

# **Chronic Pain and Social Reform**

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# Preface

This series of essays is about chronic pain and the methods we employ to address it. I believe the best tools for preventing and treating pain pathologies already exist. However these tools, which I collectively refer to as “social reform”, are not easy or straightforward to wield. Social reform’s targets are not always precisely defined. And most importantly, social reform works in opposition to the billionaire class, their profits, and the conditions they insist on for workers around the world.

Chronic pain is a pathology of society. Biologists will argue that it is a pathology of sodium channel abnormalities. Clinicians will argue that it is a pathology of aberrant physiology. Psychologists and neuroscientists will argue that it is a pathology of complex changes of information processing in the central nervous system. But these scientific conceptions are all myopic half-truths. Treating a person’s chronic pain, only to release them back into a pain-producing, nocigenic environment, is stopgap medicine. It is temporary relief that does nothing to address the cause of pain at the origin. To treat the cause instead of the symptom will require social reform. But again, social reform is arduous, political, and defies the powerful elite.

Instead, we have turned to the will-o’-the-wisp of technological solutions. Leading ourselves on, we chase the conceit of a high-tech quick fix that is far more nebulous than the goals of social reform. Such a hope is incoherent in light of the societal causes of chronic pain, but its glow through the fog keeps us wandering down a fruitless path. On our way, we first turned to the high-technology of Big Pharma, which brought us the decades-long opioid epidemic [1]. In the wake of this spectacular failure have come various treatment strategies rooted primarily in digital technology. These efforts are doomed to fail as well. Technological innovation for the treatment of chronic pain will only be successful insofar as it amplifies and interfaces with broad

social reform efforts. It is this difficult truth that I explore in the following essays.

I will point out now that I am not categorically opposed to new technology. But the writing has been on the exposed brick walls of silicon valley health tech offices for a long time. The invisible hand of the market can only offer a haphazard and uncaring approach to technological advancement, and produces, by and large, expensive garbage.

I first came to understand the societal origins of chronic pain through my work [2] with STAND: The Haiti Project [3]. My efforts to document and understand the rampant complaints of pain experienced by our patients in rural Haiti have spanned my schooling and professional life. After my formal education in public health, I launched headlong down the high-tech-health rabbit hole, building a career that straddled the tech worlds of both industry and academia. When the disillusionment of high-technology set in, I found myself back where I started: considering the condition of the working class. It is through the lenses of public health, technology, and socialism, that I explore the interrelationship of chronic pain and social reform.

## Public Health

I got to know the Public Health 101 professor while working on a smoking prevention project with her in India. I had been pre-pre-med since the 6th grade, and in my sophomore year of undergrad I chose the University of Rochester’s “Health, Behavior, and Society” major primarily because I thought it would look good on a medical school application. And I wasn’t the only one with this idea. The major was teeming with neurotic and preening pre-meds all angling for a spot in the best medical schools so that they could better angle for a spot in the best residencies.

“Notorious” is too strong a word, but it was known among the public health majors that Dr. Chin [4] encouraged pre-medical students to think broadly about their career options beyond any hospital. As opportunist as we were, most of us also came with a commensurate dose of idealism. We wanted to *change*

*the world.* With some of this in mind, we were sipping our chais and looking out at the foothills of the Himalayas when she finally dropped the question on me.

**0.0.0.0.1 \*** I don't get it. Why do all these smart, motivated young people who want to change the world go into *medicine*?

**0.0.0.0.2 \*** - Nancy Chin

I responded with some amalgamation of all the platitudes frequently used to inculcate young people into a paradigm of health and health-morality that spotlights doctors as heroes. What she was really asking was, "What do you think makes people healthy? Is it really *medicine*?"

And then we moved on. Because Dr. Chin isn't in the business of telling students what to do. Apparently, her MO is patiently asking students perspicacious questions at indelible moments that will haunt them throughout an adulthood full of mistakes and corrections. The following essays are an attempt to synthesize my learnings from years down a path of trying to address the chronic pain pandemic through a technocratic, treatment-centered approach. They serve as a course correction to the intoxicating arrogance that an ever deeper, more scientific, more data-driven understanding of chronic pain could singlehandedly solve the suffering seen around the world today. Unlike Dr. Chin, professors espousing this high-technologic worldview *are* in the business of telling students what to do. And I was eager to take orders.

