Charité CNS Neuroscience

The Self, The Many and The Whole

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How our outdated healthcare systems are in dire need of an update

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Each of us likely think of ourselves as an individual – a part separate from the whole. But that might not be the whole story, pun intended. In the same moment in which we influence the whole around us, we in turn are influenced by it. Together, many individuals co-create something, perhaps greater than each individual, in which they find a home—a familiar and safe space to carry on their practices, and preferences and varnish their skills. A sports fan makes a fanbase. A singer makes a choir. A citizen makes a country. In the same turn, the sports team shapes the sports fan. The choir defines the singer—bass, tenor, alto, or soprano? The country defines borders and customs to which the citizen conforms. What is the self, indeed, without the many and the whole?

Before we look inward, let us first look outward, to a simpler organism – or is the honeybee in fact a more complex superorganism (p. 10)? As humans, we also create something larger through our shared behavior (p. 18) and we are in turn shaped by our cultural environments (p. 15). We invite you to ponder the idea of the Self: how much of the Self is determined by and reliant on our cultural environment? Examine with us the early stages of the “nature versus nurture” debate as it was shaped by early twin studies (p. 8), and sit with the idea of Radical Hope in the face of cultural devastation (p. 19). What to do when we as individuals are lost in outdated and harmful systems—like those as work in modern healthcare (p. 4)? Perhaps the latest in connectomics can give us a glimpse into the future (p. 12), though some of us prefer to escape light years away (p. 22).

In this issue, we explore how individuals shape each other, how many individuals shape a collective, and how all of these processes run the opposite way. We invite you to examine systems from society to biology and ask the question: how do the self, the many, and the whole shape each other in turn? Following this cue, Lorena says ‘so long’ instead of farewell. “Being part of this community shaped me and led me to further adventures. Yet, I hope to remain part of what shapes this one, even if a Lil bit.”

Like what you see? Interested in contributing? We are always looking for new authors and submissions on anything related to the topic of neuroscience and beyond.

Pitch us your idea, send us an article, take snapshots from your microscope, or submit your poems, drawings, short stories, critiques, and reviews. Not sure you want to contribute? Get involved by contacting our editing team at cns-newsletter@charite.de.

This issue’s best contribution has been awarded to Anna Lisa Soiné for her excellent critique of the modern-day healthcare system (p.4). Her article will be rewarded with the book “The Beautiful Brain: The Drawings of Santiago Ramon y Cajal.” Congratulations, and thank you to everyone for their contributions!

Lorena, Leandre, and Lilly
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The statutory health insurance system is a major societal association. Through the principle of solidarity, it enables millions of people every year to have access to good enough health care. This reflects the individual dependence on society for providing us with affordable health care through the collective body of the insurers. Vice versa, society is dependent on its members, trends, and dynamics to effectively provide a social security system. An imbalance within such social systems is not only disadvantageous for society but has major consequences for each and every individual. We as a society, along with our decision-makers, need to urgently adjust not only our concepts on what health means but also how our health care system deals with the modern societal demands. Otherwise, we will need to deal soon rather than later with the consequences of a completely flawed health care system. For simplicity, this article is based on numbers relevant to the German health care and insurance system. However, the same principle applies to all other social insurance systems, such as in Austria, France, the Netherlands, Belgium, Luxembourg, and Japan [1].

The Laziness Trap

Although more disorders than ever can be treated, their treatment is usually based on superficial symptoms instead of a thorough examination of the root cause of the disease and its development over time. The disregard for the psychological and medical aetiology of diseases – in favor of an easy fix – solely postpones acute health issues. The resulting devastating consequences for the health care system are often seen at a later age. It is only then that treatment costs associated with the medical factors, which were marginalized by the quick solution, come to light. By then, treatment costs are usually many times higher than a thorough aetiology-based treatment would have been in the first place. But a quick fix will likely result in health issues at a later age. In the former scenario, what could have had a chance of healing then is usually too damaged now.

Trap in Disguise?

Often, medications are prescribed to solve the pressing issue at hand without considering how that problem came to be, allowing it to cause other, more serious problems in the future. High blood pressure, for instance, is a major risk factor for cardiovascular disease and one of the most prevalent causes of death in Germany [2]. In 2017, almost 1/3 of German adults and almost 2/3 of all adults older than 65 years were diagnosed with hypertension. Medications prescribed to treat hypertension are great in artificially reducing blood pressure, thereby decreasing the risk for cardiovascular diseases. However, we must bear in mind that this artificial treatment will not treat any other underlying health challenges such as obesity or stress. In the case of high blood pressure, prominent etiologies left untreated by the pills are obesity and stress. Excluding cardiovascular disease, obesity is further associated with a variety of comorbidities such as type 2 diabetes, obstructive sleep apnea, cancer, and joint and back pain [3]. Stress is also related to dysregulation of immunologic, neuroendocrine, and sympathetic pathways. This can lead to chronically elevated cortisol levels, chronic autoimmune disease, viral infections, tumour growth and metastasis [4].

Almost 1/3 of German adults and almost 2/3 of elderly (65+) are diagnosed with hypertension.
A Sure Sign of Impending Doom?
The appalling number of such chronically ill patients is further catalyzed by alarming demographic and societal trends. This is reflected in the concerning increase in health care costs over the last years (see graphic). Not tackling those tendencies may pose the greatest threat to our health care system since its existence. Understanding the history of the German health care system within the context of contemporary demographic and societal changes, shows clearly why continuing to kick the can down the road will certainly lead to the crash of our health care system.

Historical Origins
June 15th, 1883– a historic day in the German Empire [7]. A day that will profoundly impact the German health care system and with it the work of Charité until today. It was the day where Reich Chancellor Otto von Bismarck announced the first statutory health insurance (“Gesetz, betreffend die Krankenversicherung der Arbeit-er”). Bismarck’s historic introduction of the first statutory health insurance incorporated compulsory membership of almost everyone (below a certain upper-income limit), self-management of the insurance system, and a gross wage-coupled financial contribution of individuals [1]. Until today, many core characteristics of the German health care system of 1883 have remained: Access to statutory health insurance is granted based on income and employment status. Financing of the insurance is given by contributions of the individuals, who through the collective body of the insured, pay for the costs of illness of an individual [8]. And it’s regulation via self-management.

The Principle of Solidarity
The principle of solidarity underlies all social security regulations, such as the health insurance system. Thus, redistribution causes the healthy to pay for the ill and richer citizens to cover the costs of poorer ones [8]. Thanks to this principle, commonly accessible lifesaving and life-prolonging treatments drastically decreased mortality over the last centuries [9]. However, to ensure its promising future, a reevaluation of the health insurance system and its efficiency, in the light of the contemporary demographic and societal context, is necessary. While health care is a social construct, it is borne by economic considerations; mainly the redistribution of all contributions to the few ill.

The Aging Society: Bismarck’s Premises are Outdated by Demographics
The redistribution of health care resources, as introduced by Bismarck, is built on certain demographic and social assumptions. A change in those basic premises necessarily requires an adjustment of the redistribution principle. Otherwise, it will cause an imbalance in the whole system. Over the last centuries, we have witnessed two demographic tendencies, shifting our health care system towards a dangerous imbalance: Firstly, a change in the population pyramid, leading to proportionally more elderly people within the population. Secondly, a steady increase in life expectancy further expands this tendency. Both are major contributors to the steadily rising health care costs. With regards to projections of demographic development, this situation will continue to sharpen. While in Bismarck’s times a strong working population was financing relatively few elderly, today the tables have turned. From 1950 until 2022 the percentage of people above 67 years in Germany has increased by 12% [10]. Until 2060 the percentage of elderly (above 67) is further projected to increase by 8%, with a simultaneous decrease of the working population (20-66 years) by 8% (for more information see graphic). For the financing of statutory health insurance, this means a) more elderly will increase the health expenditures further; b) increasing life expectancy will cause additional burden over a longer amount of time; c) a decrease in the working population and increase in pensioners will reduce the deposit of the collective body of insured. [12]

Chronic Illnesses: Getting Bismarck’s Assumptions Into a Predicament
Additionally to demographic trends, medical advances enable the treatment of more chronic illnesses than ever.
As great as it is from a humanistic standpoint, it further significantly increases the economic burden on our health care system. In individual cases, even for several decades. One such example would be a child born with an autoinflammatory condition, which thanks to therapeutic advances can be treated by receiving an injection of Ilaris 150mg/ml (Canakinumab) every 4-6 weeks [11]. The issue arising for statutory health insurance is that this treatment costs almost 15,000 Euro per injection [12]. While some patients may only need the treatment for some years, others might need it for a lifetime. Zolgensma, a novel treatment for spinal muscular atrophy (SMA), recently sparked headlines because its one-dose treatment costs 2.1 million US dollars [13,14]. While Ilaris appears cheap in comparison to Zolgensma, 13 years of Ilaris intake amounts to the same costs as the one-time treatment with Zolgensma. It is obvious that the current health insurance system will only be able to tolerate a certain number of those patients before it will necessarily break under the weight of health care expenditures. With the rise of expensive genetic therapeutics, the situation for our health care system will not better within the years to come. Therefore, continuing to build our health care system on premises from 1883 is not only foolish but reckless. If we don’t act now, a health care system collapse seems possible, endangering all the medical advances we have built up.

**Modern Life (-style) as the Final Straw for Bismarck’s Premises?**

Many aspects of the modern lifestyle are not exactly known to be beneficial for health. Most of us are subject to a fast-paced and sedentary lifestyle, which does not allow for healthy dietary, sportive, or relaxation routines. As a result of our stressful habits, many of us have unlearned the ability to listen to our physical and psychological needs. Instead, our daily schedule has become the main determinant of when we take breaks, eat, drink, do sport, relax, and yes even go to the toilet. This can not only lead to chronically elevated levels of stress, but often further results in unhealthy eating routines, reflected in the rates of high blood pressure and unhealthy weight. For example, in 2019 61% of men and 47% of women in Germany were overweight [15]. Even for young adults between 18 and 24 years, it is already 25% in the EU. Compared to 2014, this is an increase of 3% (in just 5 years!). Those alarming numbers obviously do not include data on how many people suffer from fatty organs, which can be equally harmful to one’s health. Compared to obesity, which is visible fatty organs can also reside silently within skinny people. Further, our fast-paced live leads to chronically elevated levels of biological stress markers as well as oxidative stress. Oxidative stress can, for example, also be promoted through smoking. It has the potential to increase several cytokines and chronic neuroinflammation thereby increasing the risk for neurodegenerative disorders such as Parkinson’s and Alzheimer’s disease, Multiple Sclerosis, Huntington’s disease, as well as tauopathies [16].

