Pain Chapter

Quote

"The easiest pain to bear is someone else's." Francois de la Rochefoucauld.

We might be inclined to think that pain is unlike any of the other conditions discussed in Deep Resilience and not subject to the laws of Dr. One. Pain is real! Pain is urgent and serious! But even pain is subject to the laws of balance, nonlinearity[[1]](#endnote-1), Man≠ Machine, and It All Spins Together. It may surprise you but pain gives some of the clearest examples of the laws. The law of balance requiring that we Do No Harm we see the wages of back surgeries and opiates. Bioplausibility cortisone injections. The law of nonlinearity is exemplified by the fact that small or even nonexistent stimuli can lead to an exaggerated perception of pain, and conversely some instances severe pain isn't perceived at all. Similarly, we will see that clearly Man≠Machine in that abnormal Xrays and MRI's do not correlate in anyway with patients' back pain. And we will explore some disabling pain conditions such as migraine and fibromyalgia that have few biomarkers at all. And finally following the law of it all spinning together, we see the biochemical connection between stress and pain, and how elements of the immune system are intimately related to pain and its perception.

 It is said that people fear pain more than death. We know that pain has been a human condition since the beginning because humans possess receptors for opiates, showing we evolved taking opiates most likely for pain. Pain touches everyone from the cradle to the grave and takes a tremendous toll on the world at large. Some pain is unavoidable, and we need plenty of Dr. Ones and Dr. Twos. But there is room for Dr. One's laws even in the treatment of pain and we will consider some of his tools.

Scope of Problem: A Challenge for Medical Patients and Practitioners

Not only is pain terrifying for patients but challenging for the medical profession, and is one of the most common conditions seen in acupuncture clinics.

1. Cost to economy

Pain is a major health problem with horrendous social and economic consequences and costs the economy $560–635 billion annually in physician visits, analgesics, and loss of productivity.[1](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3947586/#R1)  Put another way, this expenditure amounts to between $1706 to $1934 for every man, woman, and child per year in the U. S. And of course, in the US and the developed world, pain is Big Business.

1. Big Business. As in any medical condition with this much of a "market" Big Pharma is involved. We saw how this played out with disastrous effect in regard to the plight of Bowie in the Do No Harm section of the book.

Do no harm: When it comes to Pain Management, the risk-to-benefit calculation is enormous. Can the ancients *really* teach us anything here about mitigating pain and keeping the patient from spinning out of control?

Remember from the Do No Harm chapter, there are overwhelming pressures to treat for medical conditions, and pain in no exception. Recall that the pressure comes from an "interventionista" mindset and fondness for cool toys, smartest doctors, cool research with no retesting, financial incentives (Follow the Money), inadequate mental models which require bioplausibility, and distant and dispersed credit and blame (lack of accountability) for providers and suppliers.

1. Do No Harm
	* 1. **Opiates** go back millenia derived from poppies, they're still in use and overuse today. Opioids were clearly introduced to humans early in evolution since we have receptors specific for opioids. Opiates have many adverse side effects and have resulted in a huge killer, the opiate crisis leading to many cases of the ultimate spinning out of control🡪death.
2. Opiate Crisis
	1. The nightly news stories of families helpless to safe their loved ones, overdoses taking place in plain sight, the heartbreak of fatal overdoes after a stay in rehab have become commonplace. Deaths from overdoses have reached into every community large and small, urban centers and remote rural towns. Many of these tragedies start and many end with medications requiring a doctor's prescription. How did we get to this point, where so many doctors have fallen into a Doctor Three category?

*In 2018, 1.7 million people in the United States suffered from substance use disorders relate to* ***prescription*** *opioid pain relievers…*

*In the late 1990s, pharmaceutical companies reassured the medical community that patients would not become addicted to prescription opioid pain relievers, and healthcare providers began to prescribe them at greater rates. This subsequently led to widespread diversion and misuse of these medications before it became clear that these medications could indeed be highly addictive.*[*3*](https://www.drugabuse.gov/drugs-abuse/opioids/opioid-overdose-crisis#three)*,*[*4*](https://www.drugabuse.gov/drugs-abuse/opioids/opioid-overdose-crisis#four) *Opioid overdose rates began to increase****. In 2018, 46,802 Americans died as a result of an opioid overdose, including prescription opioids, heroin, and illicitly manufactured fentanyl, a powerful synthetic opioid.***[***1***](https://www.drugabuse.gov/drugs-abuse/opioids/opioid-overdose-crisis#one)