## Technology

I was accepted into Rochester's Take 5 Program and granted a tuition-free fifth year to take classes in a field I hadn't had time to study while completing my public health degree. I titled

my application essay **Befriending Big Data and Nurturing the Human-Computer Relationship** and proposed taking a set of Math, Computer Science, and Brain & Cognitive Science courses. It was during my Introduction to Java Programming class that I was first indoctrinated into the gospel of technology.

**0.0.0.0.1 \*** If you want to change the world, learn how to code.

**0.0.0.0.2 \*** - Ted Pawlicki

Pointing out the obvious impact apps like Facebook and Twitter had made on the world, Professor Pawlicki [5] was arguing that computer programmers were the people making decisions that actually affect people day-to-day. Through the power of the internet, everyone can be touched by the code written on *your laptop*. Hot off a degree in public health, I interpreted this in some vague way to mean I could create tech that made people healthy. In fact, one of my Take 5 advisors was Henry Kautz, whose research had recently made headlines like [Your Tweets Can Predict When You'll Get the Flu](#) [6]. The obligatory comparison to [John Snow](#) was plenty to make me envisage my code as part of the impending Big Data revolution in epidemiology and health. This program equipped me with the holy trinity of the high-tech-health worldview:

1. A nebulous notion of how `more_technology == better`
2. The suggestion that anyone (including me!) could be the hero who writes the code that saves the lives
3. Some tangible coding skills to immediately start becoming a hero

With some java and python skills under my belt I went on to complete my MPH at the University of California Davis, spending most of my study time learning to connect public health databases with analytic programming languages. This paid off

when I was accepted to the first cohort of Kaiser Permanente’s “Programmer/Analyst Training Program.” At Kaiser I learned SAS programming, some more statistics, and how to carry out a digital cohort study – something I still do for a living at the time of this writing. My next job was at an electronic medical records (EMR) company called Practice Fusion. It was here my eyes were opened to what scourge the health tech sector is capable of wreaking.

Practice Fusion brought me a high salary, catered lunches, beer and wine on tap, and huge parties. And we were working on a product that helped patients! Right? RIGHT?! I learned a lot of programming there. And our mission was ostensibly to build a free EMR to help bring small doctors’ offices into the 21st century. We were going to combine their medical records and do important epidemiology, which would, in turn, even further benefit patients! Where is the harm in that?

It is exactly this sort of hard-to-argue-with *symbolism*, of technology as progress, that I hope to cross-examine in this writing. Because who doesn’t want to appropriate the Algorithms to help cure disease? Who doesn’t want people to have access to “precision medicine,” where capital “B” capital “D” Big Data is utilized to help doctors make hyperpersonalized medical decisions? It is hard for anyone who doesn’t spend all day rummaging around in this data to articulate why it might not be the best investment. Even those of us most entrenched in the industry’s dirty technical details fall for the same abstract promises CEOs continue to sell to investors. Because remember, this technology is going to

*Change.*

*The.*

*World.*

After a few years at Practice Fusion (and just before workers found out the company had been [pushing opioids to patients for chump change](#)), I got tired of working with EMR data. I suspected it wasn’t telling us anything meaningful. I decided that I needed to venture further into the technical weeds if I was going to find quality enough data to...err...change the world(?).

Or whatever Professor Pawlicki had sold me. It had sounded so cool when he said it.

I left silicon valley and moved to Boulder, Colorado to work as a research assistant in a “famous” neuroscience lab. Having watched an entire Youtube series on fancy statistical analytic methods using functional magnetic resonance imaging data, I was convinced that this was the field I needed to dig into if I were going to be the one to solve chronic pain. The lab moved to Dartmouth the following year, and I was accepted as a PhD student there.