**Rethinking the Health Care System**

Our contemporary health care system favors the unsustainable symptom-level treatment of diseases with deeply rooted psychological and medical aetiology. For example, swallowing pills to reduce high blood pressure may minimize the risk of cardiovascular diseases but it does not alleviate the origin of the problem. To rethink our health care system, we need not only to change the statutory health insurance system but to further alter the medical approach. Rather than treating human health like a mechanic replacing a faulty part, our medical system should incorporate science-based integrative and holistic approaches. The latter has already started to become more incorporated into Western medicine: for instance, in the form of dietary and sports lifestyle advice. However, many other important aspects of holistic health are...
commonly still disregarded by mainstream medicine. One emerging field in academic medicine is Psychoneuroimmunology, which tries to make sense of behavioral, neural, endocrine, and immunological factors at work [17]. By investigating the human being as a complex system, it has the potential to heal deeply rooted imbalances or diseases, instead of solely treating the symptoms.

Our health care system, as one of the major social security systems within our society, is based on demographic and societal premises from 1883. Given its age of introduction, it should be evident why the contemporary health care system is unable to persist modern social demands. Once the multilayered burden of current demographics and societal factors are broad to mind, a collapse of the health care and insurance system seems more realistic than ever. In the view of those dangerous demographic and social trends looming ahead for decades, why are we still continuing to kick the can down the road? In the interest of every individual within our society, the logical consequence should be an immediate sustainable modernisation of health care, which is based on modern demographic and social premises. Instead of fostering such a well-wrought redesign of our health care system, statistics of increasing healthcare expenditures tend to rather give rise to deliberations of where we can get the next quick fix from. Thereby coming up with suggestions such as asking pharma companies to pay up (Karl Lauterbach) for a demographic and societal imbalance instead of redesigning the system. A health care system collapse can only be prevented by thoroughly re-thinking its mainstays, based on current demographic and societal premises and incorporating scientific findings within the field of holistic medicine. While this change needs to be done on a systemic level, led by our decision-makers, awareness within the concerned is a critical tool to push this progress forward. Although an individual’s action only seems to be “a drop in the bucket[,] [...] with enough drops, we can fill a bucket” (David Suzuki). Start today, be one drop of many by holistically taking care of your health and changing your lifestyle!

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[1] https://tinyurl.com/2p86d5bv  
[5] https://tinyurl.com/bdcj7wks  
[8] https://tinyurl.com/2f9barm  
[9] https://tinyurl.com/rmt49xdr  
[10] https://tinyurl.com/2928bw6e  
[12] https://tinyurl.com/fyfbyw5w  
[14] https://tinyurl.com/4tyhe4f  
[15] https://tinyurl.com/49tx88ae  
[16] Leszek et al, CNS Neurol Disord Drug Targets, 2016  
What makes us who we are? More specifically, do different experiences shape us to reach our full potential? Or is our full potential already determined by our genome? Scientists questioned the influence of nature (genes) vs nurture (environment) on humans for decades. Are we close to detangling these year-long debates?

Fortunately, nature offers us incredible models to study these influences: monozygotic and dizygotic twins. Why are twins so important? To understand this, we must clarify some terms first. Monozygotic twins are identical, meaning they develop from a single sperm which fertilizes a single egg provided by a mother. During the first weeks of development, the fertilized egg later divides into two cell masses which will develop into identical twins. This way, monozygotic twins share 100 per cent of their genome, as they share a common origin [1].

Dizygotic twins are fraternal and come from two separate eggs that have been released from an ovary, each fertilized by a different sperm. They start developing separately straight away, do not share a common origin and therefore share only about 50% (or less) of their genes (Image 1). What does this mean in reality? Genes can determine our phenotype, such as what people look like or even how they behave. If traits such as hair colour and math abilities were fully inherited and only determined by genes, then monozygotic twins would share these traits more often than dizygotic twins. This is due to the fact that monozygotic twins have no genetic variation because they share 100% of their genes, while dizygotic twins only share 50% of their genome. Therefore, if we observe a phenotypic variation in dizygotic twins, it is due to the differences in their genomes. On the other hand, if we observe phenotypic variation in monozygotic twins, since their genome is 100% identical, the only influence we could blame is the environment (nurture) [2,3]. Therefore, twin studies can offer us an insight into environmental and genetic influence on human traits.

Many people are inspired but also intrigued by above-average twin stories. For example, Harold T. Shapiro and Bernard J. Shapiro are highly successful identical twins who became heads of two major universities (Princeton and McGill, respectively). Their whole life seems like a description of two clones who perform better than the rest of us [1]. Were they simply lucky because nature gifted them with a great combination of genes? Or was it the way their parents raised them to achieve their success? To study these questions, scientists had to look at less fortunate cases: twins separated at birth.

**Minnesota twin study and the IQs of reared-apart twins**

In some circumstances, monozygotic twins are separated at birth and reared in different environments. Since researchers have been interested in knowing the effects of nature and nurture on human phenotype, these twins were studied in “The Minnesota Study of Twins Reared Apart.” In this study, 100 sets of reared-apart twins (and triplets) underwent about 50 hours of psychological and physiological assessments. These twins were tested as adults (average age 41), leaving enough time for the environment to create different life experiences for individual twins.

However, after very extensive testing, no individual differences in the IQ of monozygotic twins reared together or reared apart were found. Some of the twins also met each other before the study, but the amount of this contact had no effect on their similarities. The scientists concluded that genetic factors have a pronounced influence on behavioural variability. It was found that rearing twins together or apart did not influence their similarities. For example, when researchers compared the mental abilities, psychological interests or social attitudes of twins that were reared apart or reared together, no significant differences were observed. The twins in the two groups were just always very similar. Moreover, the environmental effects on IQ they found did not correlate with what classical psychological studies focused on. In conclusion, they found that the IQs of monozygotic twins correlate at about 0.70, indicating that we can attribute 70% of observed variation to genetics. Environment, therefore, affects only the remaining 30% of the variation [4].

Although rearing did not affect the IQ of monozygotic twins in adults, it did influence kids. Hence, a more stimulating environment for kids helped them be ahead of their siblings, in terms of their abilities. For example, you can teach your child to count to 100 at the age of three, while other children will eventually learn it in school at the age of 6. This does not mean they are less intelligent than your child, but rather implies that their parents were not bothered to teach them. These findings suggest that we can affect the cognitive acquisitions of our babies, however the ultimate level of intelligence attained is not determined by their upbringing [4].
Researchers conducting the Minnesota twin study suggested that the psychological traits of monozygotic twins (even when reared apart) are similar because the environments affecting their identical genomes are similar as well. Hence, the effective psychological environment acts on genes which indirectly affect the mind. In other words, the genes are already present and only need turning on. Studies also suggested that genes affect how we interact with the environment and, therefore, also determine what kind of environment will affect us. For example, more active toddlers experience the world differently than sedentary toddlers. They could, therefore, seek a more stimulating environment, shaping their cognitive abilities. We could try translating this into the monozygotic twin studies, which already share 100% of their genes. If one of them is a sedentary toddler, the other one is also very likely to be sedentary (if it is a purely genetic trait) and therefore both will seek fewer stimulating environments. So, no matter how far away from each other they are raised, they naturally expose themselves to similar situations [4]. What is important to note here is the fact that this explanation sits well if children have equal opportunities to “move” and evolve. Twins in the Minnesota study were raised in the western world in somewhat similar families. There were no extreme cases of poverty, nor a case of one of the twins being raised by illiterate parents.

For example, earlier in France, many low socioeconomic status families abandoned their youngest children because they could not provide for them. These children then found their happy endings when they were adopted by upper-middle-class parents. These children also benefitted from the adoption acquiring IQs of up to 14 points more compared to their older siblings, who stayed with their biological parents [1, 5]. These results are very different compared with the observations outlined in the Minnesota twin study. In general, it could be that having more exposure to a stimulating environment was an important factor leading to increased IQ in these children. Unlike their older siblings, they had books, parental support to attend schools and probably had better nutrition. However, we cannot be sure that these kids would not have higher IQs than their siblings, had they stayed with their birth parents. On the other hand, these kids were not monozygotic twins and therefore did not share 100% of their genome, so we cannot attribute this difference solely to the environment.

Although the separation of nature vs nurture in studies continues, both types of causal explanations are equally important [6]. Although there are current studies that also found a small effect of environment on IQ, the larger variance is still attributed to genetics. Thus, suggesting that the conclusions of the Minnesota study has not changed over the years [7]. It is obvious that biology and the environment are not independent of each other, and it may even be impossible to disentangle the nature vs nurture debate. With humans, we have very limited sample sizes when it comes to the exact genetic material. We can study twins, triplets, but going above the number of three and finding these siblings in different environments is rather challenging. Moreover, human intelligence itself is also a difficult topic to study, yet it is really interesting as we are interested in boosting our IQs or making our kids really successful geniuses. Regarding twin studies, the focus has since shifted to looking at the heritability of various disorders such as schizophrenia or autism. For example, some studies suggest that environmental factors that induce epigenetic changes could be transmitted between generations [8]. The advantage of these studies compared to intelligence studies is that we can also model them in animals [9]. However, modelling human intelligence in animals is not plausible at the moment. Moreover, with humans, we cannot simply choose our sample size of twins we want to study, separate them at birth and then change their environments as we please to see a larger effect. This would be simply unethical. Therefore, not being able to manipulate the environments ourselves leads to difficulties in making any conclusions about the causal effect of nature and nurture on IQ. These older studies, however, paved the way for future areas of study, such as epigenetics.