When primary care doctors were reassured that patients would not become addicted to these opioid pain relievers (49% of opioid prescriptions are given out by primary care physicians) any Dr. Threes were born.

c. Just some of the dismal and distressing statistics of prescription opioids follow. **Every day, more than 1,000 people are treated in emergency departments for misusing *prescription* opioids. In 2017, *prescription* opioids were involved in more than 35% of all opioid overdose deaths. The CDC estimates the total economic burden of prescription opioid misuse in the US is $78.5 billion a year, including the costs of health care, lost productivity, addiction treatment, and criminal justice involvement.** About 72,000 people died in the opioid epidemic in 2017 alone. To put that in perspective, about 58,000 US military personnel were killed in the Vietnam War over 19 years. 80 percent of people who use heroin first misused prescription opioids.[7](https://www.drugabuse.gov/drugs-abuse/opioids/opioid-overdose-crisis#seven)

Often opioids are prescribed for relatively benign conditions, for example a sprained ankle or post-operative pain. But once started, opioids can hijack your brain and opioid receptors because habituation quickly leads to requiring ever-increasing doses. Eventually, there is a need for opioids to stay in equilibrium and avoid withdrawal. Physical addiction can happen to anyone, not only those genetically prone to addiction.

So though not all opioid addiction is from medical prescriptions, a large amount of needless suffering and death has been visited on the public by an army of Dr. Twos who degenerated into Dr. Threes. But the Dr. Threes were pushed by the "pushers" Big Pharma (Follow the Money.) One example is Purdue Pharma. Purdue Pharma makes OxyContin a popular and overprescribed opiate. The Sackler family owns the company, and some of its chief executives, are the targets of a case brought against them by Massachusetts Attorney General Maura Healey[[2]](#endnote-2). They recently increased the amount they are willing to pay for victims of the opioid epidemic but insist on immunity from liability (no accountability)

*The earlier* [*offer*](https://www.purduepharma.com/news/2021/09/01/plan-of-reorganization-of-purdue-pharma-l-p-receives-bankruptcy-court-approval/) *included a pledge from the Sacklers of $4.55 billion, including a $225 million federal settlement, to be paid out over roughly nine years. Under the new offer, the Sacklers would pay a total of $5.5 billion, with an additional contribution of up to $500 million, contingent on the sale of their international pharmaceutical companies. The Sacklers would have 18 years to make payments of the additional $1 billion* (lack of accountability.) Justice delayed is justice denied.

The bankruptcy plan requires that the Sackler money, plus billions more from Purdue, be given to funds for states, municipalities and tribes dedicated to the treatment and prevention of opioid addiction, and to compensate victims.

Neurontin

Another example of a widely prescribed drug for pain, let us consider Neurontin or gabapentin.

1. Case Study [[3]](#endnote-3)

*Case Study DA is an (overly) diligent COO of a prominent law firm. When she presented to the clinic, she was suicidal. She had debilitating nerve pain in her feet. She was on large doses of Neurontin for the nerve pain, but she was suffering one of the listed side effects: a severe mood disorder. She came to me out of desperation, and she needed to wean off the Neurontin, which we did. She came in twice-weekly religiously, and I treated her with manual and electroacupuncture. Her pain subsided, and she's been fully functioning ever since. She still comes frequently to the clinic because she wants to take no chances with her mood or the threat of disability from pain. She's joined a gym that helps with her overall biodynamics She can now enjoy her young grandsons and continue working into her 70's, making her who she is.*

Neurontin was developed originally for seizure disorders has had an eyebrow-raising run as an "off-label" medication for everything from restless leg syndrome to migraine. Perhaps the cleverest thing that the developers did was naming this anti-seizure medication Neurontin, so that there was Bioplausibility in prescribing it for nerve issues. But I've seen in the clinic, there can be distressing side effects even if taken as prescribed and in many instances it doesn’t help at all. [[4]](#endnote-4) As in the case of DA, suicidal thoughts represented an unusual but reported unintended consequence of this "safe" medication. Her prescribing Dr. Two slipped unwittingly into Dr. Three territory. Neurontin can be what I call a "stealth destabilizer." Because it's not a controlled substance, Dr. Two can prescribe Neurontin in large doses (it is relatively inexpensive if you have insurance.) But it also can enhance the effects of opiates, and so it can allow patients to escape opiate screening at work which has contributed to the opiate crisis and spinning out of control.