At Dartmouth I spent a lot of time thinking about how to find specific patterns of brain activity called “biomarkers” that would tell us when a person is experiencing various types of pain. You see, the lab I belonged to was already known for developing this type of biomarker for acute thermal pain. If you burned someone’s arm inside of an fMRI scanner, this biomarker would light up. However, if you only warmed up someone’s arm or showed them a picture of their ex-lover while in the scanner, the biomarker wouldn’t light up as much. Pretty neat, right? Further, one of the main selling points is that these biomarkers are made using *machine learning*. And when I say “selling point”, I mean [millions](#) and [millions](#) and [millions](#) and [millions](#) and [millions](#) of NIH dollars are being funneled into the pain biomarkers [enterprise](#).

I remember taking long walks at Dartmouth and explaining this research to my friends on the phone. With varying degrees of tenderness, the conversation would always lead to the question “so like, let’s say you had all these biomarkers. And they worked. Then what? Is the plan to put all pain patients one-by-one into an fMRI scanner for an hour just to arrive at a more ‘objective’ measure of the pain they already told you they have?” I knew, deep in my bones, that this was a legitimate question with no good answer. I usually said something like “as a neuroscientist, health care delivery isn’t my problem.”

This is, I now argue, a useless-at-best position. But this is the position of huge swaths of publicly-funded biotech research today. It is the *de facto* excuse that allows the private and academic high-tech-health sectors to squander unconscionable



sums of money each year advancing technology that is either obviously impotent or so inaccessible to the global working class that it is effectively non-existent. It is a feckless pursuit to develop high-technology without incorporating class consciousness. I now believe it is only in tandem with efforts toward broad social improvement that high-technology can be useful in improving the health of ordinary people around the world.

My time in the ivory tower indirectly led me to socialist politics. The most important lesson I learned in my neuroscience PhD work (before leaving early) was that organized labor is central in shaping health and well-being. As I documented in “[The Dartmouth Prison Experiment](#)”, a defining characteristic of academic high-tech science is extracting cheap labor through the promise and mirage of heroism. The cringe and irony involved in watching a pain-neuroscience lab foster a toxic culture of stress and overwork is itself painful. But this example also explicates the essence of what the following essays are about. Even in the closest proximity to brain scans, the avant-garde of pain regulation science, and health-tech heroes, it is working and living conditions that drive the quality of our lives.

Toward the end of my Dartmouth sojourn I joined the [Upper Valley Democratic Socialists of America](#) in their Care not Cops campaign. In some ways this was a totally new experience to me. I had never gone door-to-door before to discuss politics with other community members. Nor had I given public comment to a city council. But in other ways joining DSA was a return to form. Before my Dartmouth degree, before my tech jobs and my infatuation with high health-technology, before I had written even a single line of code, way back before I even took Public Health 101 with Nancy Chin, I signed up for my first public health course to see if the field might be a good fit for me. Departing the fog of an ill-conceived career in neuroscience, I found myself digging out old books I bought for *History 208: Health, Medicine, and Social Reform*.

Conversely, the biggest regret I have from my time in New Hampshire is that I didn’t stick around long enough to witness and support the expert-level organizing that won Dartmouth grad students [their union](#).

## Social Reform

[Ted Brown](#) walked in, as was his custom, with a few pieces of paper covered in handwritten notes. The elbows of his worn,

burgundy sweater were patched where he rested them on the podium as he began his lecture. Ninety minutes at a time, I was pummeled with evidence demonstrating the ways health is grounded in the social order. I hadn't known how simultaneously incisive, scathing, hopeful, and compassionate a critical historical lens could be. I was forced to consider how Cuba, a small socialist country, could have equal or better health outcomes than the United States while paying drastically less for medical care. I learned how the failed Global Malaria Eradication Program relied so heavily on vertical, technocratic approaches to public health and how the [Gates Foundation](#) continues to apply technologic lipstick to new renditions of this humanitarian failure. It was in this course I first read "[The Condition of the Working Class in England](#)", and where I first heard of a person named Marx.