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[12] Kaminski et al., Transl Psychiatry, 2018
Insects exhibit social organisation to varying degrees. Whilst wasps are considered solitary insects, honeybees display a highly evolved social structure, reliant on each other for survival [1]. The interdependence of honeybees is evident in several complex tasks performed in the hive. For example, division of labour, communication, environmental control and hive proliferation are all behaviours honeybees have developed to thrive in social colonies. Honeybees exhibit incredibly high levels of social organisation and meticulously carry out their individual roles in the hive. This has led researchers to consider honeybee colonies as superorganisms. Typically, a superorganism refers to an aggregate of individual organisms that function like an organic whole.

Certain criteria must be met in order to attain superorganism status. For example, a superorganism must be composed of many individual units, of which each perform distinct yet essential functions. This is undoubtedly evident in a honeybee colony in which labour division is dependent upon honeybee type. There are three types of adult bees that exist in each colony: a queen, the drones and the worker bees. There is one queen per hive who is considered the progenitor of the colony. The queen bee is the only reproductive female of the species and is morphologically distinct from other bees – evident in her long and wide abdomen. Aside from laying eggs, the queen produces pheromones that help to regulate the unity of the colony. These chemical scents affect social behaviour, swarming, mating and even inhibit the development of ovaries in worker bees [2].

The drones are the male honeybees whose sole purpose is to mate with the queen. In a single hive, there are several hundred drones and thousands of worker bees [2]. The worker bees are the non-reproductive females and are the smallest bee type in the hive. They are involved in hive maintenance, high defence and brood care (caring for the eggs, larvae and pupae of honeybees) [2]. The type of tasks a worker bee performs depends on the age of the honeybee – a phenomenon termed temporal polyethism [4].

Aside from the pheromone distribution of the queen bee, communication within the colony is also achieved by dances performed by worker bees. The type of dance relates to the location of the food source. The ‘round dance’ is performed when the food source is within 100m of the hive and the ‘waggle dance’ is performed when the food source is in the direction of the sun [5].

Another characteristic of a superorganism is the ability to regulate the internal environment in an effort to minimise environmental fluctuations. Environmental control is very important for hive maintenance as the brood area of a hive (the chamber that houses the eggs, larvae and pupae as they develop) must be kept at 34°C for optimal survival of premature bees. The worker bees are responsible for thermoregulation – when the ambient temperature exceeds 34°C, worker bees cool the hive by fanning air over droplets of water with their wings (see pic below). Conversely, if the temperature drops below 34°C the worker bees gather around the brood nest and vibrate their wings for heat generation [7].

The final criterion of superorganism status is that an individual member of the superorganism would not survive out of the unified whole. Whilst it may be possible for an individual honeybee to survive for some time outside of a colony (foraging for nectar and pollen independently), the survival of the species depends on the colony as a whole. The entire hive is involved in the proliferation of the colony. The queen bee mates with the drones and the worker bees take care of the eggs, larvae and pupae. There comes a time when a single colony splits into two or more, a process known as swarm-
ing. This is a honeybee colony’s natural means of reproduction and involves a large group of worker bees, together with the queen, leaving the apiary in search of a new nest [2]. Thus, it takes the entire colony to perpetuate the survival of the species.

The intricate social structure of a hive qualifies honeybee colonies to be considered superorganisms. Honeybees exhibit exceptional organisation when it comes to division of labour, communication, environmental control and hive proliferation. Renowned bee expert Thomas D. Seely summed it up nicely when he wrote in his book, „just as a human body functions as a single integrated unit even though it is a multitude of cells, the superorganism of a honey bee colony operates as a single coherent whole even though it is a multitude of bees” [9]. This analogy speaks to the honeybee’s exceptional level of cooperation, which seems to be unparalleled in the animal kingdom!

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[1] Leonhardt et al., Cell, 2016

[8] Creative Commons license
The potentials of neuromodulation – the idea of manipulating neural activity – have long been leveraged to treat brain disorders and advance insights into human brain (dys)function [1,2]. A whole plethora of invasive or non-invasive neuromodulation modalities exist! Here, we focus on deep brain stimulation (DBS) – a surgical technique which relies on electrical stimulation chronically delivered to specific deep brain structures via precisely implanted electrodes [1-3] – and its relationship with connectomics. Rightfully, you might now wonder: Why would these (seemingly) unconnected concepts form a fruitful synergy? Or, how can this synergy be leveraged towards better treatment decisions? The answer to these questions lies hidden somewhere between the lines of the following metaphor for the brain’s reaction to neuromodulation: “the whole is greater than the sum of its parts”. But, in which way? Well, let’s find out!

**A Glimpse into the History of Network-Based Neuromodulation**

Before we come closer to unmasking these conundrums, let us rewind to the very beginning - deriving from Theodosius Dobzhansky’s famous essay from 1973, “nothing in biology makes sense except in the light of history (evolution)”. Like many other scientific theories and applications, the development of DBS can be attributed to more than one individual. While some forms of electrical brain stimulation had been performed since the 1930s, the ethically tainted history of American psychiatrist Robert Heath cannot go unmentioned [4]. Between the 1950s and 1960s, Heath focused on electrically stimulating brain regions including the septum – known as the subcortical reward center – as a means of understanding their implication in the workings (and breakdown) of brain functions such as pleasure. On the dark side of his groundbreaking accomplishments were ethical flaws in his research. In one instance, he attempted to apply DBS to a homosexual man with the objective of “converting” him. Fast-forward three decades, French-Algerian neurologist Patricia Limousin, made the serendipitous observation of tremor – an uncontrolled, rhythmic shaking of one or more body parts – subsiding in a Parkinson’s disease patient following thalamic high-frequency stimulation [5]. Almost as if DBS got a second, redeeming chance at life, this surprising incident in a surgical room in Grenoble in 1987 gave the go-ahead for a productive era of research into DBS and its therapeutic use in many movement and neuropsychiatric disorders alike [1-3].

Behind much of what shapes the way we approach invasive neuromodulation today stand the awe-inspiring contributions of historical thinkers. For the field of DBS, some of the most formative ideas emerged from the minds of scientists and physicians who understood early on that disrupting pathological information flow along the interconnections between different brain regions may represent important drivers of symptom improvement. As early as 1890, ablative lesioning – another invasive, yet irreversible neuromodulation technique – was performed, often with the explicit goal of interrupting pathological information flow between interconnected brain regions [1,2,6]. Starting from the 1950s, Jean Talairach* and Lars Leksell, for instance, sectioned the anterior limb of the internal capsule (a limbic-associative information highway in the brain) in patients affected by psychiatric disorders to cut off the prefrontal cortex from dysfunctional neuronal transmission. It is exactly these early reflections that form the basis of what we will explore next – the concept of brain connections in neuromodulation.

**The Connectomics Revolution – Into a New Era of Neuromodulation**

While similar ideas had been in the air long before our time, rapid advances in neuroimaging technology and the boom of “connectomics” as a leading neuroscientific concept can be accredited to a renewed interest and unprecedented capability to investigate therapeutic brain networks [1-3,7]. Connectomics, first introduced to the neurosciences by Olaf Sporns and Patrick Hagmann in 2005 in allusion to genomics [8,9], represents the prolific study of the connectome. The connectome, again, in the neuroscientific world comprises the formal description of the wiring diagram (or a set of connections) between nodes within a parcel of the brain. Since the parcel is an undefined unit of space, connectomes can range from the micro-scale (single neuron) to the meso- (brain regions) and macro-scale (entire brain). Connections within these parcels can be of both structural or functional nature: Structural connections – or neuroanatomical paths between two nodes – are often measured using diffusion-weighted imaging-based tractography [10]. Functional connectivity – or co-fluctuations of neural activity within two or more nodes – on the other hand, is typically accessed using resting-state functional magnetic resonance imaging [11].

*An interesting fact here to wow your friends at the next party: an important early coordinate system in stereotactic neurosurgery is named after him - the Talairach coordinate system!
Equipped with these newly formalized concepts and emerging techniques, modern-day clinical neuroscience experienced a major paradigm shift – from a focus on dysfunction within single brain regions toward that on distributed whole-brain networks [1-3]. More and more, neurological and neuropsychiatric disorders became re-framed as “disorders of the human connectome”, and soon, the term “circuitopathy” was coined to describe the relationship between a symptom and a specific circuit dysfunction [3]. To therapeutically impact the respective symptom, as it became increasingly understood, modulation of exactly that same network was required. For the field of DBS, this paradigm shift implied that beyond the local effect at the stimulation site itself, the remote impact on brain regions connected to that stimulation site would be conceived as therapeutically critical [1-3]. And with that, the field of “connectomic neuromodulation” (and embedded within it, “connectomic DBS”) was born!

Same, Same, But Different? On the Concept of Unifying Therapeutic Networks

So far, so good! We have learned until this point that groups of functionally or structurally interconnected nodes – rather than single brain regions – are majorly involved in symptom improvement. While this may sound like an intellectually sound concept (if you agree), the real value of a clinical theory is naturally determined by its ability of informing real-world therapeutic decisions. So, does connectomic neuromodulation rise to the challenge? Let’s put this question to the test by asking a particularly tricky – yet burning – question a multitude of neuroscientists and clinicians have unsuccessfully racked their brains about before (and maybe you have, too): How can stimulation to different deep brain nuclei be therapeutically effective in treating the same symptom? This question is especially important in the case of disorders where multiple targets have been probed, with often only slight differences in therapeutic benefits observed. For instance, for treatment of severe obsessive-compulsive disorder, the tough choice between the subthalamic nucleus, the anterior limb of the internal capsule, the inferior thalamic peduncle, and several other subcortical brain regions has bugged the field for quite a while [12,13]. Among all these options, how can we best decide where exactly to place our electrodes to achieve symptom relief?

Luckily, connectomic neuromodulation has a resolution in store for this very problem: For instance, treatment success for obsessive-compulsive symptomatology appeared to rely on the degree how much a specific fiber bundle was stimulated – rather than on the one optimal choice among different focal treatment targets [12,13]. What does this mean for DBS surgery? It gives the surgeon flexibility to place the electrode at multiple different sites that lie along the course of this white-matter bundle to maximize treatment impact on obsessions and compulsions. Or, more concretely, the tract itself becomes the target! As you can imagine, this concrete guiding principle of a unified tract target may help overcome the cumbersome practice of trial and error in electrode placement to different target structures for treatment of a given disorder. And indeed, connectomic neuromodulation does rise to the challenge of clinical translatability: the idea of connectomic neurosurgery has even successfully made it into the operating room where white-matter connections instead of grey matter nuclei are increasingly becoming explicitly targeted [14].