 Side effects include sweating, tremors, even difficulty speaking, and an increased risk of viral infections, which are not uncommon. Then there's depression and anxiety, drowsiness and fogginess. We know something is addictive if there are withdrawal symptoms, and there are withdrawal symptoms with Neurontin such as agitation, confusion and disorientation being the most common symptoms. When stealth destabilizers can lead to the ultimate spinning out of control, in DA's case considering suicide, you should know to be careful.

Procedures and Surgeries

 Back Surgeries

 Though there are some high-profile cases of successful back surgery, alas, more often than not, it doesn't work. Tiger Woods recently had his fifth back surgery. In 2019 he had a spinal fusion which worked for a while *"An outcome like his from fusion surgery is so rare it is "like winning the lottery," Dr. Sohail K. Mirza, a spine surgeon at Dartmouth, said."* He then had a 5th surgery in 2021. Granted, the torque and stress placed on a golfer's back is extreme, but back surgery is common and has a poor track record. If Man is Machine, back surgery should work, but unfortunately, it often doesn't and can make matters worse. Of course, interventionistas doctors get paid $80,000 to $150,000 for this surgery (Follow the Money.) (Think about that for a second. The cost of this would easily pay for a year of acupuncture and physical therapy both with a ride share or taxi there and back and nice lunch to have afterwards and cleaning services for your house in addition. But, of course, in the U.S. health insurance would never pay for that, unlike Germany[[5]](#endnote-5)which will pay for spa treatments.)

"*People with a broken spine, for example, or scoliosis, which is severe spinal curvature, or spondylolisthesis, in which vertebrae slip out of place, tend to have terrific results," he said.[[6]](#endnote-6)*

*But those are a tiny minority of fusion patients. The vast majority of fusion procedures are performed on patients with one or more degenerated disks, disks that are worn out, dehydrated, stiff and friable. And at least half of patients in pain who have a fusion for a degenerated disk remain in pain…Disabling lower back pain from degenerated disks often improves on its own, eventually. It's not clear why because the disk is still degenerated. But the pain diminishes or even goes away…The solution sounds reasonable: Get rid of the degenerated disk and get rid of the pain [Bioplausibility, and Man as Machine]. But maybe not. About half of middle-aged people with no back pain have degenerated disks(nonlinearity.) And at least half of patients in pain who have a fusion for a degenerated disk remain in pain(believing in treatments that don't work.)*

*By another definition of success — more than 30 percent relief of pain and 30 percent improvement in function —* [*only about half of fusion operations succeed*](https://www.ncbi.nlm.nih.gov/pubmed/23890947)*, Dr. Mirza said.*

*But the operation remains wildly popular — fusion surgery is among the top five operations in this country, and the vast majority are done for deteriorated disks.* [*Only knee and hip replacement account for more inpatient hospital stays*](https://www.hcup-us.ahrq.gov/faststats/NationalProceduresServlet?year1=2015&characteristic1=0&included1=0&year2=2010&characteristic2=0&included2=0&expansionInfoState=hide&dataTablesState=hide&definitionsState=hide&exportState=hide)*. Medicare pays for 300,000 of these operations each year, and private insurers are thought to pay for an equivalent number, Dr. Mirza "If your goal is cure, that isn't what this is going to offer," he said.*

*Another option, for those willing to be patient, is intensive physical therapy. Large clinical trials found that those who take that route, as a group, have outcomes indistinguishable from those who have surgery.*

*But, Dr. Mirza, said, it has to be the right kind of physical therapy, strengthening muscles in the back, improving flexibility(hormesis.)*

Some, like Dr. Atlas and Dr. Mirza, say they try to talk most back pain patients out of fusion surgery, urging them to try conservative treatment first." [[7]](#endnote-7)New York Times Gina Kolata May 15, 2019[[8]](#endnote-8) Dr. Atlas and Dr. Mirza trying hard to stay away from becoming Dr. Threes.