These lessons are the type that once you see them, you can never un-see them. Health, medicine, and social reform, from a socialist perspective, go a long way in explaining how the world works for people on planet earth. I was hooked on this type of analysis and took the rest of Ted's courses. One of which was an Introduction to the U.S. health care system. It was in this course that I picked up this mantra of his, which I've had stuck in my head over the last few years:

**0.0.0.0.1 \*** Every budget is a *moral* document.

**0.0.0.0.2 \*** - Ted Brown

What any group or society decides to pay for is a representation of what it values. I found myself thinking of this every time a lowly research assistant at Dartmouth was stuck running \$500/hour fMRI scans late into the evening after a full work day, fearful of punishment for any mistakes, having been told explicitly they would collect no overtime pay. All so we could...mmm...look for brain patterns that would...ermmm...help us predict when people who tell us they're in pain are...in pain.



of patients they’ve seen whose experience in the workplace had something to do with their chronic pain. But their explanations, at their most wide reaching, centered on the interpersonal relationships of people with pain. Politics were not mentioned, and they seemed unaware of the ways in which societal structures might create pain-producing environments for patients. Having omitted this entire realm of the human experience on earth, the biggest question for pain clinicians today went unasked. Why should we expect psychological therapies and modern neuroscience to treat (let alone prevent) chronic pain, when it is a pestilence that is grounded in the social order?

It is this question, and questions about how we might effectively work towards a societal treatment for chronic pain, that I hope these essays begin to answer. The most beautiful thing about replacing technocratic approaches to chronic pain with social reformist solutions isn’t that it’s the correct thing to do to reduce the prevalence of chronic pain, but that it is the compassionate, human, and right thing to do to reduce all forms of suffering around the world. Let’s get organized.

At the behest of Captain Ludd,

**Luke**

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# 1 High Technology and the Chronic Pain Pandemic

A family of billionaires agreed to pay \$6 billion last year in response to thousands of lawsuits inculpatating their company, Purdue Pharma, for its role in creating a nation-wide opioid crisis. This money will do little to stem the current of these life-ruining prescriptions, while also failing to address the dilemma opioids were originally purported to solve: people across the globe are struggling with very real and persistent pain. In a world still ravaged by deadly infections like malaria and chronic killers like cancer, pain may appear an unfortunate, though relatively inconsequential, externality of our economic system. But our pain can amount to something much greater than that. Chronic pain is uniquely poised to be a lodestar for public health in this moment and a rallying point for the working class the world over.

Chronic pain today has three important features. First, [it is ubiquitous](#). Across the globe pain is the most common reason people seek medical care and its subtypes comprise three of the four leading causes of years lived with disability – a common measure of quality of life. Second, people’s pain is being endured in the context of the [popular, ongoing and catastrophic](#) failure of prescription opioids. This ensures that pain researchers today are more likely to line up behind alternatives to pill-popping. Finally, perhaps more than any other ailment, chronic pain can now be seen as a poignant reflection of the structure of capitalist society. Unstable housing, long hours, poverty wages, food insecurity, and a general lack of social security coalesce in the human brain to produce much of the hurt we feel day-to-day.

Together, these three features can give new direction. Big Pharma’s and Big Medicine’s overtly technocratic attempt to

address the pain pandemic trumpets a fresh reprise of a tale as old as time in public health: high-tech gadgets, without broad social mobilization, rarely create lasting positive change. And yet, funding for pain research is being pumped into brand new tech “solutions” while ignoring the dire need for social reorganization. The result has been a vast dearth of treatment options, sparsely littered with feeble non-pharmacological strategies. Costly brain scans here, inaccessible therapy there, with mindfulness apps scattered throughout. But it is in this vacuum the working class has an opportunity to act on old wisdom: good health is won through class struggle, and disease prevention is best fortified with social reform.

## 1.1 Pain, Class, and a BioPsychoSocietal Model

Best estimates show the incidence of chronic pain in the US [now surpasses](#) that of diabetes, depression, and high blood pressure. Globally, [it is estimated](#) that 3 in every 10 people are affected by chronic pain. If you aren’t living with pain yourself, it is likely you’re interacting with someone who routinely suffers from pain. However, rates of chronic pain are not uniform throughout society. Persistent pain is [more likely to be found](#) in adults currently unemployed, adults living in poverty, and older adults. In other words, as with diseases like malaria and cancer, [the most economically vulnerable](#) members of society suffer the most.