But that’s not all: there are more chapters to the connectomic neuromodulation story! Even without the need of opening the skull (as done during DBS or ablative surgery), the usefulness of this unifying connectomic principle extends toward non-invasive brain stimulation strategies including transcranial magnetic (TMS) or direct current stimulation (tDCS) [1,2,15]. How so, you may wonder at this point? To answer this question, we need to remind ourselves of the fact that non-invasive brain stimulation techniques rely on magnetic fields induced by coils precisely positioned over an individual’s head (in the case of TMS), or on electrical stimulation induced via large electrodes that are applied directly to the cortical surface (in the case of tDCS), to modulate brain activity. In fact, specific cortical stimulation nodes – much like different subcortical DBS targets – may form part of the same therapeutic network [16]. So, theoretically speaking, no matter which brain stimulation technique a clinician would pick to tackle a given disorder, its treatment success would likely involve this very network. And yet, the story does not end here! Beyond brain stimulation, other neuromodulation options including pharmacotherapy or behavioral interventions (such as psychotherapy or neurofeedback) may also provide access to (some of) these pathologically altered networks to unfold their therapeutic effects. As seen in these examples, the beauty of the connectomic framework lies in the fact that it provides us with a harmonized theory of treatment effectiveness across different network access nodes and neuromodulation modalities.
Which Opportunities Does the Future of Connectomic Neuromodulation Hold?

So far, we have focused much of our attention on network targets with therapeutic properties for a given disorder. However, there is one significant flaw in such a disease-centric view: Within one and the same disorder, individuals may present with heterogeneous phenotypes, which may consist of amalgamations of symptoms and comorbidities that are expressed to varying intensities [15,17]. Of two patients, both diagnosed with Parkinson’s disease, one might exhibit the tremor-dominant type with comorbid depression, while the other may present with predominant bradykinesia and rigidity. Conceivably, it will thus likely be impossible to alleviate different symptom clusters in both patients to an equal level when relying on the same “one-size-fits-all” targeting strategy [15,17].

Instead, treatment effectiveness in each relevant symptom may, again, rely on a specific therapeutic network that may even have transdiagnostic properties due to the co-occurrence of some symptoms in multiple disorders [1,2,15]. Did you know that compulsive behavior, for instance, is a common denominator of substance use disorders, Gilles de la Tourette syndrome, compulsive eating as well as obsessive-compulsive disorder? Luckily, most if not all commonly targeted brain structures in DBS are network hubs whose functionally organized subterritories provide access not only to one but to multiple of these symptom-specific networks [1,2,15]. This very fact is also the reason why stimulation to the subthalamic nucleus – one of the most investigated DBS targets – is effective in treating the main symptomatology of multiple severe network disorders of heterogeneous phenomenology, including Parkinson’s disease, dystonia, Gilles de la Tourette syndrome, or obsessive-compulsive disorder [1,15]. Depending on where precisely within this nucleus you place the electrode, DBS may preferentially activate the limbic, the cognitive-associative, or the motor loop.

All well and good, but how can this vast amount of knowledge be synthesized to improve the personalization of DBS targeting and stimulation parameter tuning strategies? Rather than setting our hopes on a disease-specific strategy, we may make use of a target structure’s well-connectedness to optimally tailor interventions to an individual patient’s unique phenotype [1,2,15,17]. After thorough characterization of the prevalent symptom constellation, the tracts corresponding to these symptoms could be weighted by experienced intensities and other important factors (such as subjective preferences), matched to the patient’s individual brain anatomy, and finally tailored into an optimal stimulation target suggested by an automated (but expertly supervised) algorithm. The hope is that this strategy may help to increase coverage of relevant symptom networks through the volume of tissue activated by the electrical stimulation. Stated simply on an example, the tremor-dominant Parkinson’s disease patient who also experienced depressive symptoms would require a treatment focus with maximal stimulation impact on tremor and depression networks, while a patient of bradikinetic-rigid type would likely benefit most from stimulation primarily applied to the networks matched to these two symptoms.

Connectomic Neuromodulation – A Fruitful Synergy, Indeed!

Have we convinced you that in the way the brain reacts to neuromodulation, the whole is greater than the sum of its parts? With the importance of valuing the ethical implications of neuromodulation research in mind, we are now armed with exciting new techniques and concepts to take scientific and clinical efforts to new heights. Clearly, we have seen that neuromodulation and connectomics indeed do form a fruitful synergy, which endows us with therapeutic insight that bears considerable translational value. Above and beyond its promise to significantly improve the lives and wellbeing of many patients affected by severe circuitopathies, connectomic neuromodulation also opens a unique window into the (dys)functioning of the human brain [1,2]. We are excited to see which big milestones will be next for this multifaceted and rich field – and hope that after you reading this article, we are in this excitement together!

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If you hear or read the word “culture”, without any context, what does it remind you of? Well, you might think about people in different parts of the world with different preferences for food, clothing, ideologies, traditions and languages. If we look beyond the superficial, then one might be able to appreciate how individuals across the globe can have differing sets of beliefs, worldviews and may see the same situation differently! Interestingly, cross-cultural studies [1] have revealed that when we think of a particular scenario, people in western cultures, e.g., North Americans and Europeans, utilize an analytical way of thinking, which focuses on individual aspects and separating parts from the whole. On the contrary, people in Eastern cultures, e.g., East Asians tend to utilize a holistic style of thinking which takes into consideration the overall pattern of things and how they exist in relationship with other things.

Interestingly, these cultural differences and thinking patterns might influence perceptual experiences of people across cultural boundaries. In lab-based investigations on such a phenomenon, researchers discovered that when presented with a complex scene, Westerner’s eyes focused highly on the main objects while the East Asians shifted to an enhanced orientation on the background environment soon after they inspected the main objects [1]. Notably, Westerner’s remembered more details and East Asians were able to recall more about the background. This finding was suggestive that the former attend to individual things and latter attend to relationships, reflecting their analytical vs holistic thinking mannerisms [1].

If culture effectively shapes our perception, does this mean it can also shape our brain? Precisely, yes! Let’s have a look at how culture shapes our cognition.

"Outside" affects the "Inside"
How the “Outside" (i.e., structure) affects the "Inside" (i.e., function) of the human brain is a question that resides at the core of cognition [2]. Deciphering the neural correlates of socio-cultural influences on our overall thinking, judgement and behavior can provide vital insights into understanding how the social environment is constructed. Neuroscientifically, our brain processes visual information in two streams. Beginning from the primary visual cortex, the dorsal stream informs us about the location of things and how they move [2]. By contrast, the ventral stream enables us to recognize what the things we are seeing are. For our purpose of investigating culture and perception, we need to look at the ventral stream. In particular, the ventral visual cortex (VVC), which is characterised as a collection of brain tissue localized across the occipital lobe, fusiform, inferior temporal lobe, parahippocampal and lingual regions [2]. VVC can further be divided into smaller areas e.g: the fusiform area (which processes facial structures) and the lingual landmark area (which processes scenes and environment) [2]. Knowing that we have those different areas required for processing distinctive types of visual information, we can now decipher once again whether different cultures respond differently to stimuli. For example, looking at the patterned response of the Western and Eastern brains.

Modern neuroimaging techniques such as fMRI allow us to visualize brain activity while people perform different tasks. Using this effective tool, researchers looked at brains of people from the West (European’s) and East (Asian’s) whilst they looked at images.
of human faces without background or photos of houses with background [3]. In alignment with previous behavioral studies, Westerners’ (Europeans) fusiform face area exhibited significantly higher activation than the Asian’s while processing faces, suggesting that they prefer a single focal object, such as an individual’s face [3], whereas Asian’s lingual landmark area showed more activation when they looked at scenes with environmental contexts. This fascinating finding was indicative of a preference for perceiving overall relationships. Notably, this effect of culture on our visual processing has become increasingly robust with age, suggesting that prolonged exposure to certain cultures influences our brain and lets us think in the way of that culture.

**Individualistic or collectivistic thinking patterns?**

One of the fundamental ways in which cultural beliefs, practices and traditions influence psychological processes is in the cognitive schema [3] or self-construal. Malleability of thinking thinking patterns and that the mPFC activation patterns in these individuals are representative of both, themselves and a close other. In addition, in a similar study differences in gray matter (GM) volumes were observed between Westerner’s (Europeans) and Asian’s (Taiwanese) populations (Figure 1) [9]. Thus, our brains actively absorb information associated with the regularities of distinctive cultural environments. These representations, which stem from the nervous system, in turn greatly influence how we interact with the world and shapes our environment. Furthermore, as the self is central to our social as well as interpersonal interactions, these findings that culture can affect neural representations is striking and has canonical implications regarding how we represent ourselves, others across cultures. Interestingly, the brain undergoes neuroplasticity and is principally malleable, therefore like how a changing tide can erode a footprint on the sand, experiences can also modify these interesting brain activation patterns. In this sense, the brain can be seen as a “cultural sponge”: absorbs the regularities of our surrounding physical and social environments.

**Nurturing the brain: Impact of family and upbringing**

Ever heard of “infants are constantly absorbing and learning things, not just when we are teaching them”? Well, this notion reflects that what is going on in their environment is literally shaping physical connections in their brain. Similar to appreciating that culture plays an important role in shaping an individual’s perception, the environment at the home also has been linked to contributing to overall neurodevelopment [5]. Stress or neglect at home actively contributes to psychological consequences in adulthood. Recent population-based studies have shown that parental behaviors are proximally associated with the prevalence of social, emotional, and cognitive discrepancies in children [5]. For example, adults with a childhood traumatic history, such as exposure to major familial disturbances, have been implicated to show reduced gray-matter volume in the prefrontal-limbic brain areas [6]. Notably, an altered structural connectivity amongst the temporal pole, insula and ventromedial prefrontal cortex was also observed [5]. In a behavioral-level correlation analysis, aimed at investigating relationships between family environments and children’s behavioral issues, cognitive scores demonstrated that large-scale structural differences in orbitofrontal and cingulate cortices of children are prevalent. Based on the preliminary data, family conflict scores (FCS) negatively correlated with all the cognitive scores measured (CM) [6]. In particular, the range of correlations between FCS and CMs was -0.02 and -0.08 [6]. These values suggest that children in families with higher FCS had a poorer cognitive performance. Whilst...
it is interesting to see how the neural correlates are altered with regards to FCS, parental monitoring and cognitive scores, what is vital to note is that individual attachment styles also play a crucial role in deciphering the overall cognitive schema.