**Surgical Implants**

*In this country today[[9]](#endnote-9), joint replacement is commonplace, increasingly just another rite of passage in aging. Schneider catalogues the numbers. In 2014, surgeons replaced 522,800 hips, 723,100 knees, 90,000 shoulders, 15,000 elbows, 16,000 finger joints, 12,000 toe joints, 2,000 ankles, and 2,000 wrists—a total of nearly 1.4 million procedures. By 2030, he estimates, there will be some four million a year. Implants such as pacemakers and cardiac stents are clearly lifesaving, and joint replacements, by keeping us mobile, also extend and improve our lives. But the benefits of many other devices are more questionable. …Unlike drugs, these items [surgical implants] do not need to be tested in clinical triBetween 2003 and 2010, more than ninety thousand patients worldwide, a third of them Americans, were given the DePuy Articular Surface Replacement (A.S.R.) hip implant. Years ago, a colleague at Harvard asked me whether he should get the implant. als, and they are said to be “cleared” rather than “approved.”…* *In 2015, the F.D.A. received around sixteen thousand reports of deaths associated with medical devices. What’s more, a study by the Government Accountability Office estimated that ninety-nine per cent of such “adverse events” are not reported in the first place, and noted that the “more serious the event, the less likely it was to be reported”—which, Lenzer points out, means that the true number of those deaths could be as high as 1.6 million.*

*Between 2003 and 2010, more than ninety thousand patients worldwide, a third of them Americans, were given the DePuy Articular Surface Replacement (A.S.R.) hip implant. Years ago, a colleague at Harvard asked me whether he should get the implant…When his orthopedic surgeon could not offer sufficient data on the implant's safety(when evidence says no but doctor says yes), my colleague decided against proceeding. His choice proved prescient. In 2010, the device was recalled, after it was found that, in some patients, metal particles released by the ASR triggered intense inflammation around the implanted hip, sometimes resulting in destruction of the surrounding tendons, ligaments, muscles, and bone.*

*Schneider writes, "Patients who trusted their surgeons to take away their arthritic hip pain were sometimes damned to experience even worse pain than they started with." (spinning out of control)These botched procedures necessitated "even more complex hip surgery," entailing the removal of the flawed implant and the insertion of a new one "that (hopefully) can find firm foundation in the remaining bone."*

*The ASR hip is hardly an isolated example. In 2008, after I experienced a severe bout of lower-back pain, a doctor recommended implanting a spinal-cord stimulator to block the painful impulses. I read the clinical literature and concluded that the procedure was fraught with serious risks—including infection and damage to my spinal nerves—and that there was scant evidence of benefit(believing in treatments that don't work). Sure enough, in 2015 the manufacturer, Medtronic, paid a $2.8-million fine to the Justice Department for selling the device without FDA approval; a year later, the company admitted that, over the course of five years, it had failed to report more than a thousand adverse events related to the implant(lack of accountability).*

As you can see in these examples, there is good reason to carefully assess risk benefit with any surgery, but Doctors who are particularly attuned to the downsides are doing their patients a huge favor. And why wouldn't all Doctors want to stay firmly in the territory of Dr. Two or even Dr. One?

The root of the problem is the pressures that engender an interventionista mindset, follow the money, cool toys, faulty mental models, and lack of accountability. In medicine, progress is driven by innovation, and, in our society, innovation is driven by profit. *"Among implant manufacturers," Schneider writes, "market analysis drives research and consideration of device innovation."* The implantable-device industry is even more lucrative, for many companies, than the pharmaceutical industry is.

Cortisone shots

Steroid injections can quickly relieve inflammation in the joints, and the effects may last from several weeks to several months. Corticosteroids are produced by the body under stress (remember the HPA axis in the stress response with corticosteroids as their hormonal messenger that decreases inflammation.) I've seen several patients who got significant relief from steroid injections every three or four months. But, [**a new report**](https://pubs.rsna.org/doi/10.1148/radiol.2019190341) of one medical center's experience and a review of past research came to some concerning conclusions about joint injections for osteoarthritis of the hip or knee. These included a lack of compelling evidence that they work, and about 7% to 8% of people getting steroid injections to seem to worsen; with their arthritis accelerating "beyond the expected rate," unusual fractures may occur (in about 1% of people), bone damage (called osteonecrosis) in about 1% of people). Other side effects include a temporary increase in blood sugar, bleeding into the joint, and, quite rarely, infection. [[10]](#endnote-10). From blog [[11]](#endnote-11)

How can ancient medicine possibly help? Here is where the concept of nonlinearity is crucial.

