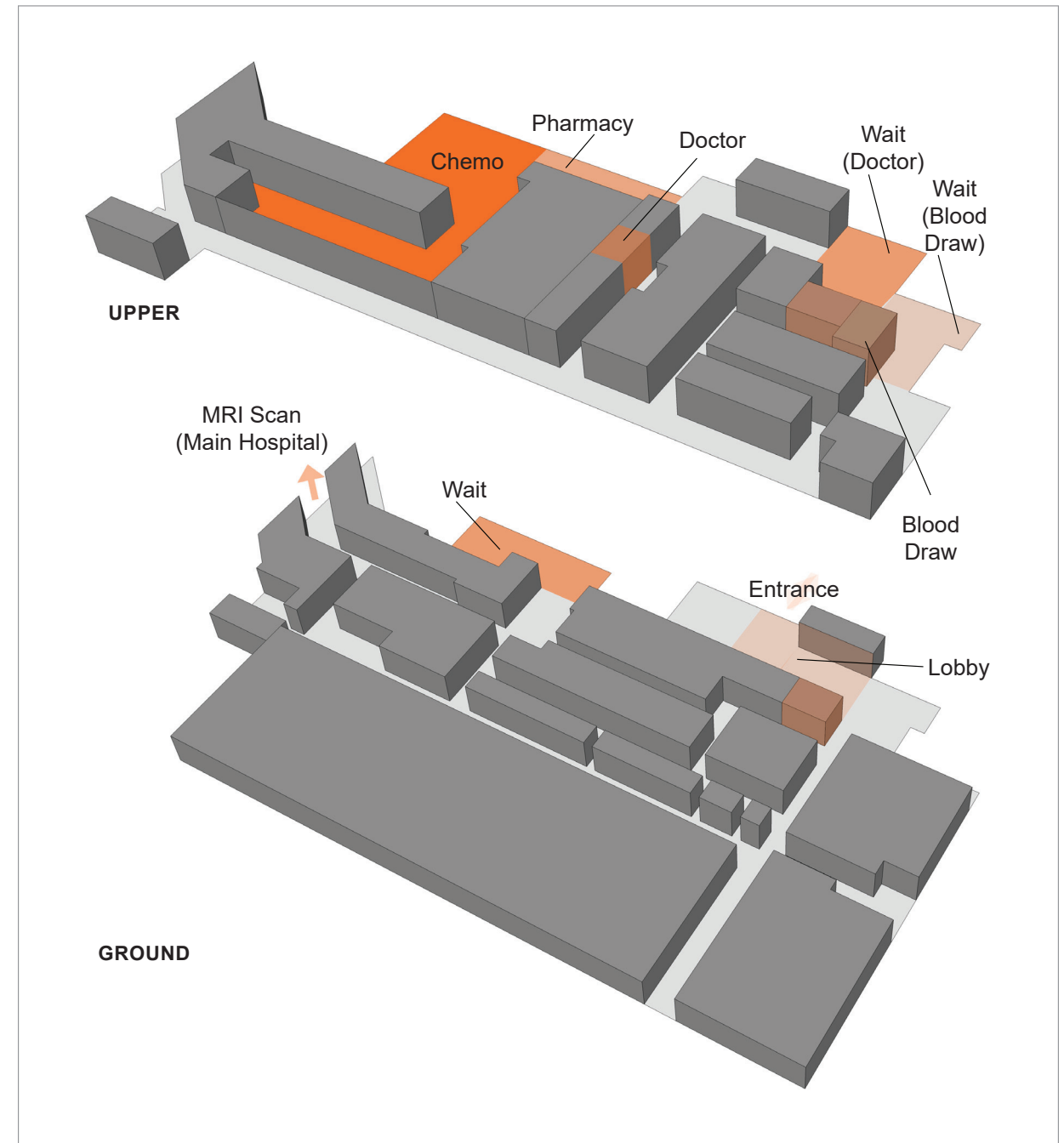
Approx. size (varies): 0.85m (H) x 0.5m (W) x 0.4m (D)

ILL. 7.4. Elements required for chemotherapy

REQUIREMENTS FOR CHEMO

The treatment of chemotherapy typically requires very little medical equipment in the chemo suite (see Ill. 7.4). Each patient needs a chair and an IV pole for the medication. Medical carts are used by nurses to move their supplies around. With such few requirements,

the chemotherapy suite can be very flexible in its design while still accommodating the necessary equipment. At Grand River Hospital, patients often have many other appointments before and after chemotherapy, and these are generally located throughout the cancer centre (see Ill. 7.5).



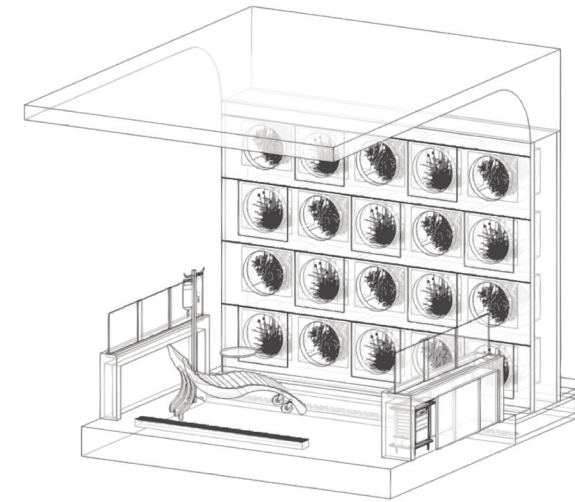
ILL. 7.5. Schematic Axo, Grand River Regional Cancer Centre



DESIGN DEVELOPMENT PROPOSALS

Three design iterations have been proposed with the purpose to address the challenges of stress and cancer treatment in the chemotherapy suite, discussed throughout this thesis. All iterations focus on using the elements of *coloured light* and *scent* to stimulate a stress reduction in patients. These proposals act as mini studies to further advance the conversation around how hospital spaces can be improved to aid healing. Each of these proposals were designed one after the other, each successive design trying to capitalize on the previous design's strengths, while attempting to improve the overall scheme in terms of effectivity, logistics and practicality.

DESIGN 1: WILE WALL



The Wile Wall introduces natural plants into the chemotherapy space, contained within a wall hosting multiple compartments for different plants. Sliders allow patients and hospital staff to close or open the compartments to the treatment space, allowing the scent from the intended plants to be drawn out of the wall and into the area where the patient is situated.

The multiple compartments allow for flexibility for a variety of plants to be available for treatment. Plants could include *peppermint*, which helps fight fatigue, *lavender*, which acts as a sedative, *rosemary*, which helps with alertness and *jasmine*, which has a scent that is very calming.

ELEMENTS IN CHEMOTHERAPY SUITE

The following pages examine elements used in the Wile Wall Chemo Suite Design (see Ill. 7.6) as well as the scents that could be used in the wall itself (see Ill. 7.7).





Glass screens

Sliding glass screens operate to either expose plant fragrances in the Wile Wall into the treatment area or to block the scent from each individual compartment. When the lavender compartments are “open,” the peppermint compartments are “closed,” and vice versa.



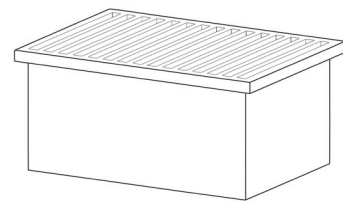
Lavender

50% of the plant matter in the Wile Wall is lavender. Lavender has been known to act as a sedative showing relaxing effects by slowing reactions, reducing attention, and impairing working memory. A study conducted by Dr. Mark Moss found that residents in a Japanese nursing home who wore a lavender skin patch suffered fewer falls. Researchers speculate that lavender has a stabilizing effect on balance (see Ill. 7.7 for study sources).



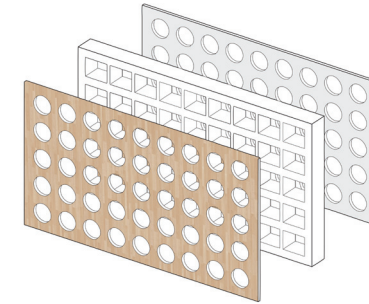
Peppermint

50% of the plant matter in the Wile Wall is peppermint. Peppermint has been known to help fight driving fatigue, as found in a study by Dr. Bryan Raudenbush at Wheeling Jesuit University (see Ill. 7.7 for study sources).



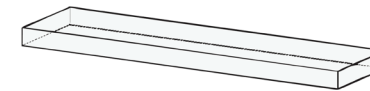
Intake vent

A vent drawing air in is placed on the floor behind the chemo chair, directing air from the plants in the wall to the vent, passing by the chair and hence the patient, spreading the fragrance of the plant onto the user.



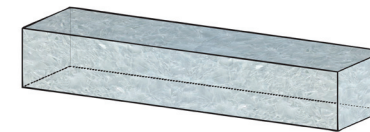
WILE Wall

The wall houses various types of plants that each give off a fragrance that directly has an effect on the brain’s chemical processes to produce an effect in the body to aid in the comfort and healing process taking place during chemotherapy.



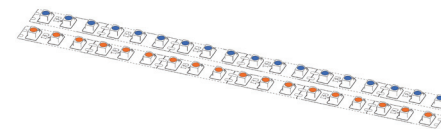
Glass

Transparent glass covers water, allowing a visual connection through to the water and the colour produced by the light.



Water

Water allows the light from the LED strips to pass through and create a natural reflection on the wall. The water also carries the colour of the light to project onto the wall surface. As water drains through plant material and empties into the trough below, reflections of these ripples are projected onto the wall and ceiling.



Lights

Light fixtures located within the water produce coloured light to be projected onto the wall.



Colour

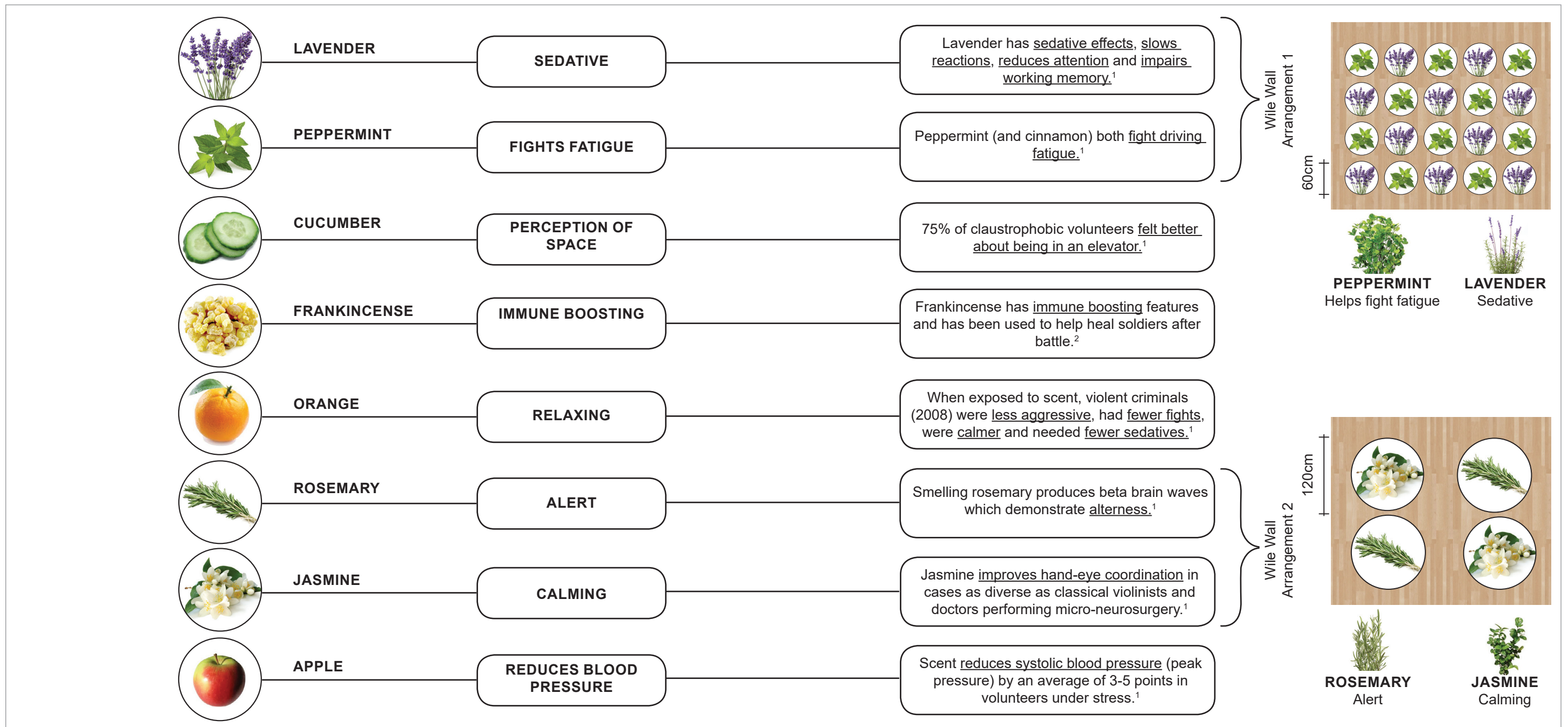
ORANGE: With a wavelength greater than 570 nm, orange will trigger the release of melatonin, making the body perceive the time as true night, feeling tired.