This link between chronic pain and the social order has implications for how pain should be studied, treated, and prevented. Today’s psychologists and neuroscientists argue the need for a “biopsychosocial” approach. Published in 1977, George Engel’s [biopsychosocial model](#) of disease emphasizes that a strict biological approach “leaves no room within its framework for the social, psychological, and behavioral dimensions of illness.” While nominally embracing a biopsychosocial framework, today’s clinicians and researchers have adopted an incomplete interpretation of the word “social”. In modern pain studies, “social” implies various aspects of interpersonal social interactions such as [handholding](#), [clinician-patient relationships](#), and

information based on [others' experiences](#). While these things may play a small role in influencing a person's pain, they fail to clarify the role of enormous pain-producing forces that come into view when "social" is interpreted as "societal".

George Engel actually specified a more expansive meaning of "biopsychosocial" 46 years ago:

"This approach, by treating sets of related events collectively as systems manifesting functions and properties on the specific level of the whole, has made possible recognition of isomorphies across different levels of organization, as molecules, cells, organs, the organism, the person, the family, the society, or the biosphere."

This interpretation of "biopsychosocial" would subsume social policies and structures in its attempt to understand the origins of chronic pain pathology. So what is the impact on pain of a lack of social housing, quality food, basic income, and medical insurance? What effect would wealth and land redistribution programs have on the huge prevalence of chronic pain around the world? The truth is that we don't know. And we're not looking.

## 1.2 Policy Framing and Victim Blaming

Faced with nearly 300,000 [deaths from prescription opioids](#) in the last 20 years, the US has spent a significant amount of money trying to better understand pain. But research initiatives to find opioid replacements remain focused on the technocratic treatment of individuals while failing to embrace a population-focused biopsychosocial perspective. Without so much as considering possible societal origins of pain, the US continues to prioritize the discovery of complex biotech solutions to treat pain after it arises, one person at a time.

Amid a record-setting incidence of prescription opioid deaths in 2010, the Affordable Care Act provisioned the creation of [a new committee](#) to harmonize pain research efforts across federal agencies. To this end, the committee published an [analysis](#)

detailing a \$430,000,000 annual budget for pain research. This money was distributed to over 1,200 research projects. Investigations of “neurobiological/glia mechanisms” and pain treatment received the lion’s share with 35% of the budget. In comparison, pain prevention received a pitiful 1.4%.

Table 1.1: Percentage of the Pain Research Portfolio by Category

Research Category	Percent of Budget
Neurobiological/Glia Mechanisms	20.4
Pharm Mechanisms & Treatment	8.3
Non-Pharm Mechanisms & Treatment	7.3
Training in Pain Research	6.9
Biobehavioral & Psychosocial Mechanisms	5.9
Development of Animal and Human Pain Models	5.2
Outcomes & Health IT for Decision-Making	4.6
Genetics and Genomics	4.2
Unique Populations	4.2
Mechanisms of Transition Phases	4.1
Pain & Non-Pain Comorbidities	2.8
Analgesic Development	2.7
Device & Therapy Delivery Systems Development	2.3
Comparative Effectiveness Research	2.0
Diagnosis & Case definitions	1.9
Epidemiology	1.8
Pain Education	1.8
Substance Use and Abuse/Addiction	1.7
Medical Management	1.4
Pain Prevention	1.4
Other "Omics" of Pain	1.3
Women's & Minority's Health Research	1.3
Informatics, Databases & IT Development	1.2
Chronic Overlapping Conditions	1.2
Sex & Gender Differences	1.1
Analgesic Drug Safety	0.9
Pain and Trauma	0.9
Health Disparities & Access to Care	0.9
Health Care Utilization	0.3

Allocation of Pain Research Money  
Grouped by 29 IPRCC Pain Research Categories<sup>1</sup>



<sup>1</sup>Interagency **Pain Research Coordinating Committee**  
Source: [IPRCC Federal Pain Research Portfolio Analysis Report](#)

Even more tragic, the focal point of the nominally preventive research was “pain prevention through various approaches including self-directed activity, diet, life style programs and education campaigns for many disorders.” This up-by-your-bootstraps conceptualization of prevention despicably foists the burden on people who are relegated to the most pain-inducing environments. Those driving uber all morning and bussing tables all evening for low wages and no medical insurance are also expected to find time to meditate in order to relieve their chronic low back pain. A truly preventive approach would focus on creating analgesic societies for the working class to inhabit. And while we can’t expect too much from “prevention’s” 1.4% of the pain budget, we could hope that significant strides have been made in translating our well-funded understanding of the neurobiological and glial underpinnings of pain into successful treatment strategies.