Revising Mental Models: Accepting Nonlinearity

Having a solution commensurate with the problem can be deceiving both ways. Because of the intense fear that people have of pain and the level of disability it can cause, there is a natural tendency to want the “big guns” as a solution and an urgent pressure to "Do Something."(interventionista mindset.) "Big guns" can be "strong medicine" (prescription medications,) or the newest surgeries (cool toys), the"smartest doctors", and "bioplausible" solutions. Noninvasive solutions like physical therapy or acupuncture, don't make sense because they defy the law of the proportionality of cause and effect. But remember, More is not Always More. And in the new frame of complexity science inputs do NOT always equal outputs, the law of nonlinearity. Remember in the case of fusion back surgery, *Large clinical trials found that those who take that route[physical therapy], as a group, have outcomes indistinguishable from those who have surgery.*

But unfortunately, the more desperation, the more likely to spin out of control. Dr. Two deteriorates into Dr. Three. Because of the intensity of the understandable aversion to pain it's hard for people to see how "balance" is relevant and how in the world it could work. This is the pitfall of the mindset of proportionality of cause and effect at work, it is an inadequate mental model. We see pain as a simple equation, you hurt yourself, sprain an ankle, and you heal, and it's over. Right? What is the role of an alternative? Often, in acute pain situations, that assumption can be right. A course of over-the-counter medications or physical therapy can be good enough.

Similarly, if people have an abnormal X-ray, or worse, an MRI (cool toy and expensive)[[12]](#endnote-12) , they tend to think they somehow need to fix it (Man as Machine.)

Man≠Machine, human beings live between heaven and earth, and as we have we are organisms made up of feedback loops, cross talk and cascades of response. The frame of proportionality of cause and effect of solution to problems can be a dangerous mental model that leads to insistence on cool toys, the smartest doctors, and can slide rapidly into Dr. Three territory. Countering this frame takes education and persistence. We now have the means to quantify these feedback loops and it is imperative that we drive these lessons home.

Pain and its control involves sophisticated feedback loops from the brain to the periphery and back again. The topdown feedback from the brain allows us to witness the parado of athletes who can continue to play, despite severe injuries. Conversely, a feedback loop out of control leads to the phenomenon of others with crippling pain with no apparent cause.

 Man is not machine, or at least not a simple one.

Acupuncture has similarities with muscular activity, stimulating neuro peptide y in the hippocampus.  Acupuncture induces extinction but requires repeated sessions. (Copying down my notes here, so not entirely sure what that means.)[[13]](#endnote-13)

How can tedious physical therapy or tiny acupuncture needles possibly stop horrendous types of pain? Of course, there are no miracles, but if we understand a bit more about how we process pain, we can see how small hormetic interventions can help.

We will look at some of these processes in this chapter and how acupuncture and other hormetics can affect pain perception and reality. We'll see how Dr. One can help keep you more resilient to pain and help with chronic and acute pain conditions.

 **Chinese Medicine Point of View**

*"Where there is movement there is no pain.*

*"When the qi and blood flowing continuously through the body within the channels are attacked by a cold pathogen, they stagnate… it will simply decrease the blood flow. When it attacks in the channels, it actually blocks the qi flow and creates pain*." From the Yellow Emperor[[14]](#endnote-14)

In Chinese medicine, musculoskeletal pain represents a stagnation pattern in the meridians and causes pain. Physical therapy in Western Medicine incorporates similar principles. Physical therapy's goal is to increase flexibility, increase strength in corresponding and complementary muscles in order to increase function to relieve pain. Hence there is an the orthopedic adage, "motion is lotion." If you can decrease pain enough, you can get more mobility, blood flow, and function, you get less “stagnation” leading to less pain. Acupuncture, anti-inflammatories, massage, and heat can also help reduce stagnation and keep from spinning out of control in a feed-forward virtuous cycle of healing.

To fully understand the underlying science of these alternative pain treatments, we will briefly consider the two general types of pain—acute pain, which is more linear and easier to understand and treat. And the problem of chronic conditions that are nonlinear and can be challenging to treat.

Acute pain.