BLUE: With a wavelength less than 570 nm, blue will block the release of melatonin making a patient feel more awake.

ILL. 7.6. Elements used in Wile Wall Design



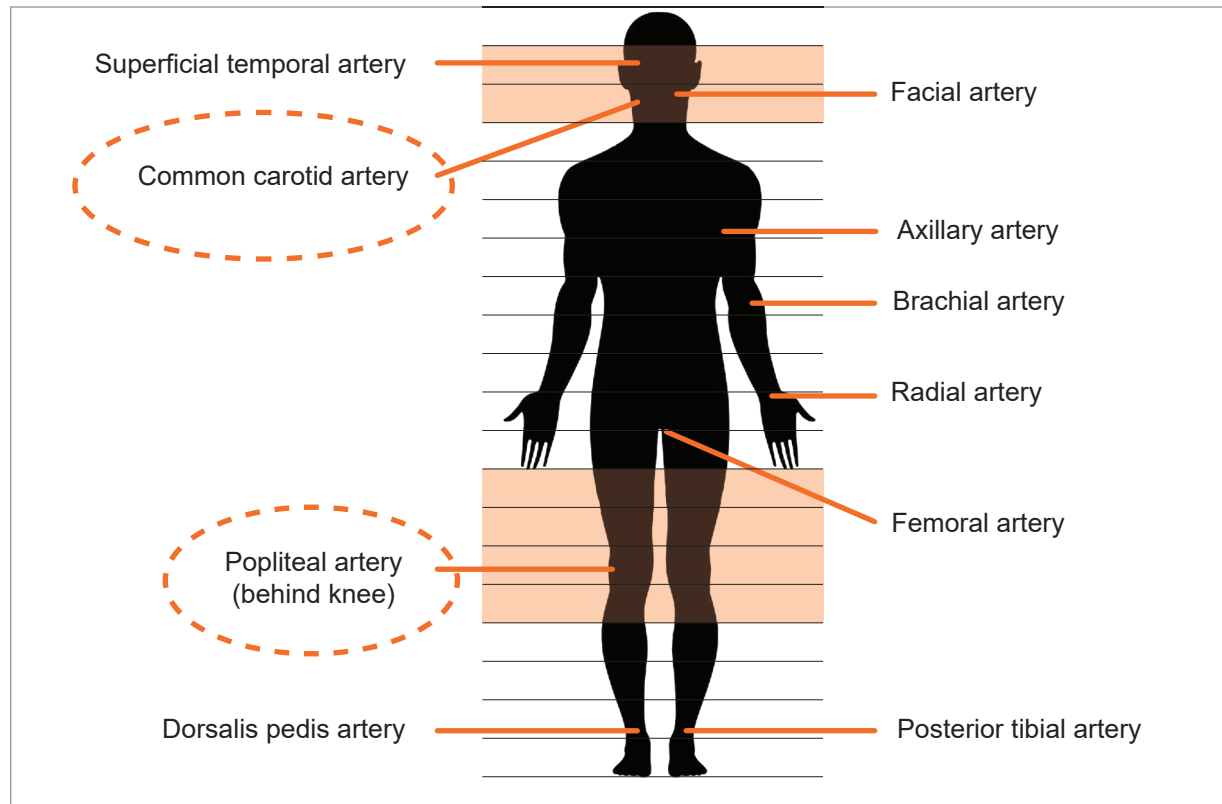


ILL. 7.7. Natural Scents

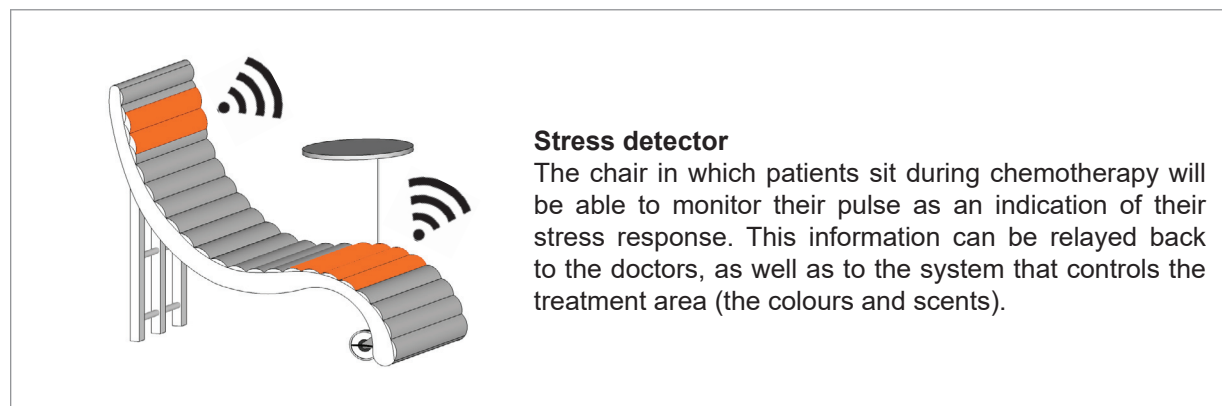
1) Bateson, Lynne. "Smells to make You Well." Daily Express Health. Daily Express Health RSS, last modified Dec 4 2012, accessed Sept 18, 2014, <http://www.express.co.uk/lifestyle/health/362320/Smellsto-makeyouwell>.

2) Sternberg, Esther and Tippett, Krista. "Esther Sternberg - the Science of Healing Places." On Being, last modified 2013, accessed Sept 17, 2014, <http://www.onbeing.org/program/the-science-of-healing-places/4856/audio?embed=1>.





ILL. 7.8. Arteries in the human body that can be used to measure pulse, an indication of the body's stress level.

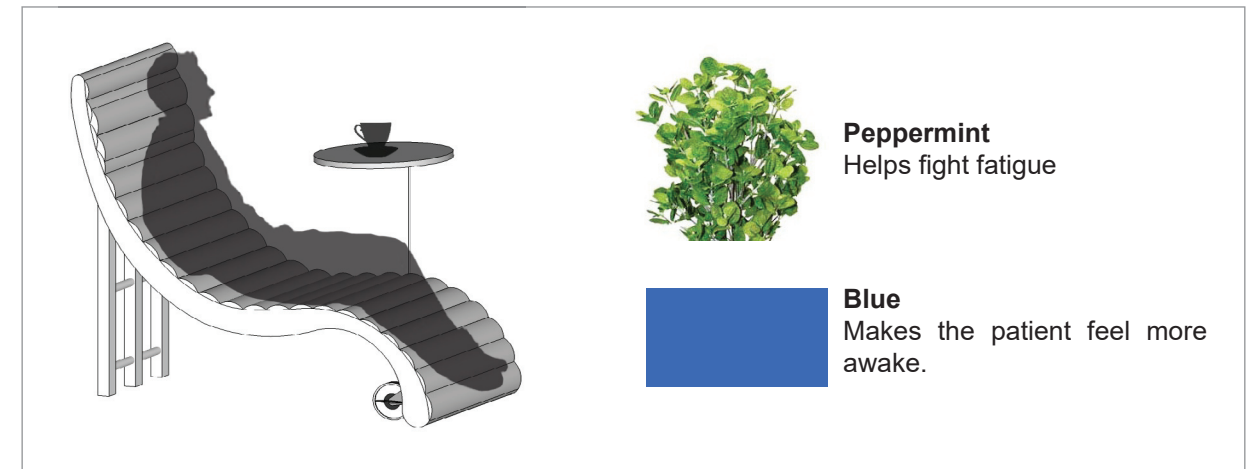


ILL. 7.9. Stress detecting chair

MEASURING STRESS

Various techniques can be used to evaluate one's stress reaction by measuring their breathing, heart rate, and blood pressure. Below is a proposed chair with the ability to detect specific points in the body, such as

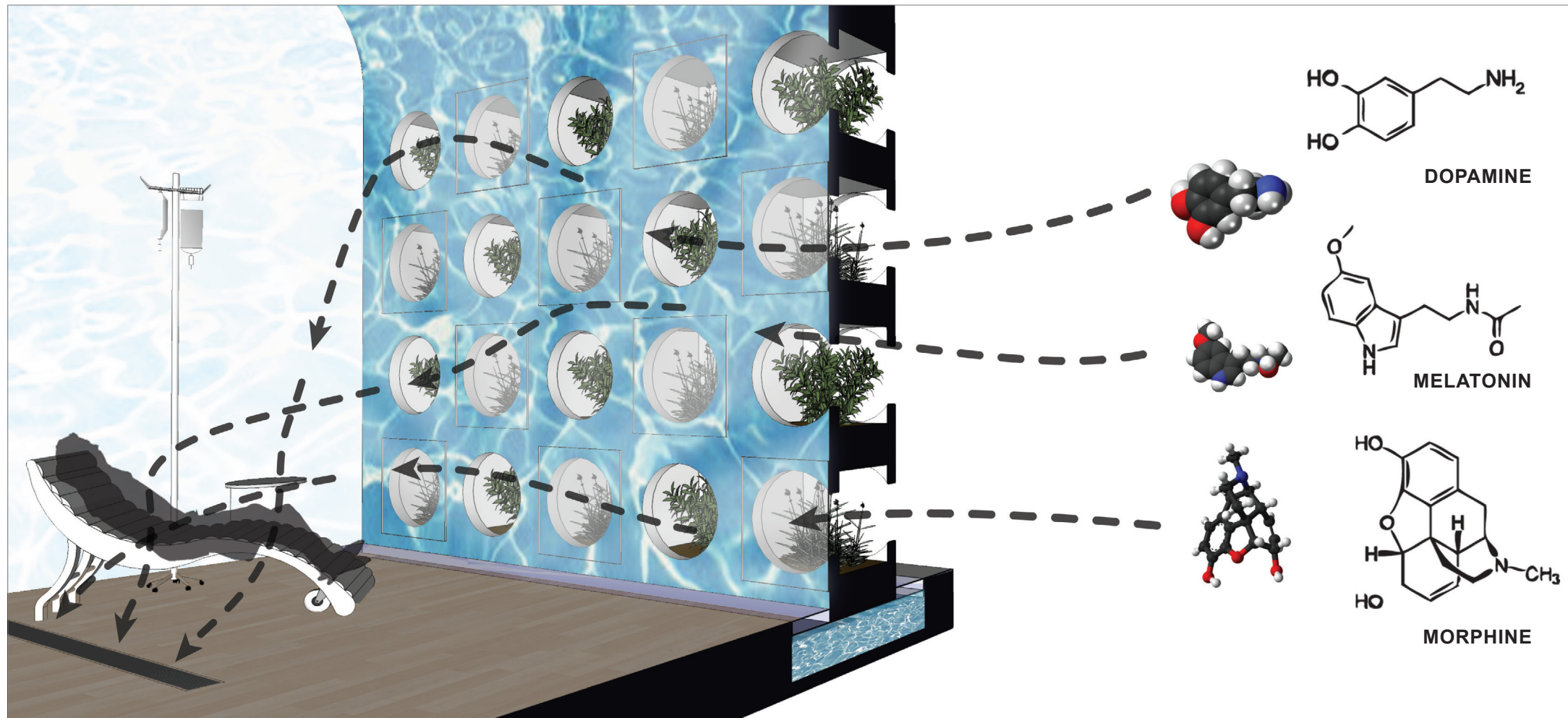
the *common carotid artery* and the *popliteal artery* to measure stress reactions (see Ill. 7.8, 7.9, 7.10 & 7.11). The chair will wirelessly send signals to the Wile Wall to set the appropriate scent and colour to be released for the patient in order to promote calming.