Impact of attachment styles on neurodevelopment and interaction with the world!

The Attachment theory, revolves around the notion that attachment security is a derivative of social experiences which stem in childhood/ early in life and continues into the formative years of adulthood. In the words of the British psychoanalyst John Bowlby (1988), the father of attachment theory: "Attachment is an integral part of the human nature; from the cradle to the grave. It is very prominent in childhood" [7]. Based on the three-compartment model of the attachment-behavioral system, threats or potential harms to the individual activate the attachment system and cause the individual to ponder on the presence (availability) or absence (responsiveness) of a security-providing attachment figure, for example, a parent or guardian. With time, in case there is a lack of such a figure, the individual would usually turn to either implicit or explicit decision-making to deactivate (avoidant-attachment)/ hyperactivate (anxious-attachment) [7].

Briefly, Bowlby’s attachment theory focused on the following postulates, important for disslicating the impact of attachment styles on neurodevelopment: (i) Children have an inborn need to attach to one central attachment-providing figure, suggesting that infants are naturally programmed with innate behaviors. (ii) Children, should carefully, diligently and continuously receive care from the main attachment-providing figure for at least the first two formative years of their development. The deficit of the same could potentially lead to long-term cognitive, social, and emotional disturbances [7]. (iii) If the continuous hinderance in the attachment of the child and the mother takes place (maternal-deprivation hypothesis), the child could experience delinquency, elevated aggression, depression or reduced higher-order thinking skills e.g., problem-solving and critical thinking at a later age. Therefore, the lack of caregiving or the presence of intergenerational trauma, violence, and addiction can negatively impact the cognitive development of children [7]. It is safe to mention that children, for the most part, experience the world from the eyes of their caregivers, therefore, they tend to mimic parental behaviors and learn to navigate relationships they encounter in the future based on how they relate to their parents.

Within the relms of cultural neuroscience, it has been elucidated that children often also respond to emotional signals at the neural level when a stimulus is presented by an attachment-providing figure, this tends to differ cross-culturally! In a 2008 study by Chiao and Colleagues, significantly higher activation of the amygdala was found in response to faces of attachment-providing figures [8] from one’s own cultural group vs another group. Suggestive, that it is natural that growing up children are less attuned with people from other cultures. However, fostering exposure to other cultures, and nurturing interpersonal growth at a young age can make the brain culturally tuned. To conclude, sustained values, principles and behaviors we encounter on a day-to-day basis are largely influenced by distinctive patterns of neural activity responsible for our self-concept, quality and quantity of our relationships. As the field expands questions at the core for our understanding of culture and how it influences neural networks remain unanswered, at the forefront of which is are there critical periods during development when the brain might be more sensitive to cultural exposure? So, the next time you think of culture, you may realize that besides the exotic foods, and clothes; culture is also something that is embedded in our brain and is profoundly influenced by how we interact with this beautiful world!

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[4] Qu Yang et al., Frontiers Human Neuroscience, 2019
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How is the self integrated into the whole of society? Cognitive scientists have a compelling answer: large-scale rituals! Rituals bind the members of a group and draw group boundaries. This kind of group membership not only shapes our opinions of the world but might also impact how we perceive the world.

Collective rituals are present in every human society [1], while most are religious, examples in secular contexts include synchronised group rowing [2], mid-day exercises in Japan [3, see figure 1], celebratory clapping after musical performances [4], protests & concerts [5].

Developmental psychologists have also found that children, between 4 -11 years old, report higher affiliation scores when they participate in ritual activities (scripted, synchronous necklace making) versus non-ritualized activity (unsupervised necklace making) [10]. They also tend to imitate ritual actions with more fidelity after experiencing ostracism [11], indicating that we are psychologically prepared to use ritual as a means of social affiliation.

Rituals provide an environment for the highly arousing group activities that form strong and persistent bonds amongst participants. To understand the mechanism by which rituals create group bonding in real time, researchers in the field studied the Paso del Fuego (fire-walk) ritual in Spain [7, see figure 2]. Intriguingly, they found that those performing the ritual as well as spectators belonging to the same community had synchronised arousal patterns [8,9].

In one of my experiments, participants perform a perceptual task (e.g. judging the directional motion of floating dots) in the presence of the simulated group after they’ve marched together. If we find that the propensity for imitating group decisions increases only in the ritual participation conditions, this would indicate that group rituals impact people on a perceptual level.

Rituals can be ecstatic experiences promoting a lifelong sense of loyalty between group members. New research on rituals from a variety of perspectives highlights how these activities are employed to integrate individuals into groups.

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[1] Gelfand, Caluori, Jackson, & Taylor, 2020
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A state of devastation is one of a great deal of destruction, damage, and degradation. By defining it as an “overwhelming shock or grief”, the Oxford dictionary further frames devastation as a psychological experience that entails a great state of loss. Devastation is either a physical act of violent destruction or a psychological one. In Radical Hope: Ethics in the Face of Cultural Devastation, Jonathan Lear presents both sides and looks at the extent to which great loss damages not only the individual but spreads through the collective.

Radical Hope portrays states of devastation as what happens when a culture dies, and its people are yet alive. Through the voice and stories of Plenty Coups, the last chief of the Crow people, the book narrates how the Crow endured as one of the remaining tribes of the native population of North America. In the late nineteenth and early twentieth centuries, they had to face the devastation of all they held dear. As such, by the end of his life, Plenty Coups told the tales of such a “clash of civilizations” to a white man, Frank B. Linderman, as they faced seemingly overwhelming and traumatic forces that set out to extinguish their way of life. Radical Hope tells part of the stories of those facing the horrifying fate of cultural devastation. Through this retelling of his oral tales, Plenty Coup tells how he was set to collaborate with the white folks to counteract blunt annihilation. Yet, the question lasts. How does a culture die while its people, those enacting and embodying those cultural practices, are still alive?

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Enactivism | Enactivism was developed as a theory describing cognition not as a mere mental function but as arising from the dynamic interaction of the organism with its environment and its sensorimotor states to specify its own domain. The concept understands cognition as embedded within neural and somatic activities and emerges through actions of the organism within its own domain. Actions are proposed as more than responses to environmental stimuli; they instantiate and co-create one’s domain by setting the expectations about the valence, sequence and form of the organism’s environment. Via sensorimotor processes organisms engage in transformational interactions, and not merely informational: they enact a world. It emphasizes the interactions between mind, body and the environment, seeing them all as inseparably intertwined. [3,4]

For the Crows, that was true. Their culture died, yet a significant portion of its population remained alive. Cultural devastation meant for them an impossibility to enact their traditions, their practices and their beliefs. For those, used to walking the buffalo and hunting and gathering, suddenly finding themselves enclosed in a reservation had catastrophic consequences.

Loss, lack and affordances
Cultural devastation can be understood as a radical experience of loss, without losing a concrete person or an object. Jonathan Lear portrays such an experience as a loss of meaning that accompanies the loss of movement. On one hand, the loss of meaning entails that what one was valuable is now depleted. Let us unpack this assuming valence (or what is valuable) is a two dimension measure: positive and negative. When those are depleted, it means that valence is gone - not that things became bad. It is a much worse fate of them becoming just empty. Everything that shaped their landscape of possible actions and spelt how to behave accordingly is now devaluated. What was once good/desirable or bad/undesirable or avoidable is just flat. In other words, their landscape of affordances is not fully available to them anymore - thus, depleted.

Affordance | Affordance is commonly defined as an opportunity to act. Borrowed from Ecological Psychologists, affordance gained a more contemporary definition to include action as something that is embedded in the environment and how a living organism can relate to it (couple). The term was coined by James J. Gibson in his book, The Senses Considered as Perceptual Systems and later defined in his seminal 1979 book, The Ecological Approach to Visual Perception: “The affordances of the environment are what it offers the animal, what it provides or furnishes, either for good or ill. The verb to afford is found in the dictionary, the noun affordance is not. I have made it up. I mean by it something that refers to both the environment and the animal in a way that no existing term does. It implies the complementarity of the animal and the environment.” [3, p. 127]

On the other hand, new possibilities are made present in a dull way. Nothing seems interesting, salient or relevant. Lear makes clear a point that while many of the Crow people survive, what makes them Crows is no longer available to them. That culminates with an elderly Crow lady confessing to her grandchildren: “I now live a life I can’t understand”. [1, pg. 89]

Lack of meaning, lack of motivation or lack of adaptive skills may seem a lot like mental illness, depression or fall under a category of behaviour that resists adaptation. Oftentimes, it sounds a lot like sadness or a profound nostalgia. I advise you not to jump to conclusions too quickly. While Radical Hope is a book about
trauma and its consequences, it aims to describe a darker thought, hard to grasp. A sort of ineffable feeling of what is possible after everything else is gone.

As poetic as it sounds, it is not a book about anthropology, sociology, social cognition or psychology. It is a book about philosophy and, more particularly, it is a book of philosophy of affordances. Affordance is a technical term inherited from ecological psychology and means "the opportunity to act" given an environment [2]. The experience of affordance is known in the literature as embedded in cultural practices, and meaningful relationships with the environment, such as rituals and practices. Radical Hope beautifully summarises what it feels like when a landscape of practices is abruptly interrupted: "When the buffalo went away the hearts of my people fell to the ground, and they could not lift them up again. After this, nothing happened." [1, pg. 3]

Was Crow culture so rigid and static that it could not adapt to the changing situation?