In ancient Chinese medicine, Dr. Ones and Dr.Twos might treat pain that recently occurred, like a pulled muscle or strained ligament, with direct needling, massage, or calming teas. And, of course, any serious accident would require medications, primitive types of surgery or application of splints, and drastic intervention with the hope that the person will heal once repaired. And to this day, these urgent acute situations need aggressive means of surgery and powerful medications. The benefit of surgery or the side-effects of strong medications is warranted because the risk of doing nothing is sky-high. Dr. Twos play a massive role in these serious situations, and we are blessed to now have the miracles of modern medicine, trauma centers, blood transfusions, and powerful medications. But what happens when healing does not occur? That is the challenge of chronic pain.

Chronic Pain

Case study[[15]](#endnote-15)

*JT is a slender, bookish academic who has had debilitating back pain for a year. Sitting is difficult for any length of time. The exercise that he loves the most, swimming, seems to aggravate it. Physical therapy seems to exacerbate it too. His Orthopedic surgeon suggested surgery, which he declined. Upon treating him with acupuncture, he is extremely sensitive to needling so I use the finest needles. After a few visits, though the pain isn't gone, he's able to walk further distances and is cautiously encouraged. He has a few more visits and is determined to go on a trip to Greece (he's a Greek scholar/professor) that he had planned. Europe, in general, can be challenging because of the cobblestones and uneven surfaces and the necessity to walk sometimes great distances. To his relief and delight, he did well on the trip. He withstood the plane trip, the walking and the general rigor of trave and carrying baggage l. "No way I could have done that 6 months ago." He continues treatment, but at ever longer and longer intervals. He's back to swimming and exercising and now, even jogging. And what has been a game-changer, he can sit for extended periods enabling him to write an entire book along with articles for publication.*

To understand this more complicated, and in some instances, intractable problem of chronic pain, a brief overview of how pain is transmitted. Pain, in most cases, starts in the periphery (the Peripheral Nervous System) with what is called nociceptors, or pain receptors. They relay the pain message to the spinal column and then up to the brain. The spinal cord and brain together comprise the Central Nervous System. The brain processes the information as pain and then feeds back to the periphery to heal the injury. In this "top-down" feedback, multiple pathways are involved, for example, from anti-inflammatory processes to hormonal systems. One of the pathways involved is our favorite feedback system the conduit of the autonomic nervous system.

*Some chronic pain conditions are the product of supersystem dysregulation. Individuals vary and are vulnerable to dysregulation and dysfunction in particular organ systems due to the unique interactions of genetic, epigenetic and environmental factors, as well as the past experiences that characterize each person*.[[16]](#endnote-16)

[Groopman](https://ksparrowmd.com/exercise-not-surgery-for-back-pain/) , a physician and science writer for the New Yorker, had his own bout with a chronic pain situation and explains how dysfunction in the Peripheral Nervous System can cause spinning out of control, an asymmetry in pain signals which are out of proportion to the injury.

*Lots of people who are pain-free actually have terrible-looking MRIs. And among those who have MRI abnormalities and pain, many specialists question whether the abnormality is really the cause of the pain, and whether fixing it can make the pain go away…Research is showing that the pain often has nothing to do with the mechanics of the spine, but with* ***the way the nervous system is behaving****,(Man≠Machine) according to of New England Baptist Hospital in Boston.
"It's a change in the way the sensory system is processing information," says Rainville, who is a physiatrist, or specialist in rehabilitation medicine. "Normal sensations of touch, sensations produced by movements, are translated by the nervous system into a pain message. That process is what drives people completely crazy who have back pain, because so many things produce discomfort."(input≠output)
This is a different way of thinking about pain. Normally pain is an alarm bell that says, "Stop what you're doing right now or you may hurt yourself!" But for many people, that pain is a false signal. It's not about looming danger; it's actually caused by hypersensitive nerves.
Rainville says that about of patients with acute back trouble get stuck* ***in an endless loop of pain.*** *He thinks this chronic back pain is often due to persistent hypersensitivity of the nervous system.*

It is this pathway from periphery to the brain and back which makes pain so subjective. This complicated system of feedback loops is why the athletes during a crucial game can keep playing in spite of a severe injury. In these athletes or soldiers in danger there are powerful flight/fight inputs overriding the pain impulses to the brain. This lack of symmetry can work in reverse, where a person can have a normal back X-ray and have excruciating pain. This is also why back surgeries have such a poor track record despite their being valued for being expensive and cool.