ILL. 7.10. Environmental elements help patient stay awake.



ILL. 7.11. Environmental elements help patient fall asleep.

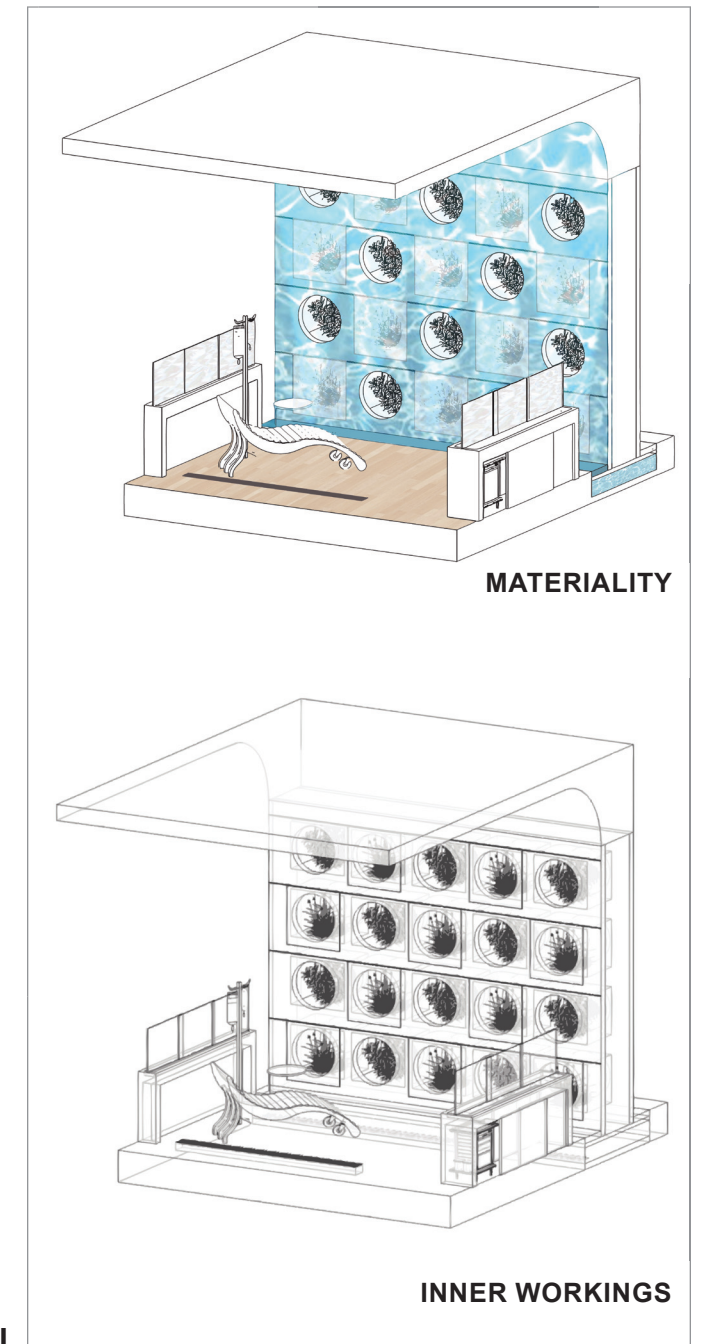


ILL. 7.12. Wile Wall releases natural chemicals to help reduce stress.

WILE WALL

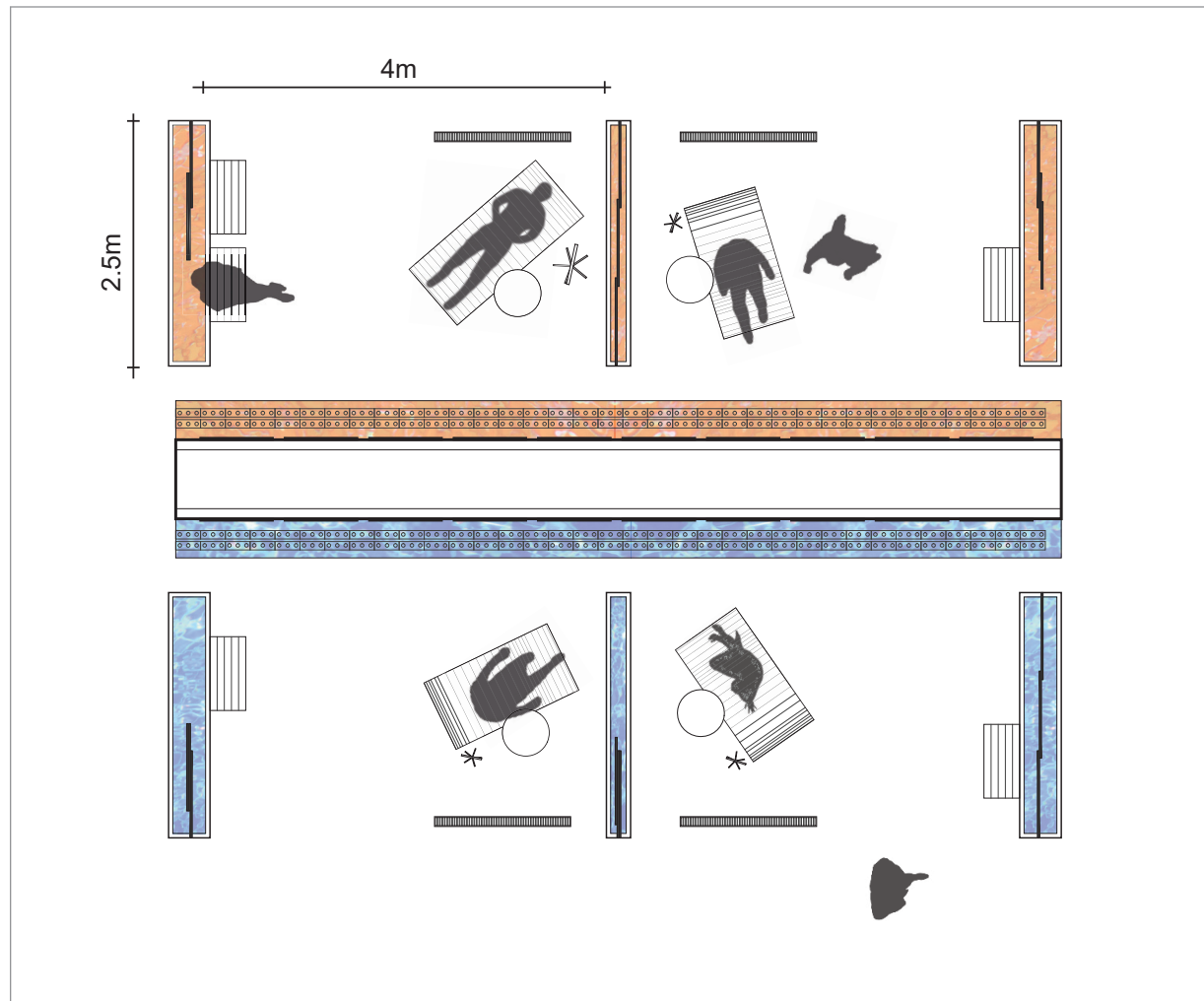
“Wile” is a noun which means to *trick* or *fool*, trap or entice. As traditional drugs such as morphine are potentially harmful and addictive, plants can replace the need for drugs by encouraging the body to release certain chemicals in the brain to augment

healing. Different plants release different chemicals and can be very effective in terms of making a person feel calmer, alert, less claustrophobic, less aggressive, fatigued, more awake, or boost the immune system, depending on the specific scent and plant (see Ill. 7.12).



ILL. 7.13. Structure of the Wile Wall

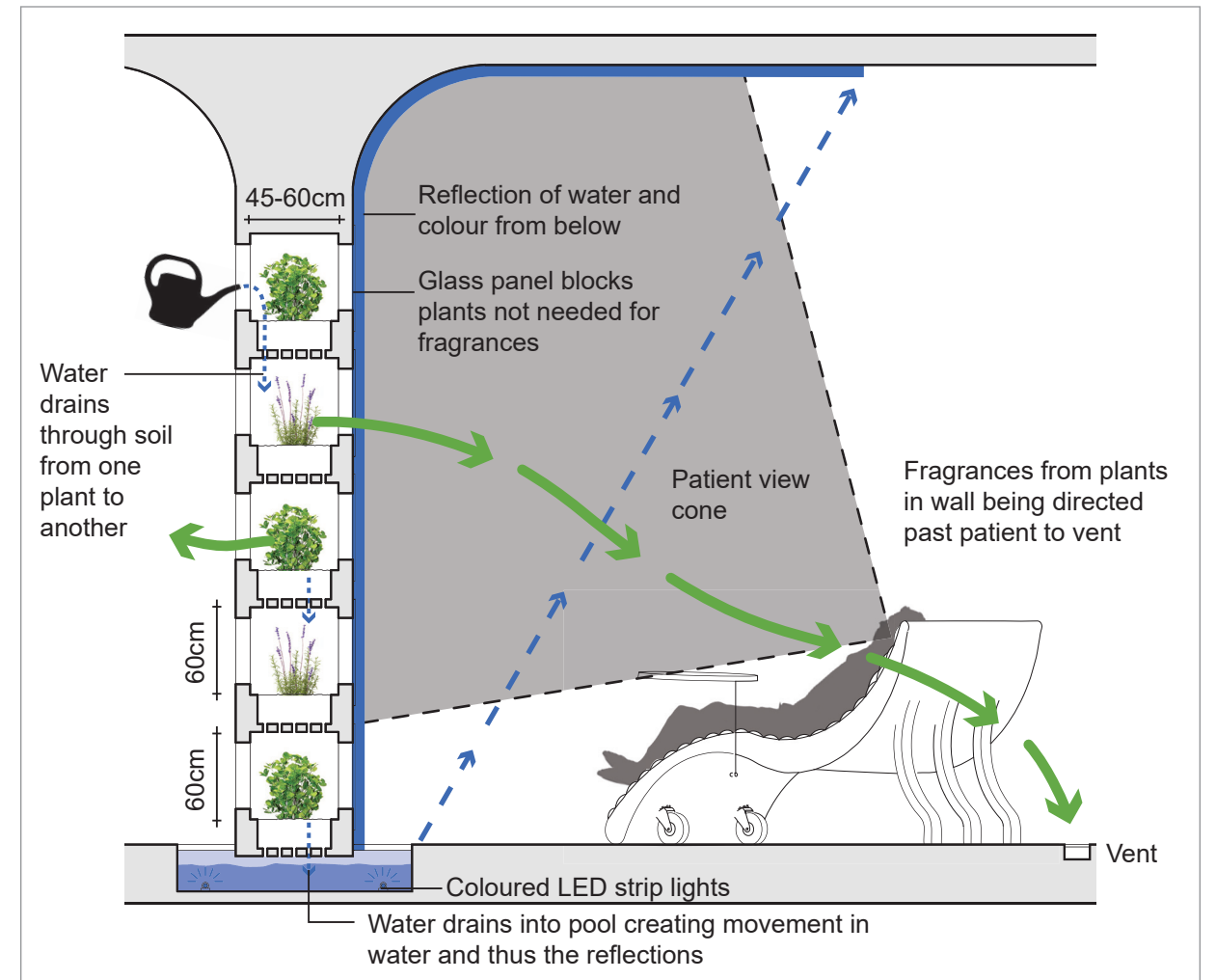




ILL. 7.14. Proposed Plan, 1:100

The Wile Wall encourages both flexibility in the plant and scent selection that each patient is exposed to and offers a stimulating element to focus on while undergoing treatment (see Ill. 7.14). Many chemotherapy suites are laid out in configuration that leaves patients with

nowhere else to look except to stare at another patient across the room. The Wile Wall has individual compartments with operable doors to contain plants. Each patient has control over what plant scents they prefer. Coloured light and the water reflection can be viewed