Those were the report of Plenty Coups about what he experienced and witnessed. For the Crow, buffalo hunting was more than searching for sustenance. It oriented their existential goals and stances. Throughout the book, Lear weaves the fabric of what was unfolding behind the absence of those animals. For the land, the buffalo’s disappearance exposed them to the extent of the devastation brought along by the white people’s interference in the landscape. For the Crows, the buffalo’s absence meant a brutal lack of their affordance to hunt, to bond with the practice and connect to their habits. They could not perform their rituals, which translated into more than merely hunting, but moving, chanting, defending their territories and being honourable and courageous warriors. When the buffalo went away, even their wars were rendered pointless. Apart from the truism that, for hunter-gatherers, hunting is more than a survival activity, the enactment of such activities bonded them to the land and sculpted their relationships with one another, their beliefs of good, bad and sacred, and therefore their future [3]. Their biases were made relevant for those practices, their preferences were shaped to inform them of their history of interactions, and their future depended on those possibilities afforded by their land. Their social organization was meaningfully built around their physical mobility following the buffalo and, more than that, their social disputes, their territorial wars and their motivation to build their tents around a specific place vanished. The rituals and honours of those wars, the pragmatics of hunting and the courage of defending their home, became depleted. Courage was not an act of manipulating risks, because what was risky was no longer clearly defined. The buffalo going away entailed so much that it radically emptied the Crow people of their relational meaning. The materiality of such practices, enacted by those that belong to the material space, had been stolen. "After this, nothing happened".

Yet, everything happens to people on a daily basis. The milk goes bad, the train is late, the weather is too hot, elections in an obscure corner of the planet go terribly wrong and make the news. Life goes on when everything fails. Maybe specifically when everything fails... Perhaps that is the most terrifying experience: that life keeps going when nothing else matters. Perhaps then, and only then, nothing happens.

No country for wild men: Everything leaves a trace

While the colonial forces were too great for the Crow to fight and win, they were also pernicious. What Lear wants to make salient is not only that they were ill-equipped to win the wars against the colonizer. They were also not equipped to perceive the white colonizers as a full-blown threat until it was too late. How can one counteract the enemy you cannot perceive as a foe? As Lear goes on, when they realized what made "the buffalo go away," it was too late, as it had already disrupted their social organization. As the buffalo disappeared, to their surprise, they encountered a different type of animal: domesticated, smaller, and less agile. The cattle mesmerised the Crow as much as they brought along the brutal acknowledgement of the annihilatory force of colonization. By reshaping nature, the population, and more crucially, the mode of thinking of the Crow, the white men destroyed everything the tribe held dear.

Reading this book comes with a rather intimate significance. Not because of loss, but because of my upbringing as a daughter of an archaeologist who studies indigenous cultures in South America. I’ve navigated many archaeological sites, their forms of cultural development and the forms of devastation. From those who were slaughtered and from the few who
remained. And for those who lasted, as much as I learned, what remained when all cultural meanings were gone, with no hope to return, is a radical experience of emptiness. “After this, nothing happened.” My mother always explained to me during her travels, many of which I accompanied as an ungrateful child, that the journey of an archaeologist is inherently impossible. According to her, apart from all the knowledge a scientist gathers over years of experience, a good archaeologist needs to learn the impossible: to think and experience the landscape as those who are no longer there. This task requires thinking with the resources those people had, but it also entails more. One must try to see what they saw. She meant it as an attempt to reenact their own sensorimotor from the clues they left behind. What would be relevant for them, with the resources they had under their landscape of affordances? How does a specific civilization relate to their landscape and to one another? In the end, one can do as much as an uneducated guess, build a hypothesis and test it. Check what those findings will teach. In a way, the reports from Plenty Coups and others, those that lived such experiences, bring some extra clues to what is missing in those guessing games.

So why is the book named Radical hope?
If you are asking yourself this question, you are on the right track. Radical Devastation requires a specific way of seeing the future, otherwise, they would have perished. But more than that, it makes a point that we radically need to foresee possibilities and possible modes of interactions to remain alive without falling prey to rather prevalent behaviours among populations experiencing such a radical loss: addiction, depression, self-destruction and ultimately suicide. The fact that life continues when possible futures are nullified suggests life also inexorably pushes forward. But what if the mere continuity is not enough? Then Radical Hope should kick in. The expectation of continuity in a certain way, which Lear poses as Radical, is so strong that it should be enough to build upon lost values not to modify them, but to relieve them.

Lear frames culture within the boundaries of hope. And hope points to the future, which is built upon the past, the normatively and the goals that were passed on by those who came before us. For the Crow, a culture of honour: The highest honour belonged to those counting coups, or who made a large number of coups against the enemy, hence their chief’s name of “Plenty Coups.” Honour came hand in hand with the concept of courage, telling them how to act and how to hope. The risk and uncertainty require what Lear calls a „Radical Hope“ for renewal. It should demand profound courage to survive the destruction that could not be anticipated. Beyond that, Radical Hope is an experience so foundational that it reframes values and encompasses what Lear describes as an extreme kind of courage: “So if there were to be such a thing as a courageous response to these radically altered circumstances, it would seem to require a transformation of the psychological structure with which we „face up to reality“. At a time of cultural devastation, the reality a courageous person has to face up to is that one has to face up to reality in new ways.” [1, pg. 97]. I am not sure if that is fully possible, yet I can’t shake the feeling it paints a kind perspective. A beautiful way to continue.

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The Crow People

Crows | The Crow, (Apsáalooke (ə̃psáːɾòːɡè)), inhabit mostly southern Montana. Today, the Crow people are federally recognized as a tribe, the Crow Tribe of Montana. Since the 19th century, they live in a territory demarcated as an Indian reservation in the central-south part of the state. During the expansion into the West, the Crow Nation was allied with the United States against their neighbouring tribes and rivals, the Sioux and Cheyenne. Before white colonization, the Crow lived in the Yellowstone River valley, extending from Wyoming through Montana into North Dakota, where it joins the Missouri River [1].

Plenty Coups was the chief of the Crow Nation („Apsáalooke“) that became a leader guiding them through a crisis.

He envisioned an alliance between the Crow and the whites during the times of the war for the West. Plenty Coups had a vision, manifested in his dreams, that non-Native American people would take control of his land. Crows believe dreams speak to their hearts about the past, the future and their duties and they cultivate the practice of retelling and interpreting their dreams. From that, he told the tales that cooperation would benefit his people more than engaging in a fight they could not win. His influence is crucial for the Crow’s survival along with their customs and spiritual beliefs [1].

Counting Coups | Among the Plains Indians of North America, counting coups is a warrior tradition of fostering a reputation among their peers by being brave and knowledgeable against an enemy in battle. It is a traditional way of showing courage in the face of battle by intimidating the enemy and making them aware of who is appalling, without or, if necessary, before having to kill him. As such, victories would be remembered and retold as part of the community’s oral and pictorial histories [1].
The Cosmic Mind

Star Maker
In the year 1937, the British philosopher Olaf Stapledon wrote the book ‘Star Maker’, which was afterwards counted as science fiction, although at the time neither the public nor Stapledon himself had ever heard of science fiction. With an unparalleled magnitude of billions of years and lightyears, ‘Star Maker’ tells the story of the emergence and decay of life in the universe, from the first pre-galactic nebulae over conscious stars to symbiotic species of superhuman intelligence and finally to galactic communities of planetary minds. While the idea of hive minds emerged long before Stapledon, his account of the very nature of such consciousness is an exceptional and intricate journey into the essence of being.

The novel follows a disembodied mind from our earth on his journey throughout the universe, where he experiences the rise and fall of life and the great lifeforms in between. But as he is just a human consciousness in the beginning, he is only able to perceive minds similar to his at first. With each new increasingly alien species he meets, his capacity to imagine different and superior minds develops, until he encounters the first grand advancement - the planetary mind.

More than the sum of its parts
The planetary mind is the first step of a collective consciousness and can only arise on a planet where civilization has reached a utopian state of society – a state that is still unimaginably far away for our planet.

By using advanced future technologies for energy harvesting and eugenics, ‘trivial’ matters, such as aging, diseases, and environmental problems are no longer of any concern. These developments are paralleled by advancements in mental capacities to superhuman intelligence and insight, eliminating threats of war, violence and crime in a truly utopian world community.

As a consequence, the now free time and power of mind is used equally by all for creative and meditative purposes – on the path of gaining insight into the nature of being. Somewhere along this way, the individual consciousnesses of the planet’s population are so in sync in their harmonious endeavors that they form a larger planetary mind.

The planetary mind is the sum of all its individual minds, but at the same time more than that, since it reached insight into unknown aspects of the cosmos. The focused mental power can be used for telepathic exploration of the galaxy in search of other planetary minds as well as those planets that have yet to reach this stage.

Galactic minds
For the formation of a galactic mind, many individual planetary minds need to unite in the common endeavor of exploring the nature of the universe. A prerequisite for such a mental union is the constant telepathic communication among the minds, which start sharing the others’ memories, thoughts and behaviors, as if they were their own.

On the way to forming such a galactic mind, many sociological and astrophysical challenges have to be overcome, from massive ideological wars to dwindling energy reservoirs from dying stars. The struggle for the emergence of a galactic mind in the main galaxy of the novel is overcome by a highly advanced species of Symbiotics - symbiont life forms of Ichthyoids and Arachnoids, that are described in great detail due to their important role in the galactic history.

Once the galaxy has succeeded in this enormous endeavor, it is able to telepathically explore the universe into the past and across its whole area searching for other galactic minds and stumbling upon even stranger forms of consciousness: pre galactic nebulae, the great predecessors of galaxies and first forms of primitive aware beings.

All these alien forms of consciousness enrich the composite minds and bring them within reach of the final stage: the supreme cosmic mind.

The cosmic goal
In ‘Star Maker’, the inherent driving force behind the development of higher and higher forms of consciousness is the search for the nature of the universe.

By experiencing being in previously unimaginable ways, like as a galactic consciousness, the mind gains ever more insight and approaches the rather abstract goal of absolute understanding of itself.

The ultimate object of mental encounter is the Star Maker himself, a personification of the force of creation of universes and life. Only the highest form of consciousness, the cosmic mind, is able to perceive the Star Maker in the supreme moment of the cosmos.

In an endless circle of creation and decay of imperfect universes, the Star Maker himself an immature being in the beginning, who learns from each being in his creations, which mature alongside him.

While ‘Star Maker’ is, without a doubt, a fictional work of scientific mysticism, the idea of where our minds, planet, galaxy and universe might be placed in the creative stream of the Star Maker is quite comforting.

Lilly von Kalckreuth, Integrated M.Sc./Ph.D. fellow MedNeuro, ECN

The Tectonic Relationship between Software and Research

The Good, The Bad and The Ugly

For better or worse, today’s research is inextricably linked to the distribution, development, and maintenance standards of software.