Percent of Budget	
Neurobiological Mechanisms and Treatment	
Neurobiological/Glial Mechanisms	20.4
Pharm Mechanisms & Treatment	8.3
Non-Pharm Mechanisms & Treatment	7.3
<i>Group Total</i>	36.0
Prevention	
Pain Prevention	1.4
<i>Group Total</i>	1.4

Table 1.2: Funding of technologically-driven research to the neglect of ~~Pain~~ **Pain Mechanisms and Treatment vs. Prevention** Funding Comparison

No such luck. Most pain neuroscience involving human participants uses functional magnetic resonance imaging (fMRI) to measure activity in the brain while study participants lie in a small magnetic tube and perform simple tasks. This [type of](#)

research is still barely able to identify when a person is currently experiencing chronic pain, let alone reduce their pain in a meaningful way. It also primarily recruits young healthy college students and fails to include participants from diverse income levels, all but ensuring study findings will not generalize to the working class. In fact, some clinical guidelines recommend against using imaging in the clinical treatment of patients with chronic pain. The last 14 years of pain neuroscience have produced a lot of neat and high-tech studies but taught us very little about how to prevent or treat pain in the global proletariat. Unfortunately, this sort of fetishization of high technology is not new in the world of public health.

### 1.3 Technology on the Horizon

Public health practitioners in the first half of the nineteenth century had weaponized broad social reform strategies to combat disease and promote health. Such work aimed to clean the environment, improve housing and working conditions, and provide water and sewage systems throughout society. But in the latter half of the 1800s, public health shifted its gaze with the advent of bacteriological research methods. The late doyenne of public health history and health leftism, Elizabeth Fee, pointed out that

“Public health practice required a diverse set of disciplines and skills: economics, sociology, psychology, politics, law, statistics and engineering, as well as the biological and clinical sciences. In the period immediately following the brilliant experimental work of Pasteur, Koch, and the German bacteriologists, however, the bacteriological laboratory became the primary symbol of a new, scientific public health.”

Reverberations of this new technologic symbolism, and promise of “scientific public health”, shaped the treatment of acute and then chronic conditions for the next century and a half. In recent years, first opioids and then the fMRI scanner became the primary symbols of a new approach to pain management.

The symbol of technology as a perpetually impending solution to disease is recapitulated in public health budgets throughout the world today. The magic bullet seems perpetually on tomorrow's horizon while people suffer today. Further, what we know about pain in the brain already supports broad societal improvement initiatives over additional technology [see the following chapter](#). ~~Basically, on its face pain seems different from cancer or malaria, but all diseases and well-being probably get better through societal improvement.~~

At first blush, chronic pain might seem like an entirely new category of pathology. ~~It is a subjective experience arising from complex information processing in the central nervous system.~~ Scientists can't point to something like a parasite or a tumor cell as its origin. Therefore one approach to managing pain is to spend exorbitant resources trying to pin down an objective measure, or "biomarker", of its neurological provenance. Having dragged subjectivity into the objective realm, scientific public health could then deploy its usual methods. In this case that would include developing technology that specifically targets the pain biomarker and beating pain with experience. The only snag is that the history of public health demonstrates that addressing even more "simple" diseases solely through the development of high-technology rarely leads to lasting prevention or cure.

### 1.3.1 Acute Malaria and Technology

Most people today understand Malaria to be an acute, infectious disease caused by mosquitoes. These mosquitoes, living near the equator and carrying one of the malaria parasites, bite and infect people. UNICEF [reports](#) that malaria infections kill a child under 5 years of age every minute. To save these kids and many adults, we need to directly kill either the mosquitoes or the parasites, right?

This is the logic that came to prevail around the turn of the twentieth century following the discovery of the malaria parasite. Malariologists began to describe the disease's epidemiology in increasingly narrow biological terms because for the first time they could see with their own eyes the immediate cause

of malaria in a person's blood. New medical discoveries like these were made using the achromatic microscope, the latest and greatest microbiological technology of the time. These discoveries undoubtedly played important roles in curing patients and saving lives. But over time they served to close the aperture of the public health lens. What could not be seen under the new microscopes were the more proximal social structures ("the causes of the causes") sustaining malaria transmission in the tropics.