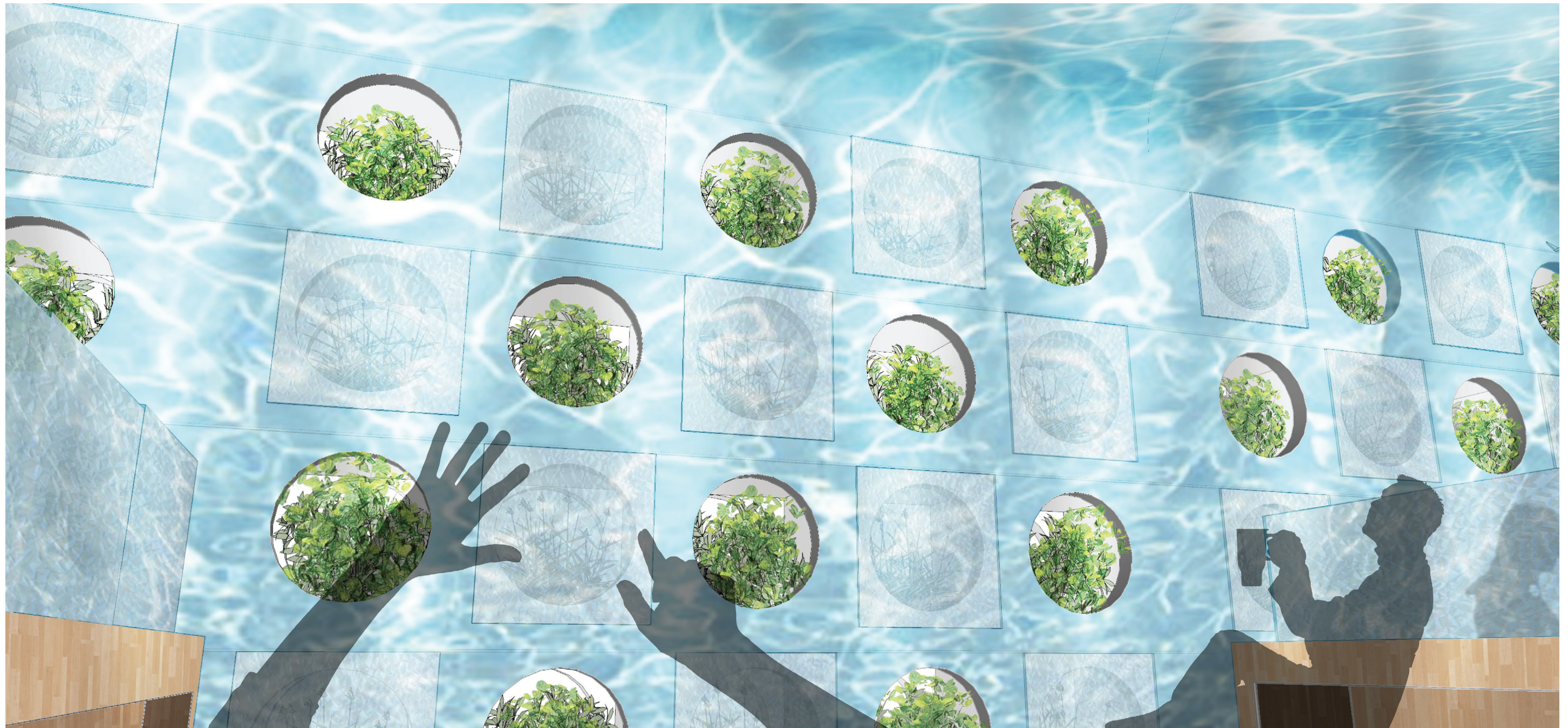


ILL. 7.15. Proposed Section, 1:50

on the wall and ceiling. The compartments are perforated at the bottom to allow water to drain to below. This water eventually makes its way through to a trough at the bottom (see Ill. 7.15) and a coloured light will project the water reflections onto the wall and ceiling.

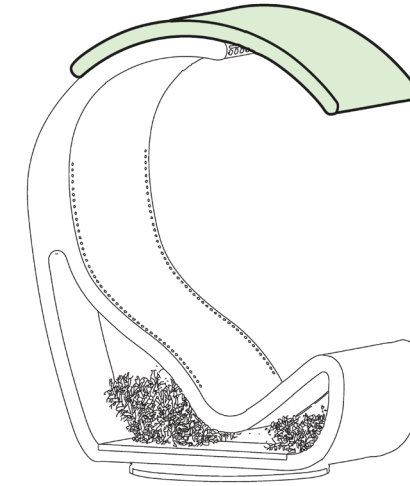
Certain colours will promote different reactions in the patients, and the colour can be changed depending on the patient's needs. The following page illustrates the view a patient would experience within this setting (see Ill. 7.16).





ILL. 7.16. Patient's view of the Wile Wall during treatment

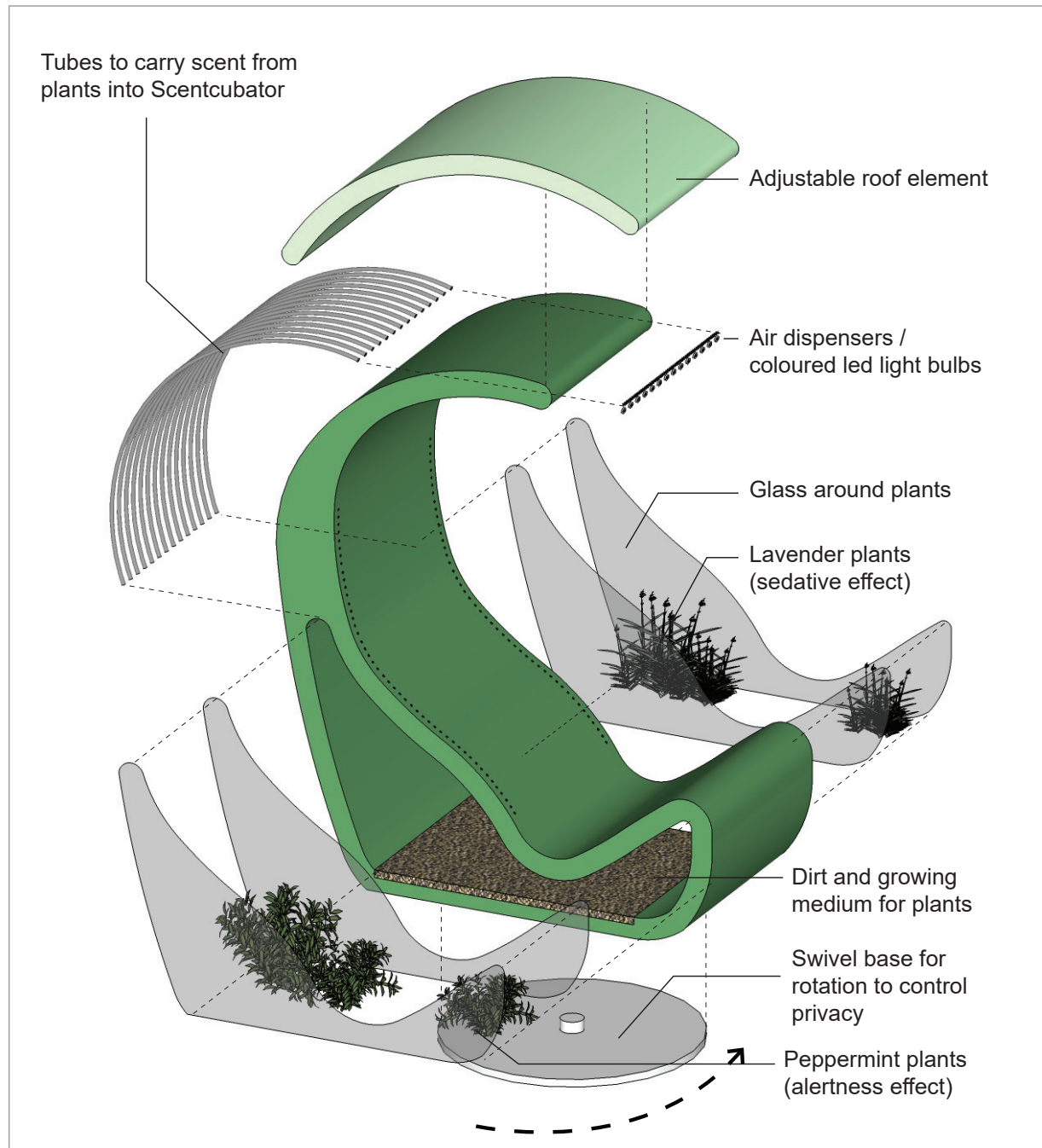
DESIGN2: SCENTCUBATOR5000



While the Wile Wall showed design strengths, its weaknesses include its large size and inability to be installed into existing spaces, as well as its lack of control over the scents from plants in the wall.

The Scentcubator 5000 addresses these weaknesses by introducing a self-contained treatment chair that is better able to contain scent and light. Its size also allows it to be moved and installed into existing chemo suites, taking up no more room than a standard recliner chair currently used in most spaces.

In this design, plants will be placed below the seat, and tubes will draw the scent up into the seating area, while coloured light is projected on the inside of the roof of the shell. The plants sit on removable trays and can be changed between treatments to suit the individual needs of each patient. Vents on the side of the chair draw the scent back into the chair to contain the effects. The roof is adjustable, allowing patients to choose privacy or be more visually connected to the room.



ILL. 7.17. Axo of Scentcubator

SCENTCUBATOR 5000, INNER WORKINGS

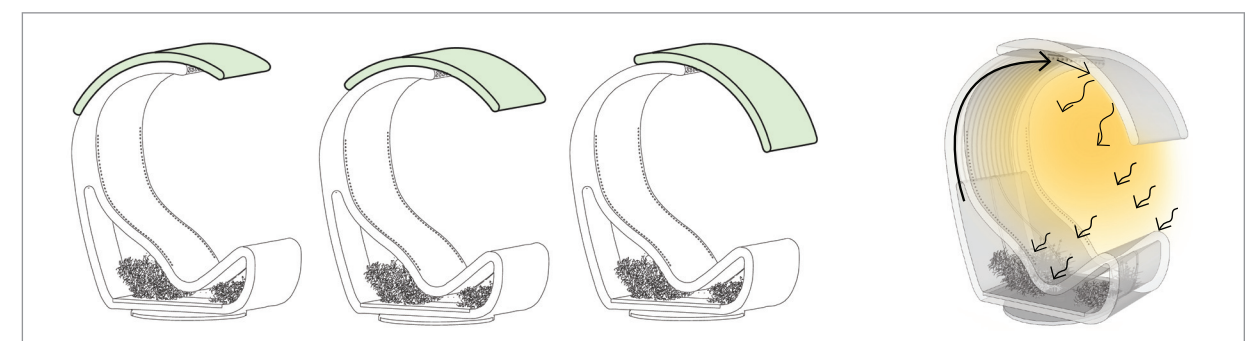
The Scentcubator 5000 holds plants of the patient's choosing below the patient's seat and draws the scent up through tubes in the backrest, dispersing the scent throughout the shell of the chair (see Ill. 7.17 & 7.19). Scents from the chosen plants in the chair will have differing effects on the patient. The patient can also choose to not have the scent released into the Scentcubator.

Coloured light is projected onto a slightly reflective surface when the roof of the chair is lowered (see Ill. 7.18). Colours such as blue and purple block the release of melatonin in the brain and help people feel more awake. Colours such as yellow and orange promote the release of melatonin in the brain, making the patient feel tired and helping them sleep. The combination of scent and colour are controlled to address the needs of the patient, whether they need help sleeping, calming, relaxing, or staying awake. Fig. 7.20, 7.21 and 7.22 on the following page illustrate, in plan and perspective, the atmosphere the