Algorithms empowered by computers are the fastest solvers of mathematical and logical problems. They automate many parts of human exchange and interaction through the internet, paving the way for fast and contactless commerce. The personal computer (PC), and its unmatched feature set, has revolutionized human culture, ingenuity, and business. One of the key components of this calculus is pre-packaged algorithms or software packages that have a scoped set of utilizations with respect to their target audiences.

Foundations of research have also been influenced. Software packages are an imperative component for tracking and analysis in experimental research. Most of these packages are very expensive to develop and maintain, leading to a plethora of emergent issues stemming from bad practices in government, industry, and academia. I outline these issues, and finally, come up with commonalities between probable solutions for policymakers.

**The Good**

There will never be an abundance of computational power and software; they are virtual tools that have no counterpart. Large datasets and pattern recognition will always be the cornerstone of modern research and experimental projects. In experimental life sciences, we use software for organizing the logistics, maintenance, and activating workflows in animal husbandry; in experiment analysis, we use software to track and analyze metrics derived from signal recordings, subject movement, and environmental interaction; every researcher uses software to collaborate, write, and publish results. Research groups often employ technicians and/or researchers with competence in computational methods. There is also a potential for collaboration between industry and research groups whenever their goals are aligned. Researchers openly collaborate and exchange ideas on online forums such as Research Gate, and in meetings, symposia, and seminars.

Software has two forms: source code and compiled code. Compiled code is the version of the code that executes the designed algorithm. The source code is the version of the algorithm designed for human comprehension and collaboration—it is written in a computer language designed by software developers. Every language has a compiler (or interpreter), which is used to generate compiled code from source code; note that this is a one-way operation, compiled code can’t be used to generate source code.

Free and open source software (FOSS) projects release both source code and compiled code together on open access repositories on the internet, free of charge. Open access to the source code or open sourcing allows engineers to add new features, fix broken elements or bugs, and give feedback to future iterations of the source code. Notice that this is an open review process, similar to academia’s peer review system. Some software benefactors choose to open source their product under a proprietary license. For instance, qt is a popular GUI framework that is free for non-profit, but, when used commercially, the license requires purchase of use-rights.
The Bad
Open access to source code exposes the ingenuity behind products, which is the reason many benefactors choose to keep the source code a secret. We refer to this as proprietary or closed software. Sometimes companies include an application interface (API) that allows software developers access to features in a software package. This ensures that the underlying source code remains secret while simultaneously allowing customization by consumers. Many hours are spent learning and adapting proprietary APIs; moreover, users that don’t have access to the proprietary software can’t take advantage of these adaptations.

Companies must assure the quality of their proprietary products before advertising the product; this is where quality assurance takes the role of open review. Quality assurance is a private audition enterprise that ensures and brands provided products as performant of their advertised utility. The difference between audition and review is that the latter provides feedback, and ideas for additional features. The privacy of quality assurance makes it comparatively subject to human error and corruption for monetary gain. Human error alone must be a concern for the incompatibility between scientific research and these products.

Everything has a lifespan, including software packages. The public will eventually lose interest, and move on to packages that have newer features and more modern aesthetics. This is not the case for most software packages that bite the dust—most don’t have the adequate outreach for critical market penetration. Researchers as a target audience are also a challenging category because they are far apart and reside in different institutions. Situations with low demand for the package aside, a consumer might not be able to find the right package in a timely manner, opting for a solution within their organization.

Neither of these situations are healthy for the longevity of any software package; therefore project maintainers must choose the right product distribution and marketing strategy for their product. Proprietary software is frequently a victim of these circumstances, as benefactors require sustainable cash flows. Marketing departments might lose key figures and neglect the product’s need for marketing attention; being a single source of failure is a noteworthy disadvantage. Free and open source software also experiences these issues; however, its open nature functions as a buffer against decay by individual neglect, as the package license regularly allows for a new maintainer to emerge and maintain the package under a new name with reference to the previous maintainer.

The Ugly
Software packages benefit from having a community of engineers and users to maintain a healthy feedback loop between provider and consumer. These communities also provide passive marketing for the software package, as satisfied users spread their positive experiences in forums. Community building is, however, difficult and time consuming; requiring tutorials, documentation of code, utilization guides, and contribution guidelines. Presence in social media platforms such as Twitter or Minds should also be utilized for effective outreach towards target audiences. Companies that understand these dynamics strategically publish the source code of their products, at least partially, to stimulate mass adoption, and facilitate free review and improvement suggestions; these projects have a huge impact when successful. These instances are rare as most products don’t have the necessary potential for mass adoption.

Companies are profit-driven, and will always put the customer second to profits; employed engineers and psychologists design strategies that blur this reality. A landscape of rebel and conforming engineers has, therefore, emerged. Free and open source is a principle for the rebels; moreover,
their focus are directed at sustainable projects with potential for a large audience. The conforming engineers have a stable source of income at the cost of their autonomy and freedom. In the meantime, employers also have no issue utilizing the free work of the rebels that work for free outside their faculties.

There is a noteworthy cross-pollination between these two groups in differing orders of magnitude. Wealthy enterprises give donations or assist in the operation of free and open source projects impactful to their product line. This is an emergent positive feedback loop between the rebels and the employed engineers fueled by abundance of financial resources in the private sector. Research leaders have no method for interfacing with this loop, and must take matters into their own hands.

Researchers must search for software that satisfies their requirements when preparing projects. When they can’t find the necessary resources, they are obliged to either terminate their project or create their own software packages—taking months or, sometimes, even years. The timesensitive nature of research projects forces in-house software packages is a significant constraint on the quality. Useful features are highly specialised to the respective project structure, and community building elements such as software commenting and documentation are often neglected. Most research groups don’t have software engineering staff, and depend on the sole competence of the group leader that is typically outdated. This is the reason research software is often proprietary with costly licensing schemes and/or no active community for assistance in case there are any issues during utilization. This is a tragedy of commons.

**Commonalities between solutions**

Difficult problems should be stimulating, not depressing! The solution to this issue is non-trivial, will be arbitrary, and, naturally, open to many mistakes. I will try to outline what I believe are the absolute commonalities between every arbitrary solution.

The delivery of research-related software and separate larger engineering projects from research must be driven by dedicated engineering teams. These teams must be autonomous, and have independent public funding for work environment stability; just like research groups. Their products must be free and open source to stimulate mass adoption and review. We need to build a public forum as an open channel for collaboration between these engineering groups and research groups. This will be the Companies must change to make their products open source, but not necessarily free; this can be achieved through proper licensing. This requires a cultural change in financial institutions that fund and evaluate these companies, where long-term financial metrics must have more weight with respect to those that are short-term. The increased burden on private resources must be balanced by improved protections for open source products across relevant country borders.

Research is a part of a complex cabal with many interests. It is the governments’ role to set the rules of the game and make sure it moves in the right direction. Leaders in research must push for change, and accept a more collaborative future; specifically, the development of research tooling in public forums. Everybody has a role to play in this important effort.

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*Can H. Tartanoglu*

*Ph. D. candidate*

*AG Haberl, MedNeuro*
**What Should We Look Forward to in Season 5?**

**WARNING: Spoilers ahead.**

From music icons to big hair and bright clothes, the 80s had a lot to offer. And for those that lived Hawkins, Indiana, USA, you even had Dungeons and Dragons come to life, with demogorgons and Vecna terrorizing your town. That is, only if you were a character living in the fictional world of the popular Netflix show, Stranger Things. With the announcement that one of Netflix’s most popular shows is only going to continue for one more season, we are left with huge expectations. Netflix has a big job ahead of them to conclude the stories of every well-developed character in just one season.

The recent release of the fourth and second-to-last season of Stranger Things offers a breath of fresh air to the show following the third season and acted as the savior for the show as a whole, guiding us back to the intrigue we had after season 1. To set-up the story, the first three seasons took place in Hawkins, Indiana, and centered around a group of kids who stumbled upon a girl with superpowers in the middle of the woods. With the appearance of the girl, named Eleven, the town also starts experiencing strange interactions with dangerous creatures coming from an alternate dimension, coined as the Upside-Down. Creatures from the Upside-Down, like demogorgons and the Mind Flayer, arrive at Hawkins via gates that appear to have been opened by Eleven’s supernatural abilities.

As the residents of Hawkins narrowly escape death by the grotesque creatures, what captivates the audience is the courage they display, even in the face of a terrifying threat that they barely understand. The heart of the show is certainly the character’s determination to protect their loved ones. We see this early on from Joyce, the mother of Will Byers, who is relentless in her search for her missing son, who she fiercely loves and won’t give up on, even when told by everyone else that there is no hope. The performance from Winona Rider as a protective, no-nonsense, strong single mother draws you in and keeps you hooked on the story from season 1.

Along the way, we get to know the other characters as well and start to see how they too become affected by the Upside-Down. In seasons 2 and 3 we are also introduced to more characters who become intertwined with the dangers coming from the Upside-Down, especially as they get more dangerous season after season. In season 4, we also have the introduction of new characters like Eddie, whose performance by Joseph Quinn quickly charms the audience and keeps us rooting for him while the rest of the town ostracizes him and labels him as a “freak.” One thing the show does consistently well, is their ability to generate a strong storyline for each character, no matter how small of a role they have on the show. This only increases the burden on Netflix to create a justified end for everyone in the last season.

This is especially true after the release of season 4, which finally explains why out of all the towns to possibly terrorize, the creatures chose Hawkins. We find out just how much Eleven is tied into the Upside-Down, going beyond just the girl with superpowers that can fight off the demonic creatures. Since Eleven is a girl of very few words, actress Millie Bobby Brown does a great job of acting mostly with her facial expressions, showing us the confusion and fear and anger that stays with Eleven for the majority of the show, making the moments where she
truly experiences joy and love that much more moving and touching to the viewers. She also does a beautiful job reminding the audience in certain tear-filled moments that at the end of the day, even if she is the most powerful human character on the show, she is just a girl who wants to have a normal life.