Prior to the fanfare surrounding parasites and mosquitoes, a large body of evidence had accumulated showing that malaria epidemiology is heavily influenced by agricultural practices. For example, a lack of decent housing often forces farm workers to sleep outside, exposing them to infected mosquito bites. Facing low wages, these same workers migrate elsewhere at the end of a harvest season in search of alternative income sources. When their new work lands them in an area with little or no malaria, a new epidemic can be triggered. Such epidemics are [not confined to tropical regions](#) and have flared up in places as far north as [city] Russia, [city] Italy, and the Chicago river basin.

### 1.3.2 Chronic Cancer and Technology

## 2 Neuroscience and Chronic Pain

Ironically, at the acme of modern cognitive neuroscientific theory lies a refutation of the neurobiological approach to the pain pandemic. One of the most recent and promising frameworks for understanding what the brain does is called “predictive coding”. Put simply, the PC framework asserts that our qualitative experiences arise when our brains create hypotheses about the state of the world around us and then test those predictions. But when scrutinized, even this technical neuroscientific approach to pain control seems to support socialist preventive strategies over expensive neuroscientific treatment.

Imagine for a second that you’re a brain: a dense set of 86 billion neurons trapped inside of a dark, wet cavern. You cannot directly see or hear or touch. Instead, you receive noisy electrochemical signals that are related to what’s going on around the skull you inhabit. The problem of figuring-out-what’s-going-on-out-there requires combining these inputs to make an informed guess about the environment causing those signals in the first place. As you make informed guesses you receive immediate feedback as to whether or not they were correct via the next set of electro-chemical signals. Guess and check. Guess and check.

But you’re smart. So you write down notes of specific guesses you made and how correct they turned out to be. Of course not all guesses get one line in your notebook. Things are crossed out, underlined, and bolded and circled in the margins. As you make and test your little guesses every second of every day for your entire life, you develop an extensive understanding of what various signals from your environment likely mean. Neuroscientists call this palimpsest of memories you have a “model” of

the environment. It is a detailed user manual for the world you inhabit. Your model is a powerful thing.

Predictive coding theory emphasizes that conscious experiences are not simply the result of signals arriving at the brain. Your brain's model of the world sits between the world and your experience of it. Imagine walking into a shed in the afternoon on a hot day. On the ground is a coiled up piece of rope. Upon entering the shed your brain leafs through its notebook to the page that says "hot day, 2pm, shed in low light, small coil on the ground" and follows the arrow it drew to the note "THIS WAS A SNAKE ONCE!" And for a moment, you literally perceive the rope to be a snake.

The rope snake is a silly example of the power your model holds over your experience. It is also an example of an illusion; the rope wasn't a snake, after all. But what happens when the scary, caps lock warning in your notebook indicates exactly the situation you're currently facing?

A lot of people believe their chronic pain is the rope snake – the pain is not actually there. But it's actually the second case – your body is in serious danger!

Some studies have shown that people who expect an upcoming stimulus to be painful experience stronger pain than those who expect a benign stimulus. And the more certain they are that pain is coming, the stronger they feel it. In fact, many chronic pain patients are now being diagnosed with "primary", "nonspecific", "nociplastic", or "centralized" pain. These are essentially synonyms for when clinicians find the volume knob for a patient's pain signals is inexplicably high. It is estimated that in 85% of chronic back pain cases, the most common type of persistent pain, no definitive source of bodily harm can be found.

So where is all this pain coming from? In the context of PC, the absence of bodily damage means there shouldn't be strong bottom-up pain signals. And yet, day in and day out, people are experiencing debilitating pain. If chronic pain isn't coming from the sensorium, a good guess as to where it originates is a person's model of the world. Faced with a lack of social safety nets, a compulsion to sell one's labor, and the ever looming

threats of joblessness, homelessness, and poverty, how could we expect the human brain to predict much other than “Pain! Pain! Pain!”? Our 86 billion neurons curate a sophisticated model of the expanse of an avaricious civilization, and the truth they discover hurts.

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