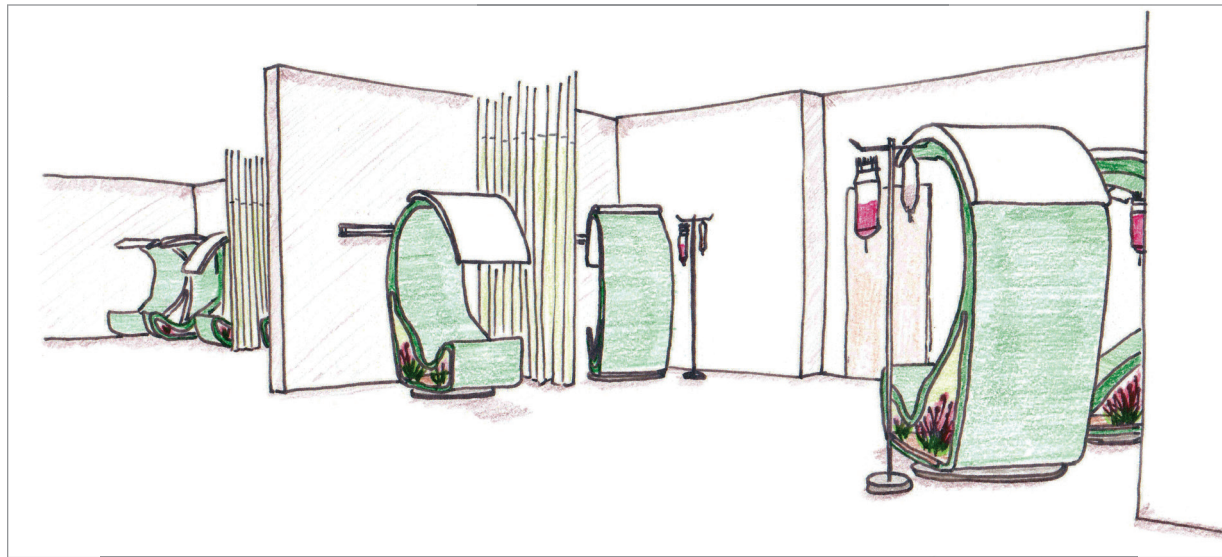


ILL. 7.18. Coloured light fills the Scentcubator to reduce patient stress.

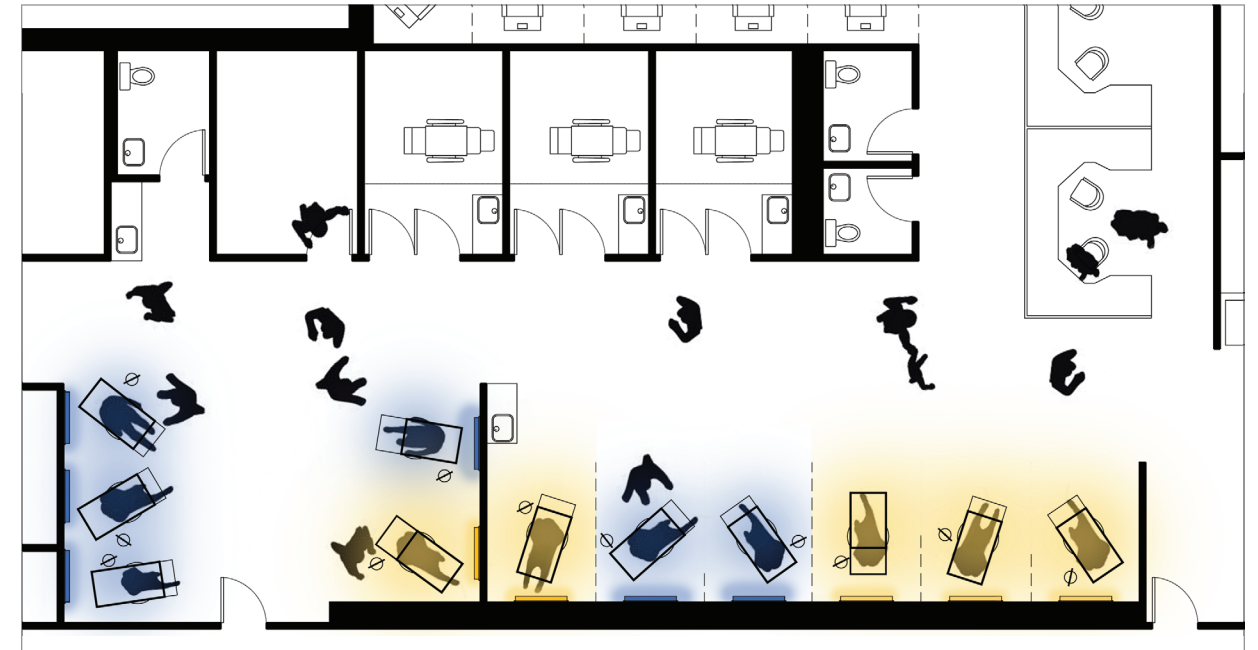
Scentcubators create. The following page also evaluates the advantages and disadvantages of the elements of coloured light and scent in the chemotherapy suite.



ILL. 7.19. Top of Scentcubator extends to suit needs of patient, and scent travels from plants through tubes into Scentcubator.





ILL. 7.20. Chemo Suite (South side) with Scencubators



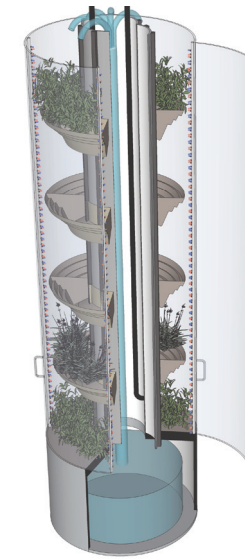
ILL. 7.22. Plan of Chemo Suite (South side) with Scencubators, 1:150, shows how each scencubator can be personalized with light and scent to suit patient's specific needs



ILL. 7.21. Chemo Suite (South side) with Patient Activity

- | | |
|---|--|
| <p>COLOURED LIGHT </p> <ul style="list-style-type: none"> + Easy to control <ul style="list-style-type: none"> - on/off switch - dimmer - walls/curtain - variety of colour + No chemical odors or poison inhalation - Must be carefully designed to reach maximum potential | <p>SCENT </p> <ul style="list-style-type: none"> + Natural (no poison / overdose risk) + Easily accepted by body + Large variety of plants and corresponding effects on body + Great potential to enhance immune systems and to work with medications - Hard to control where scent travels to ensure it stays localized |
|---|--|

DESIGN3: VERTICAL GARDENS

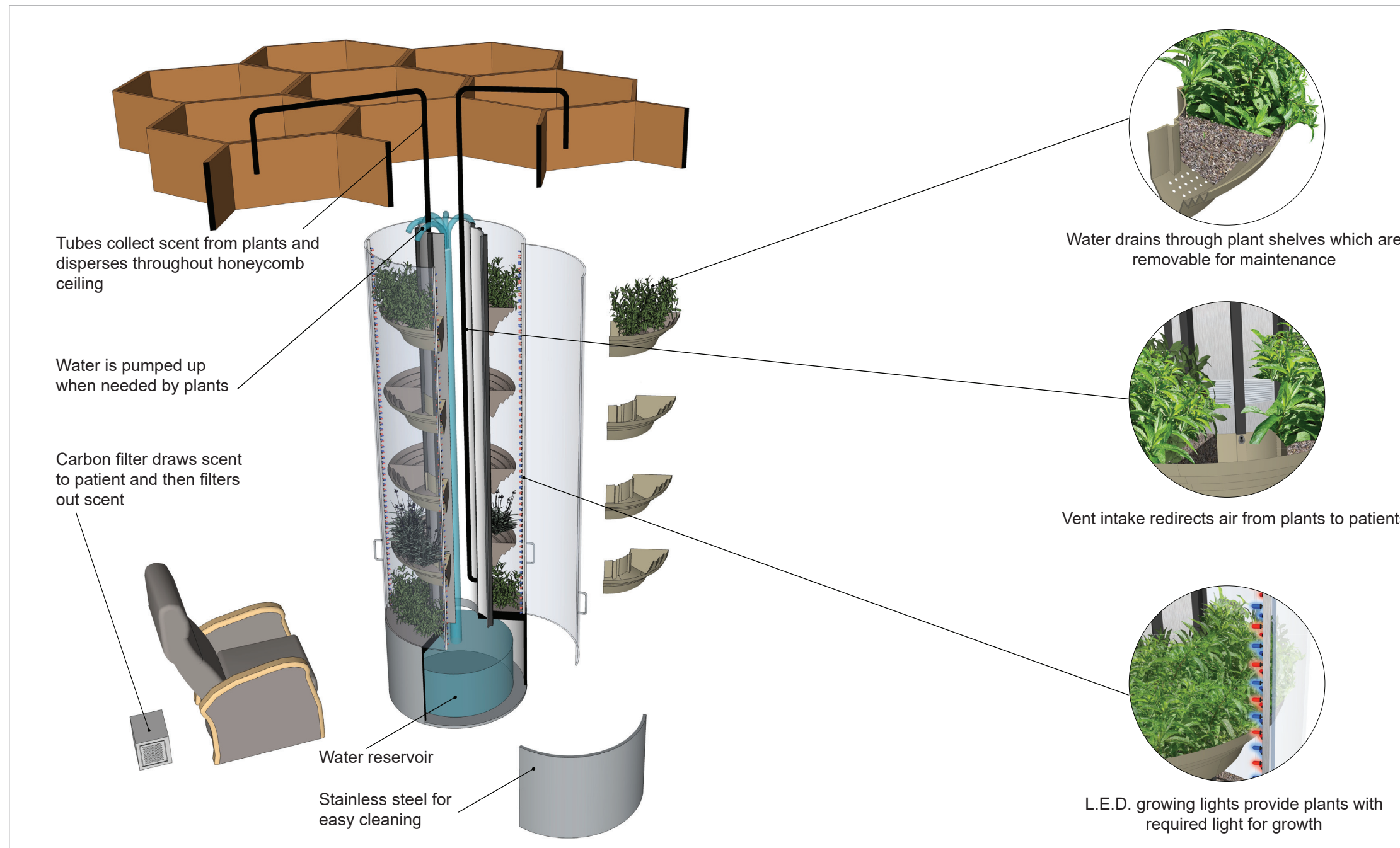


The Scentcubator 5000 addressed some of the weaknesses of the Wile Wall. However, with the plants being placed below the patient, it loses the visual connection between the patient and the living foliage.

Plants represent much of what patients are looking for in themselves during treatment: growth, renewal, life, cycle, and healing. Plants have the power to instill hope in people.

The vertical gardens take the plants component of the Scentcubators and bring it to the centre attention of the chemo suite by introducing several self-contained vertical gardens throughout the room. Patients can gather around them and are able to see the plants, while also receiving the benefits of their scents. Psychologically, a visual connection with plants and other elements of nature has tremendous healing abilities.

Glass doors, which enclose the garden elements, open for watering and maintenance of the plants. This also gives the opportunity for patients to help with the upkeep and watering of the plants, which provides another way for patients to interact and hold some control over their situation.



ILL. 7.23. Axo, Vertical Gardens

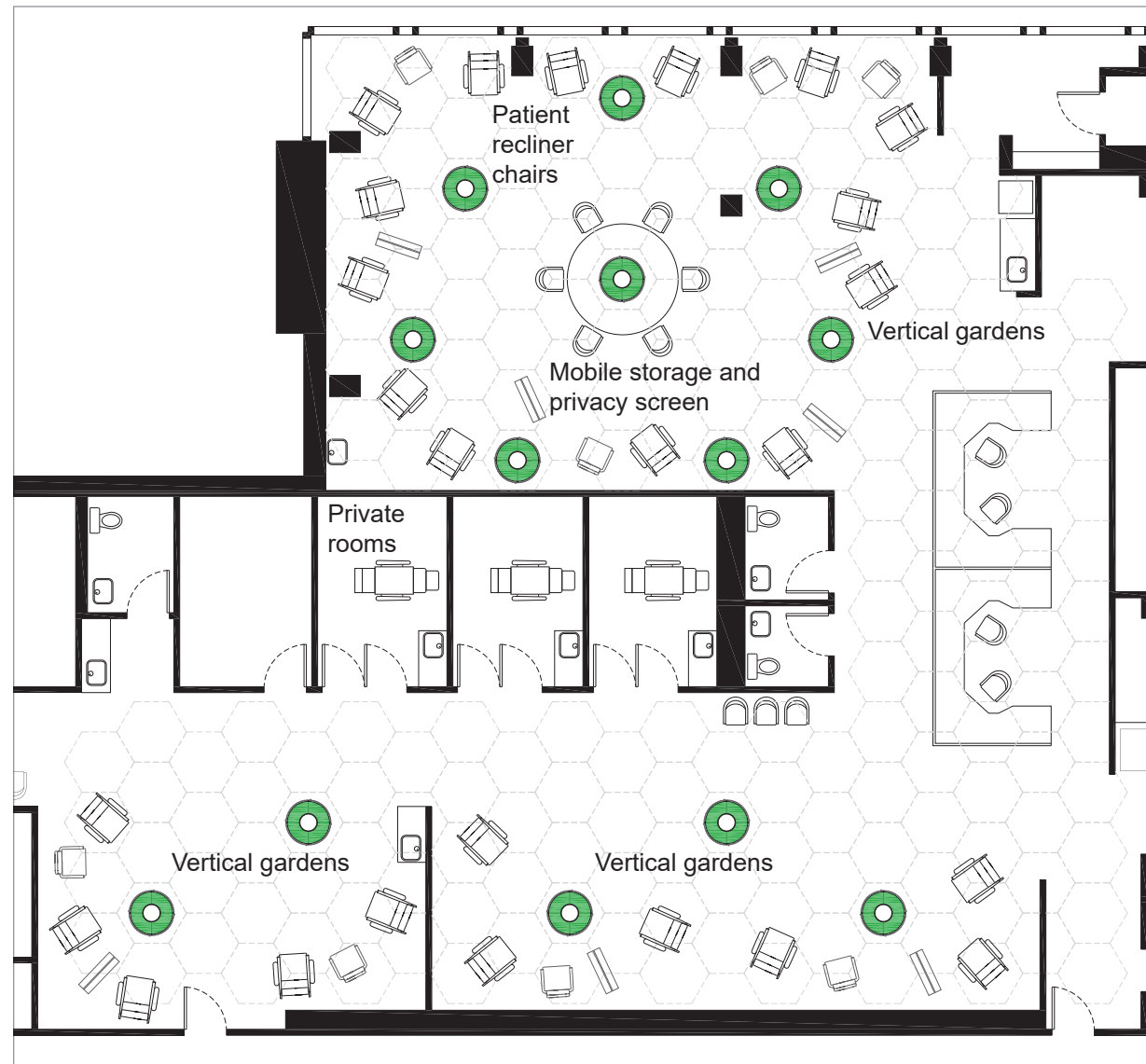
COMPONENTS OF THE VERTICAL GARDENS

The Vertical Gardens consist of self-containing glass tubes with several shelves containing plants. Patients are thus given a visual connection with the plants and over time will be able to notice and observe the plants as they change and start losing leaves and branches as they die off and re-grow new life form in replacement. This growth and life cycle provides hope to patients who are in the process of growing themselves, mentally and physically.