The connection that Millie makes with the audience through Eleven makes us feel what Eleven feels when she feels it on screen, making this season’s performance Millie’s best so far. The same goes for Sadie Sink, who plays Max, in how she shows the pain and torture of losing a close family member, following the death of her step-brother Billy. Despite having a horrible relationship with him, Max can’t help but feel haunted by his death, which leads to her character going through one of the darkest storylines the show has created so far. Sadie’s performance is hauntingly beautiful and keeps the viewers biting their nails throughout the season.

As we continue hoping for well-deserved character endings, we have to stay wary of Netflix’s fondness for killing off our favorite characters. As we await the finale of this epic show, the showrunners have us running up that hill.

*Rina Patel, Ph.D. candidate  
AG Viana da Silva, MedNeuro*
Author’s Page

Lorena Sganzerla
I am a science fiction fan navigating cyberpunk Berlin. Accidentally, I got hooked on theoretical biology, neuroscience and philosophy. Probably too much of my time is spent thinking about self-organization, information, and collective behavior. I have just discovered this new thing called camping. I take it as my moral duty to inform others: it is shockingly nice.

Lilly von Kalckreuth
I’m a fast-track PhD student, who wants to unravel the mysteries of affective disorders and find new and better treatments for depression. Besides neuroscience my big interest is astrophysics, which also sparked my love for science-fiction. In my free time I enjoy playing video games, cooking and going to techno raves.

Grace Viljoen
Grace is a fast-track MedNeuro student interested in the psychobiology of stress and the role of inflammation in neurodegenerative diseases. In her spare time, she enjoys learning about herbalism, listening to 70s rock music and practising olympic weightlifting!

Anna Lisa Soiné
I am passionate about integrative medical branches, such as Psychoneuroimmunology, and their advantages over more common medical approaches. In my future, I hope to contribute to more sustainable treatment options that do not favor the superficial symptom treatment of diseases with deeply rooted psychological and medical etiology. In my free time I like to enjoy some good vibes while dancing, cooking, or sipping a nice drink.

Manisha Biswas
Manisha Biswas is a doctoral candidate at the Social Intelligence Lab Berlin investigating social conformity, ostracism and ritual behaviour in VR. Besides this, she attempts watercolour painting and strives to be a good cat-mom.

Rina Patel
I am a medical neuroscience doctoral candidate in the Viana da Silva and Haberl Labs which are studying the cellular circuitry of Alzheimer’s Disease. When I am not in the lab hanging out with my mousies, I am most likely eating good food with friends! I love to explore new places as well, inside or (mostly) outside Berlin. I also enjoy cooking and reading in my spare time.

Can Hicabi Tartanoglu
Ph.D. candidate in the MedNeuro program at the Charité; work with computational neuroscience projects for the benefit of Alzheimer’s Disease research. I have many hobbies, the most impactful ones being cooking, windsurfing and video games. My passion is technology, and I have a profound interest in anti-aging and nutrition research.

Not pictured:
Patricia Zvarova: Integrated M.Sc./Ph.D. fellow; MedNeuro, ECN
Barbara Hollunder: Ph.D. Candidate; Network Stimulation Laboratory/AG Horn; ECN & Berlin School of Mind and Brain
Nanditha Rajamani: Ph.D. Candidate; Network Stimulation Laboratory/AG Horn, MedNeuro
Sirjan Chhatwal: Alumna M.Sc. MedNeuro
Academia is becoming increasingly aware of the fact that only a minority of doctoral candidates will succeed in pursuing an academic career. The rest of us, therefore, need to face the question of what else to do with our lives and how to make a living out of it. This series aims to direct your attention to all the useful skills you have, seemingly trivial, that were acquired as prerequisites to perform your research, but which are incredibly precious outside the lab!

Labs are not only spaces full of equipment, but usually also a research group consisting of multiple people of various backgrounds, scientifically and socially. People with different interests, ideas and values. That’s the space you are/were navigating through all the time. When you first joined a lab you first had to get to know people. Not only to make new friends, but also to figure out the dynamics between people you would be among for the next couple of years.

You likely can identify aspects of the group dynamic you loved and enjoyed, like for example hiking trips or Christmas parties. Other things you might have liked less and did not participate or even avoided, like spilling the tea over a colleague or, well, Christmas parties. You might even have noticed things you would like to experience with your colleagues and which you therefore initiated or organized, like going for lunch together, having a lab retreat, going for a hike together.

Why is all this relevant? Because we easily forget that we are part of a social dynamic ourselves! This means we not only get to experience what is happening because of the people we often spend more time with than our families, but instead that everyone gets to shape this too! Isn’t this a very relieving and also empowering thought?

These days many jobs require working in teams and again, these are typically made of different people. When you reflect on your lab group you will likely identify different personalities among the lab members and how they influence the group dynamic. Same goes for yourself. How do you function and how do you affect others? What can you do to create a good atmosphere and what is beyond your influence? We often intuitively navigate this social space, both reacting to it and also creating spaces within it in which we thrive. Embrace your own influence on your lab culture and be actively engaged in creating it! You will always work with other people – ideally in an atmosphere you enjoy together with others.

Your Dr Brown Team
Final Chapter: Functional Neuroanatomy

This year was the last time we had the honor to host the “Functional Neuroanatomy” course, given by the retired anatomist Wil Smeets from Vrije Universiteit Amsterdam.

Wil was a founding member of the Neurasmus Consortium, and the inception of this course in Berlin is just one of many examples of the Neurasmus program’s synergies.

We cordially thank Wil for the time and effort he had put in the previous seven years to make this course possible, and we think that it was a really great course for developing young brain researchers.

Graduation & Defense 2022

On 14 October 2022, the MedNeuro MSc students will defend their theses (9-12:00) and afterwards we will celebrate their graduation (18-21:00). Locations: tba. Save the date if you want to join the party!

Ph.D. Retreat 2023 — Calling for Organization

The Medical Neurosciences Office is looking forward to a return to “normal” and the organization of a Ph.D. retreat in Autumn 2023. While this seems far ahead, we ask for interested Ph.D. students to join the organization team early, as this event must be planned almost one year in advance. Get back to us at office-medneuro@charite.de if you are interested in helping us choose a location and coaches to invite. As much as you already get out of locations and workshops, everyone gets also additional ECTS for organizing it.

Admission Ph.D. Program

A warm welcome to our Medical Neurosciences Ph.D. family: Fiona O’Donovan (Prof. Dr. Claudia Buss), Lois Hew (Prof. Dr. Matthias Endres), Calvin Howard (Dr. Andreas Horn), Burçe Kabaoglu (Dr. Nikolaus Wenger), Elena Kirsch (PD Dr. Philipp Mergenthaler), Stefanie Mayer (Prof. Dr. Christoph Harms), Elisa Pedersen (PD Dr. Marta de Rocha Rosário), Hakimeh Pourakbari Aslaroud (Prof. Dr. Wolf-Julian Neumann) and Jacob Walther (PD Dr. Philipp Mergenthaler).

Fiona, Lois, Stefanie and Elisa are ECN Ph.D. fellows.

Neurasmus Annual Meeting 2022

The Neurasmus Annual Meeting is a wonderful tradition in which all program students and partner universities gather for scientific board meetings, student workshops, and social activities. This past July, all participants met at the partner universities in Coimbra, Portugal. It is at this meeting when Neurasmus master students defend their theses, including Jemma Pfeifer, Zuzanna Baran, and Thomas Paul, who spent their second year here in Berlin. Congratulations!

Berlin Neuroscience Meeting 2022

After its cancellation in 2020 and 2021, the Einstein Center for Neurosciences Berlin and the Cluster of Excellence NeuroCure are excited to re-instate this annual meeting. The event will be split into scientific poster presentations and a get-together, with plenty more to come. Save the dates for October 13-14 (hybrid options are considered!).
Medical Neurosciences Master’s Program

For our MSc program, we are looking for students interested in cell and molecular biology research with a solid clinical connection in the field of Neuroscience. Your primary knowledge in biology, chemistry and physics is solid, your grades are above average and you have a degree in medicine, psychology, natural sciences or in a related subject (BSc, MBBS, Medical Doctor, Diplom or international equivalent).

In addition to a strong command of the English language, all our students need to exhibit a good amount of inquisitiveness, initiative, and independent thinking as well as organizational skills.

The next application deadline is 15 January 2023, for the program to start in October 2023. Find out more about the application process as well as formal criteria: https://medical-neurosciences.charite.de/en/application_admission/application_master/

Medical Neurosciences Doctoral Programs, Ph.D. and MD/Ph.D.

For our doctoral program, we seek candidates who have substantiated interest and experience in cell and molecular biology with a strong clinical connection in the field of Neuroscience. The ideal candidate can demonstrate an intense neuroscience education at the Master of Science level. You must be well-versed in subjects such as Neurochemistry, Neurobiology, Neuroinflammation, Neuroimmunology, Neuroanatomy, Neurophysiology, Neuroendocrinology, and the like. You should have experience in laboratory research and, ideally, you have already published in the field.

In addition to a strong command of the English language, all our students need to exhibit a good amount of inquisitiveness, initiative and independent thinking.

Application deadlines: 15 January, 15 May and 15 September each year.

Details: https://medical-neurosciences.charite.de/en/application_admission/application_doctoral_program/

Ph.D. Fellowships: Einstein Center for Neurosciences Berlin

Neuroscience is just beginning to provide us with an understanding of how the brain works and how it controls the way we think, learn and remember.

Neuroscience research requires insights from many different disciplines to make significant contributions to our understanding of neural operations from synapses to higher cognitive functions. The neuroscience landscape in Berlin is exceptionally rich, with research spanning from synapse to behavior, molecule to disease, and brain to mind.

The Einstein Center for Neurosciences Berlin was initiated to establish an umbrella structure that specifically fosters interdisciplinary, collaborative research by facilitating synergies between existing research groups and promoting interaction on all levels.

The ECN currently has about 120 individual members (principal investigators), many of whom are directors of clinical research programs. All share a common aim: to increase our knowledge of neuroscience and develop new research approaches. Furthermore, the ECN provides an educational program – the Einstein Training Program.

The next application deadline is the beginning of January 2023!

More on: https://www.ecn-berlin.de/education/phd-fellowships.html
Schutz? Impfung!

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Wir übernehmen bei privaten Auslandsreisen die Kosten für alle empfohlenen Impfungen sowie für eine Malariaprophylaxe, gegebenenfalls abzüglich der gesetzlichen Zuzahlung.

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