The self-containing systems need periodic watering. Perforated shelves allow excess water to make its way down the shelves, feeding each of the different plants. Left over water is stored in a water reservoir at the bottom. When the plants need watering, the water is pumped up through tubes and sprinkled down from the top (see Ill. 7.23).

Each plant has a unique scent, which is captured through the vents located on the inner tube structure. The scent is moved up through the tube systems and can be dispersed throughout the honeycomb ceiling over the patient when desired. The flexibility of this system allows different patients to have different scents delivered to them as they please. Growing lights are also located on the sides of the glass enclosure to make up for the lack of direct sunlight due to their interior location.

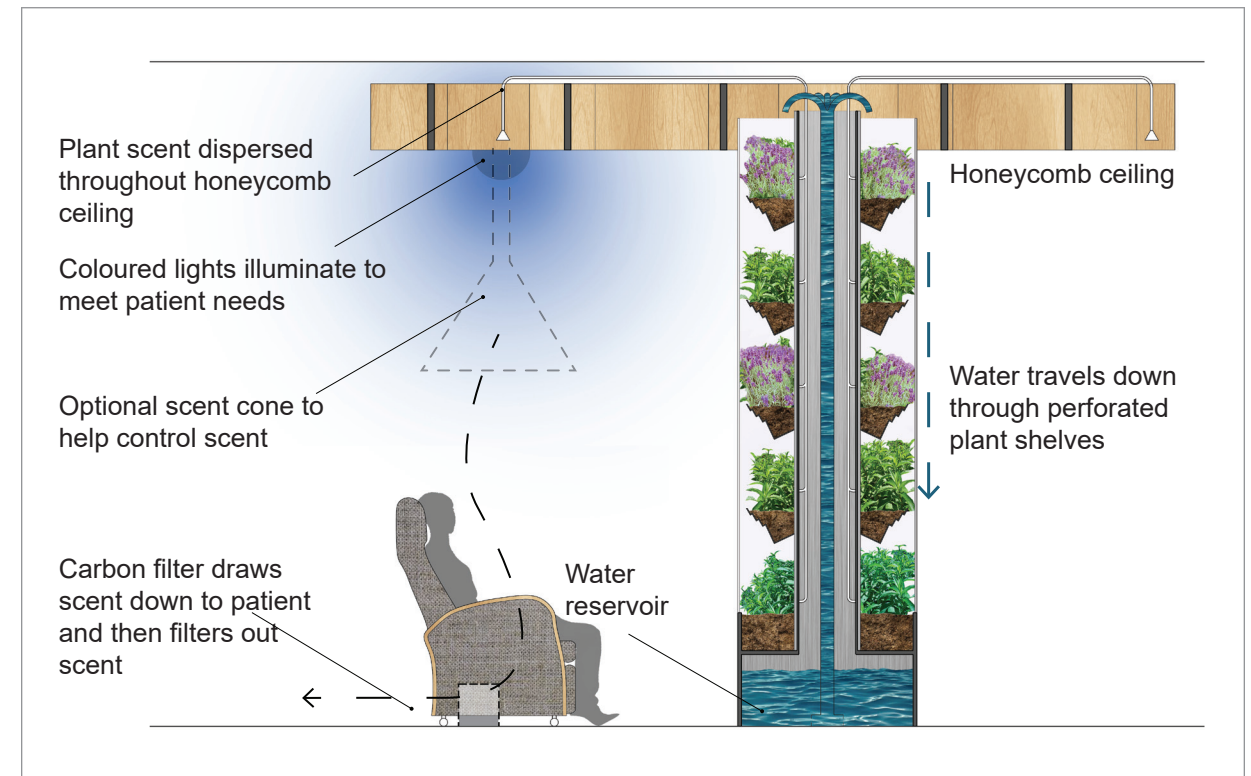




ILL. 7.24. Grand River Chemo Suite, 1:150

The Vertical Gardens are dispersed throughout the chemotherapy suite, mimicking a forest of trees (see Ill. 7.24). Depending on where patients are seated, they can view vertical gardens that are both close and far. The gardens are visually stimulating, as well as actively working through the scents they give off from the variety of plants they contain. These scents are carried throughout the

honeycomb ceiling to each patient, as desired (see Ill. 7.25). The gardens are self-contained systems that allow patients to interact with them. The patients can touch, move, or water plants by opening the glass doors. The glass capsule visually connects the gardens to the patients, while also enclosing the plants to avoid dirt or unwanted scents from reaching those who may be slightly sensitive.



ILL. 7.25. Vertical Garden Section, 1:40



BEFORE



FIG. 7.1. Grand River Chemo Suite, Existing (2015)

PROPOSED RETROFIT

The two images above show the contrast between the existing chemotherapy suite at Grand River Hospital and the opportunities that the vertical gardens offer: a warmer, more inviting space for patients to enter and continue their healing process. The existing chemotherapy suite was built fairly recently, opening in 2003, and has relatively good

light and material quality compared to many older chemotherapy suites, as well as the main part of Grand River Hospital (see Fig. 7.1). Despite large windows overlooking a green space outside and the columns covered in wood, the room still feels very much like an institutional room in a hospital. The walls and ceiling are stark white, the lights are bright, the floor is typical, hospital vinyl

AFTER



ILL. 7.26. Grand River Chemo Suite, Proposed

white-tile, and there is not much to focus your view on, except the medical equipment and the patient across from you. Even the patients located near the window face away from the outdoor view in order to be in sight of the nurses, should they ever need anything. The proposed chemotherapy suite offers soothing plants, vinyl wood flooring (ideal for sanitary reasons in a hospital), and

a wooden honeycomb ceiling, all of which give patients something else to focus on (see Ill. 7.26). This allows the body to relax and move into a healing state, making it easier to recover from harsh treatments and infections, all the while making the experience more tolerable and peaceful for both patient and staff.



DESIGN DEVELOPMENT EVALUATIONS



ILL. 7.27. Chemo Suite Proposal Evaluations

IDEAL

The ideal situation would have the source of a scent well contained and located directly under a patient's nose. However for patient comfort and psychological healing, the design must incorporate comfort, flexibility, and mindfulness into the design.

The designs reviewed have a variety of strengths and limitations as noted here (see Ill. 7.27). While there is no perfect design, they each address different aspects of the patient's needs in the chemo suite. It is important to bring these topics into the discussion of the value of internal and psychological healing

DESIGN 1: WILE WALL

Scent from plants makes its way to patient. Compartments separate plants.

- ⊕ *No chemical odors or poisonous inhalation*
- ⊕ *Adaptability and ability to choose to open and close different compartments*

- ⊖ *Large footprint - could be difficult to install in existing chemo suites*
- ⊖ *Large effective area - could be hard to control scent without affecting surrounding areas*

DESIGN 2: SCENTCUBATORS

Scent and light are encompassing, contained within zone of treatment

- ⊕ *Light and scent well contained*
- ⊕ *Adaptable to each patient*

- ⊖ *Visual connection to plant is lost*
- ⊖ *Patients risk feeling slightly claustrophobic*

DESIGN 3: VERTICAL GARDENS

Plants become focus in room, representing life, cycles, healing, growing - HOPE

- ⊕ *Light and scent relatively well contained*
- ⊕ *Adaptable to each patient*
- ⊕ *Visual connection to plant is beneficial*

- ⊖ *Vertical Gardens may make cleaning of chemo suite slightly more challenging*

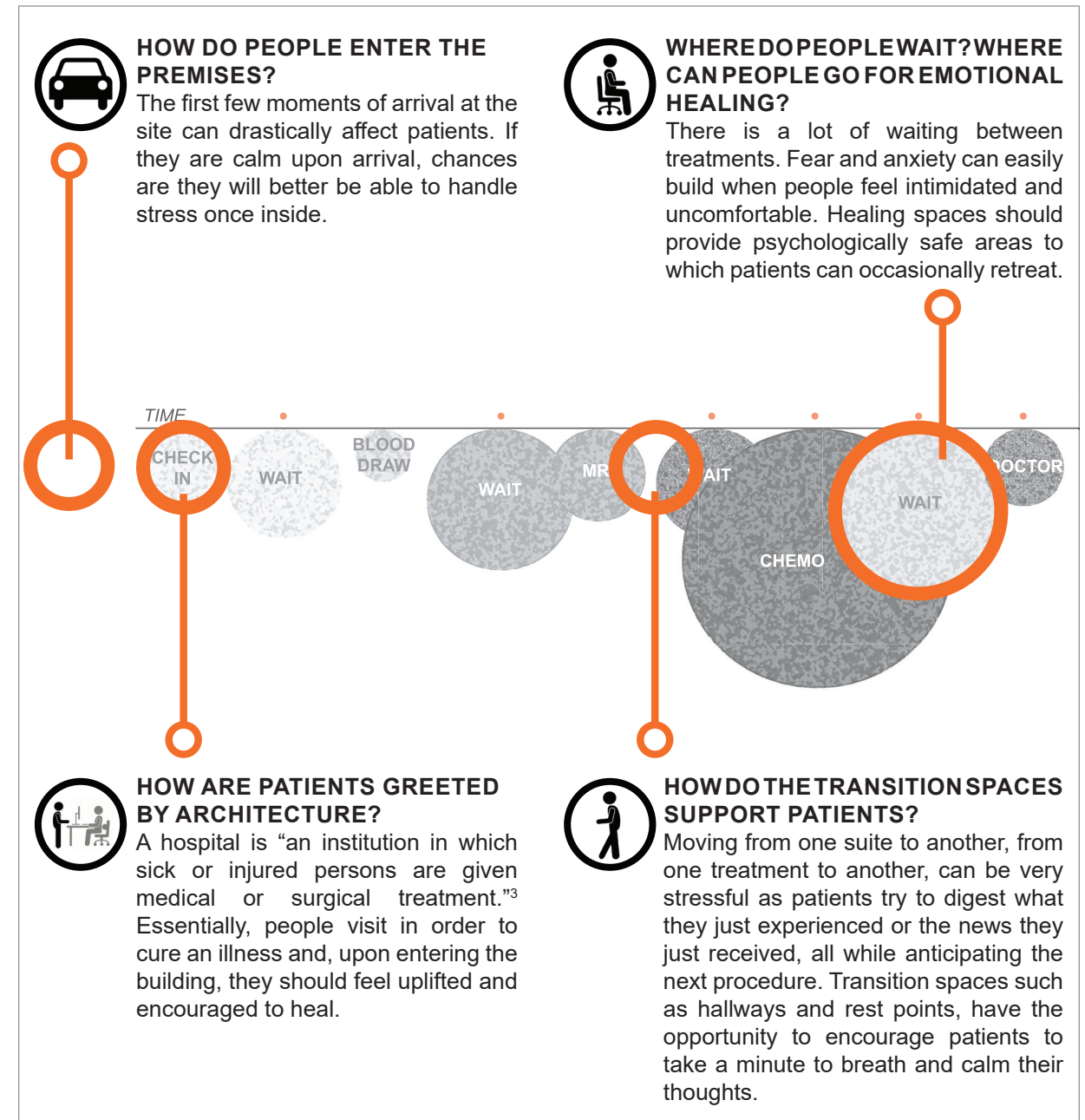
WHERE CAN ARCHITECTURE OFFER FURTHER HEALING?



ILL. 7.28. Suggestion of an *ideal* chemotherapy healing space

In an ideal situation without limitations of budget or space, Ill. 7.28 suggests what an ideal chemotherapy healing space could look like. It incorporates many elements, lacking in typical chemotherapy suites, which have turned out to be critical for proper healing: natural light, soothing colours, access to the outdoors via a private terrace that connects to a communal green space, visual connections to plants and wildlife as well as a living indoor green wall, soft materials, privacy from the rest of the hospital, control over the fireplace and blinds, and plenty of options to

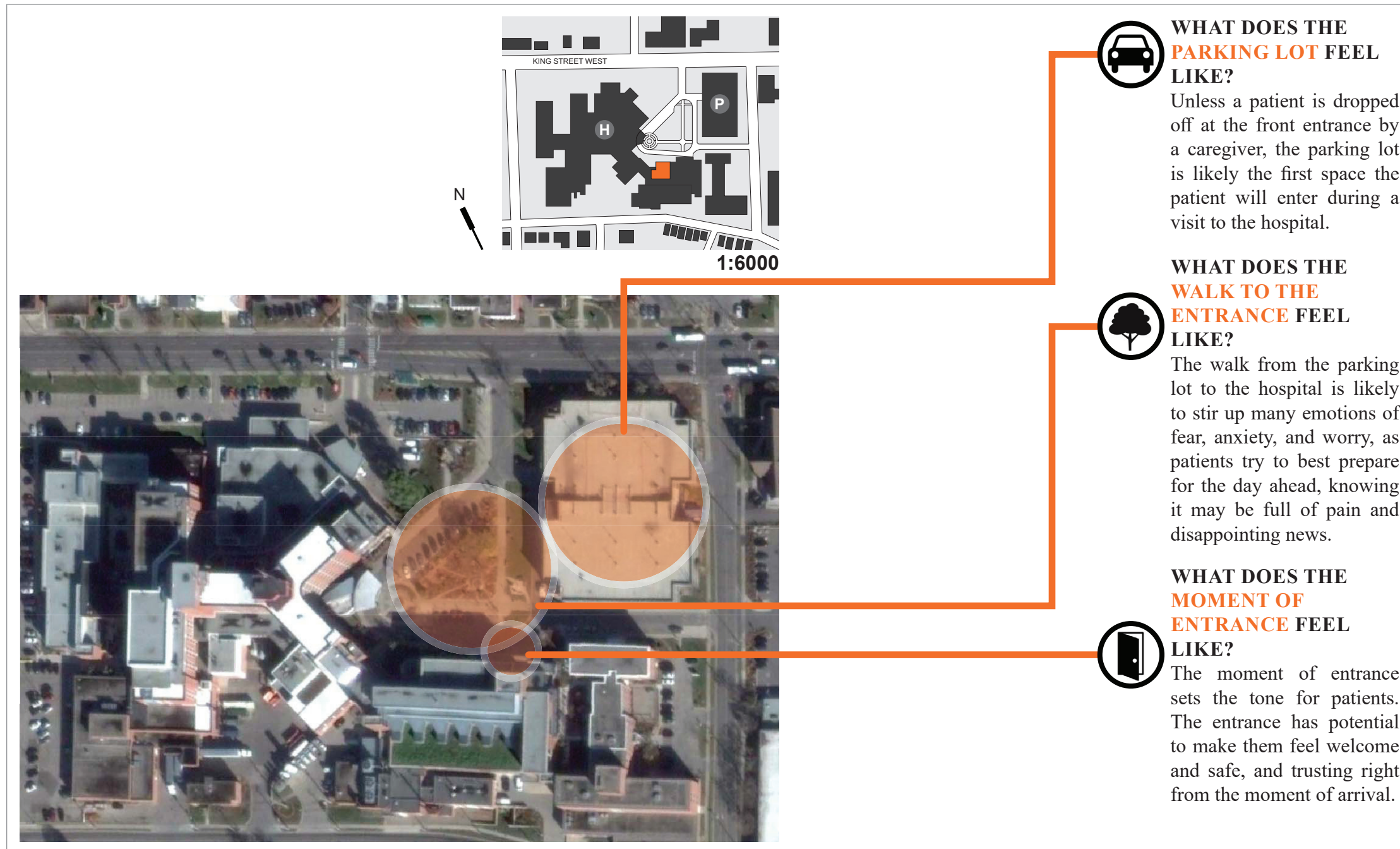
sit for comfort and stimulation. This space resembles a living room in a private home. With the home being a big comfort for so many people, this characteristic is extremely valuable. The space does not feel like an institutional treatment room, which helps patients take their mind off of their illness and the negativities that surround it. A calming area that also encourages visitors to come and emotionally support the patient will guide the patient to focus on healing and having a positive mindset. This will help avoid a stress reaction and aid the healing process.



ILL. 7.29. Where Architecture can offer Healing?

3) “Hospital.” Collins English Dictionary - Complete & Unabridged 10th Edition. HarperCollins Publishers, accessed Jun 1, 2015, <http://dictionary.reference.com/browse/hospital?s=t>.





ILL. 7.30. Detailed Site Plan, Grand River Hospital, 1:2000 illustrating important phases of the entrance to the hospital

MOMENT OF ARRIVAL

In addition to the chemotherapy suite, the arrival at the hospital is a significant moment where it is crucial to control stress (see Ill. 7.30). The hospital is a backdrop for many great joys and far too many heart-breaking moments. The arrival establishes the initial stress baseline for the patient's visit.

The arrival must be such as to keep patients calm, to help prepare them for the rest of the visit. If the mind is able to stay in the moment rather than jumping to the past or future worries, it will be easier to maintain control of thoughts, feelings, and sensations. This can lead to inner calmness, acceptance, and openness.⁴ "In many cases, one feeling threatened may actually have more to do with one's state of mind on the situation more than the triggering of the event itself."⁵

“ At the moment most hospital environments say to the patient, in effect: 'How you feel is unimportant. You are not of value. Fit in with us, not us with you'. With very little effort and money this could be changed to something like: 'Welcome! And don't worry we are here to reassure you, and your treatment will be good and helpful to you'. Why shouldn't the patient look forward to a day at the hospital?⁶ ”

- Maggie Jencks

4) Kabat-Zinn, Jon. 1990. "On Healing." Chap. 13, *In Full Catastrophe Living*, 269. New York, NY: Dell Publishing.
 5) Ibid.
 6) Jencks, Maggie Keswick. 1995. *A View from the Front Line: Marcia Blakenham*. 21-22.





FIG. 7.2. Existing Parking Garage (2015)



FIG. 7.3. Existing View at Front Entrance (2015)



ILL. 7.31. Proposed Drop-off Area at the Front Entrance of the Cancer Centre

The current parking lot is very dark and hard to maneuver around with steep stairs and tight parking spaces (see Fig. 7.2). It also requires a walk outside to reach the hospital entrance. The existing drop-off area isn't

very welcoming and allows people to be wet or cold if the weather is unpleasant (see Fig. 7.3). Imagine driving up into this space: the moment you exit the car you are already being embraced by the building. The architecture is



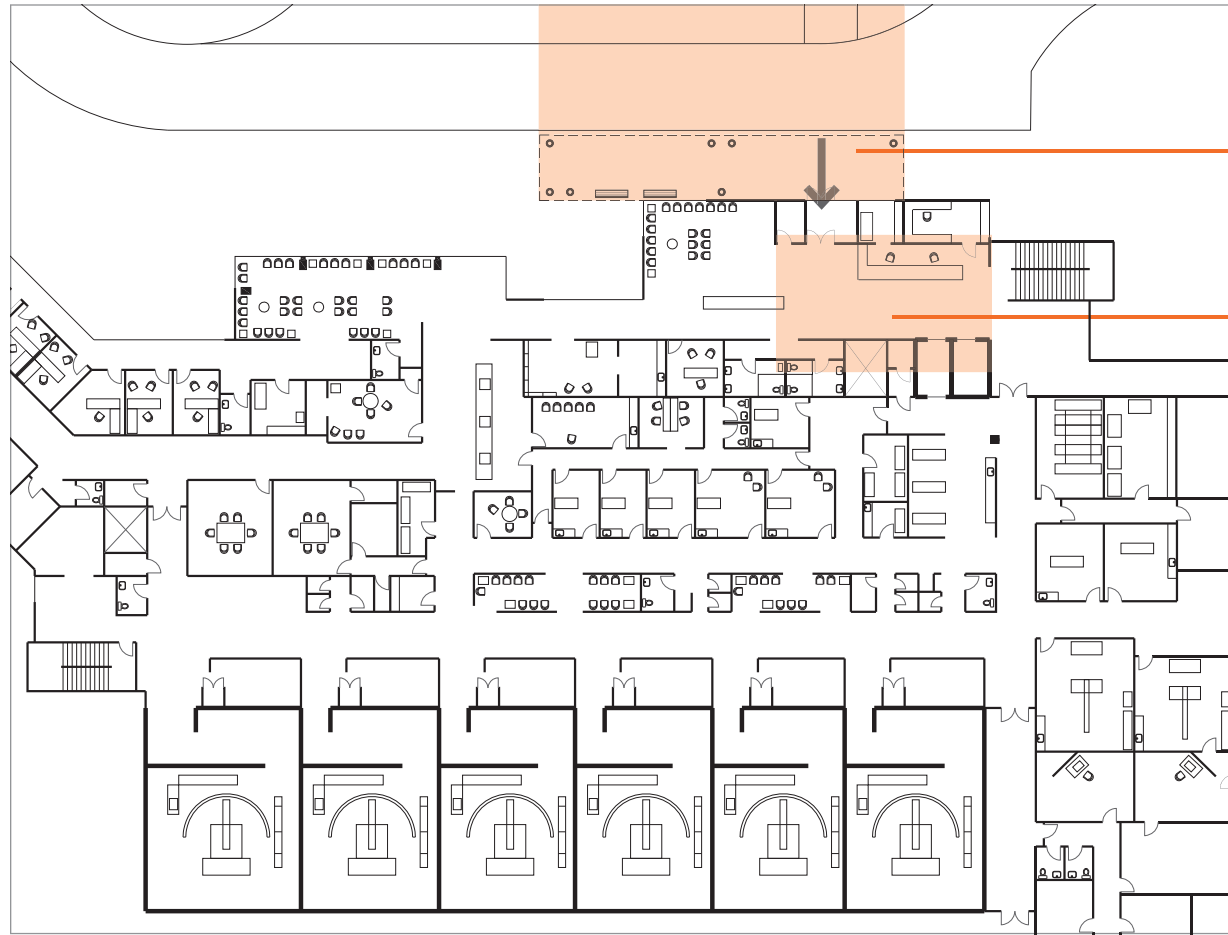
ILL. 7.32. Proposed Drop-off Area at the Front Entrance of the Cancer Centre

welcoming you from the instant you leave the comfort of your vehicle (see Ill. 7.31 & 7.32). Surrounded by plants and natural wood arches, the proposed entrance offers a mini-oasis to calm nervous thoughts before

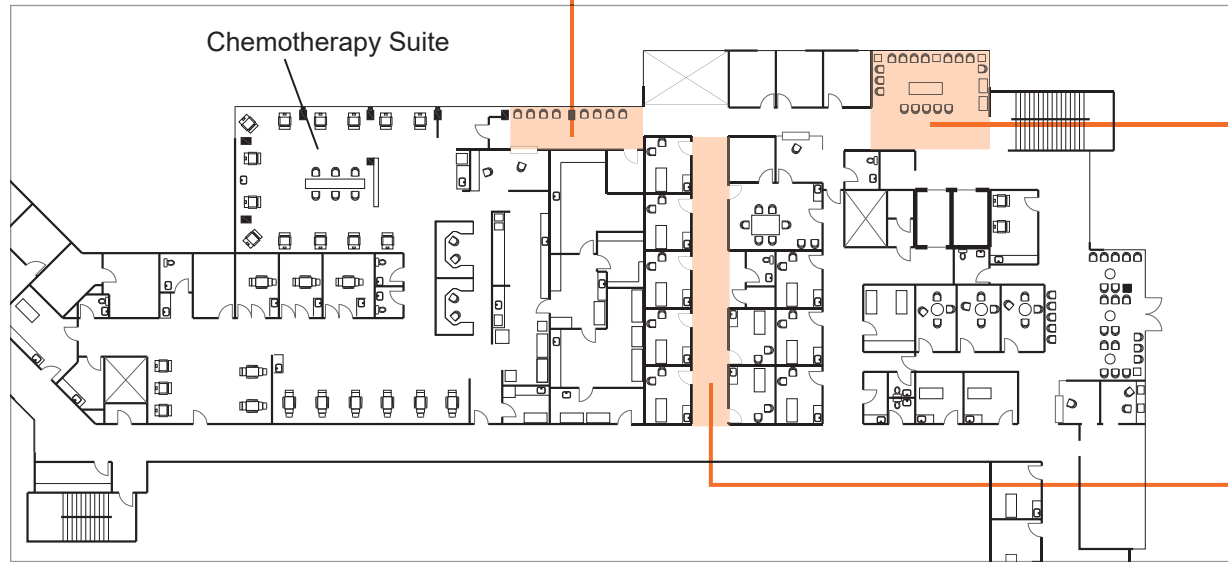
entering the building and allows for relaxed waiting, while loved ones park the car.

GRAND RIVER REGIONAL CANCER CENTRE ANALYSIS

Below is a visual list of spaces that are important to consider when re-thinking where architecture can offer healing.



ILL. 7.33. Ground Floor Plan, Grand River Hospital, 1:500



ILL. 7.34. Upper Floor Plan, Grand River Hospital, 1:500



FIG. 7.7. Entrance



FIG. 7.4. Lobby



FIG. 7.8. Lobby



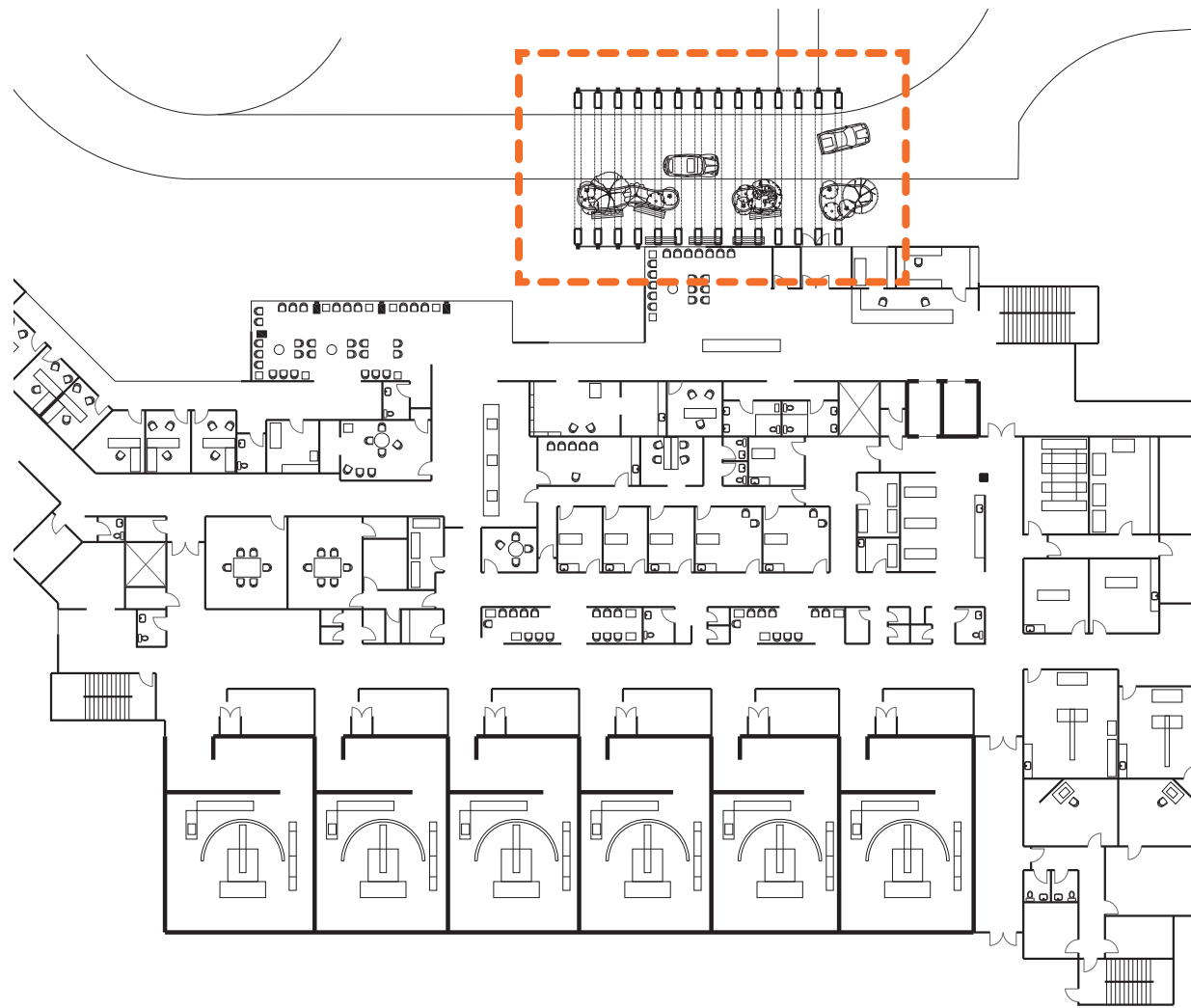
FIG. 7.5. Chemotherapy Waiting



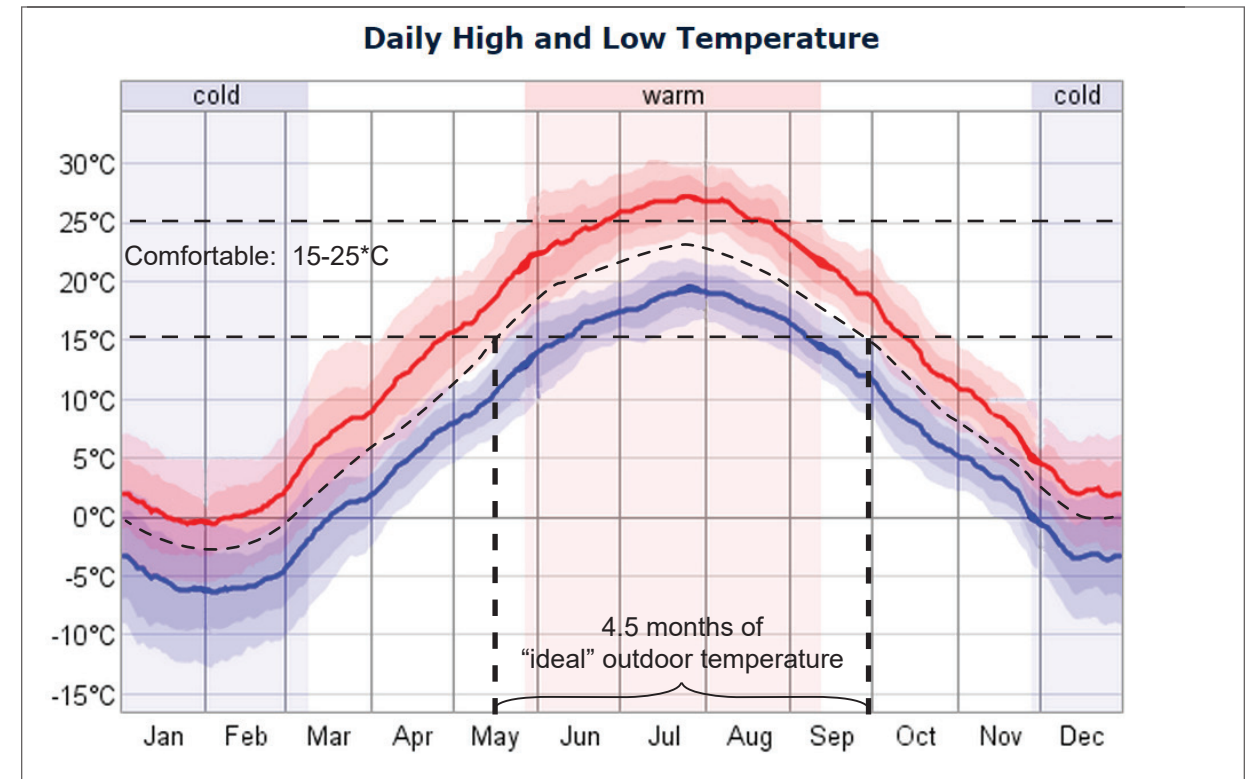
FIG. 7.9. Doctor Visit Waiting Area



FIG. 7.6. Examination Room Corridor



ILL. 7.35. Ground Floor Plan with proposed Entrance Dome, 1:500



ILL. 7.36. The daily average low (blue) and high (red) temperatures with percentile bands (inner band from 25th to 75th percentile, outer band from 10th to 90th percentile) of Toronto, Ontario.

The graph above shows the daily average temperatures for Toronto (approximately 115km east of Grand River Hospital in Kitchener) and indicates the 4.5 months per year when the outdoor temperature is “ideal” for being out-of-doors: approximately 15-25°C (see Ill. 7.36). With less than half of the year having ideal temperatures, excluding the days with rain or high winds which can be uncomfortable, it is beneficial to have

partly conditioned exterior spaces in order to maximize their usage. Cancer patients are often very sensitive to their climate. The proposed entrance features engineered wood arches enclosed with glazing and offers the opportunity to run heating or cooling throughout the space. The glazing provides a dry place in the rain and can be tinted for those days where the sun is very bright.



Part VII reviewed the goals of the design development which were set up to address the challenges associated with cancer treatment. These goals include adaptability, flexibility and localization. The *Wile Wall* was an initial attempt to incorporate plants and colour into the chemo suite. Its large size and inability to control the scents led to the *Scencubator 5000* which improved in these areas, yet lacked the visual connection to the foliage which has been proven to be extremely valuable in numerous studies. Finally the *Vertical Gardens* iteration was able to take advantage of the strengths of the first two designs, presenting the most refined project. Each design can be studied for its particular scale of architecture and unique strengths.



CONCLUSION

“In general hospitals are not patient-friendly. Illness shrinks the patient’s confidence, and arriving for the first time at a huge NHS [National Health Services] hospital is often a time of unnecessary anxiety. Simply finding your way around is exhausting... Overhead (sometimes even neon) lighting, interior spaces with no views out and miserable seating against the walls all contribute to extreme mental and physical enervation. Patients who arrive relatively hopeful soon start to wilt.”¹

Healing goes far beyond treating physical symptoms, yet hospitals have gradually moved away from a holistic healing focus in the past 80 years with the rise of technology. More technological advances do not necessarily equate to better care, which is what several Evidence Based Design studies are finding.

As discussed in this thesis, stress is one of the most common and most detrimental factors working against a patient’s recovery. However, many hospitals breed stress in the way patients enter the spaces and are restricted to little or no connection with different colours, smells, light, or natural elements. As many experts have argued, when people feel happier and more comfortable, their body responds in a positive way, which will boost healing by strengthening their immune system. This all starts with the environment to which a patient is subjected. Among these

experts are Roger Ulrich, who is a pioneer in the studies of Evidence Based Design medicine and Maggie Jencks, who battled with breast cancer until she passed away from the disease in 1995. Jencks offers a very real and humble account of her hospital experiences in *A View From The Frontline*, as she describes the range of emotions she felt and the difficulties she faced while trying to cope in such an emotionally unforgiving place.

After Maggie Jencks passed away, inspired by her struggles, her husband Charles Jencks began the design of Maggie’s Centres. Unique for its time, this series of retreat centres offers an extraordinary perspective on the power of healing spaces and how they are able to help people control their stress and anxiety when faced with unbearable emotional and physical pain from cancer. These retreat centres do not have any secret ingredient; they simply provide a quiet space for people to cry if they need to, take a walk in the garden, or sit around a kitchen table with others who similarly understand the journey they are going through and can provide support. There are many different types of cancer and many more kinds of emotional journeys that people walk. No one journey is the same, but patients have common fears and anxieties that can be addressed through calming environments that promote stress reduction. These environments have a number of elements in common: light, colour, privacy,

and connection to nature. Although these spatial considerations in design cannot cure an illness, they are vital assets in a healing environment to place the body in a state where it has the best opportunity for healing and recovering.

In an attempt to explore the ability of environments to augment healing, three design developments were proposed. The *Wile Wall* took an initial attempt to explore the effects of scent and coloured light on patients and how these could be incorporated into a building. The *Scentcubator 5000* used the concept of the Wile Wall and translated it into a furniture scaled object to examine the potential of completely encompassing a patient in the effects of scent and light. The *Vertical Garden* was able to take the strengths of both the Wile Wall and the Scentcubator and develop an intervention at the room scale to address patients and nurses in the design. It focused on a communal usage, opening patients up to the rest of the room guided by the research done on how beneficial peer support is for healing. The gardens encourage patients to feel part of a larger group and offer an opportunity to focus on living plants that represent hope, growth, and renewal. This design attempts to humanize the chemo suite by making patients feel like more than numbers in a system, and sites of a disease. What they think and how they feel is just as important as the treatment they receive.

Other positive examples that influenced the design of the three projects mentioned include the Humber River Hospital and the Dyson Centre where people are given control (or perceived control) over their environments. This kind of control also proved extremely successful in the Senior’s Residence by Peter Zumthor, providing residents with dignity through detailing, despite their loss of independence.

For the future, many of the challenges with hospital design include the very strict regulations to meet health standards, the constant changing of knowledge and technologies, which inform the use of spaces and ways of operating, and the high costs associated with hospital construction and renovation. This thesis focused on the exploration of potential designs that could stimulate the senses in order to activate brain pharmaceuticals that would naturally help to reduce stress and aid healing. With over 100 hospitals in Ontario that offer chemotherapy, this thesis explored designs that could certainly be implemented in many of them.

There is no one perfect design, but this thesis attempts to continue the ever-important conversation around the value of designing for the person, not just the patient.

1) Jencks, Maggie Keswick. 1995. *A View from the Front Line*. Marcia Blakenham. 21.



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