When considering the risk/benefit of surgery in a person like JT, we see a functional person, but not optimally functional. Acupuncture rather than surgery made sense, given the risk/benefit ratio. When it comes to back pain, it can be a vicious cycle of poor function and muscle tension a decreased blood flow; as Dr. One would say, "stagnation" can lead to a chronic pain condition where minimal movement hurts. The body has ceased to address the pain; it is walled off in a sense. Even needles as fine as the ones I used on JT , stimulate the body to heal. The needles on entry cause aggregration of local immune cells, and the pain receptors to send signals through the periphery to the Central Nervous System. The Central Nervous System then sends signals back down to the area to decrease inflammatory substances and increase endorphins[[17]](#footnote-1)[[18]](#endnote-17) When we needle, we alert the body to the presence of an issue, and it launches into action to heal. Needles in the area help direct this action so the markers will go where the needles are placed. But since the action is global, as we remember from our chapter on Immunity (quote from Abbas). . The needles help ease the "stagnation" in this type of case until the pain is decreased enough for the patient to move more freely. The freer the movement around the site of pain, the more blood flow, the more blood flow the better the function leading to even more movement causing a feed-forward virtuous cycle. Needling can reverse the vicious cycle of less movement, less blood flow, more pain leading to less movement, causing hypersensitization of the brain (which we will discuss next) leading to less movement and on and on. (consider putting in how bed rest is no longer advised for back pain)

**Peripheral Nerve Dysfunction**

Conversely, the peripheral nerves can continue to fire in chronic pain even though the injury is healed. which is so This is achallenging for traditional allopathic medicine to treat but Acupuncture can provide an effective alternatives
 As Doctor Jacqueline Filshie, acupuncture researcher from Great Britain explains*, "Chronic pain may result from ongoing signals of tissue damage (nociception or inflammation) conveyed to the central nervous system (CNS) via a healthy nervous system. Pain can also arise when there is abnormal or altered function in the nervous system, e.g. hyperactivity at some level in the pain sensory system. Such functional disturbances generally occur in the peripheral nervous system when there is peripheral neuropathy which can be managed very convincingly by acupuncture… Since neuropathic pain is associated with a lack of incoming impulses to the effector organ, a substitute excitatory input must be provided…acupuncture is the most effective.[[19]](#endnote-18)*

Sometimes the particular way a person processes nerve impulses can predict acupuncture's effectiveness in this context.[[20]](#endnote-19)

Consider getting rid of thisPreemptive local anesthesia is a simple example of the feedback systems described above.

To avoid the vicious cycle of feed-forward pain, the surgeon will inject the surgical incision site with local anesthetic before the initial surgical cut. Studies show that the patients injected in this way will require less pain medication after surgery[[21]](#endnote-20). This single preventative measure of numbing the skin is elegant and straightforward yet leads to much less pain overall, so less pain medication is needed.

Central Sensitization asymmetry in perception

Sometimes, the original injury can be long gone in intractable chronic, and unrelenting pain. The brain has become hypersensitized and keeps relaying pain signals despite no current injury. Not only that, but sometimes the brain even recruits more brain "real estate" to react to this non-impulse, so it feels more severe. In some ways, the pain really is "all in the head," but that does NOT mean it is fake or that the patient is "making it up" or malingering. This recruitment of brain space is called "Central Sensitization."

*" Central sensitization is responsible for many of the temporal, spatial, and threshold changes in pain sensibility in acute and chronic clinical pain settings and exemplifies the fundamental c****ontribution of the central nervous system to the generation of pain hypersensitivity*." (*from Central Sensitization: A Generator of Pain Hypersensitivity by Central Neural Plasticity[[22]](#endnote-21)[[23]](#endnote-22)***

What we have in central sensitization is a system out of balance. An asymmetry of perception. Perhaps the initial wildfire of pain has subsided and the tissues may even be healed, but the pain remains or even ramps up. The Man as Machine, and proportionality model has broken down. Since the injury is no longer there, it has been "fixed," and yet the pain remains. If Man were Machine, he would be all better. This type of pain resists numbing with local anesthetics at the wound site or even spinal or epidural anesthesia. The pain is coming from the brain in a feedback loop spinning out of control. We need an expert in averting spinning out of control, and that is where Dr. One comes in.[[24]](#endnote-23) As it turns out, now there are scientific explanations for Dr. One's needling strategy.

Current Scientific Models Behind Acupuncture

Gating

When I started my Acupuncture practice, the prevailing scientific model for acupuncture's effectiveness was called "gating." Gating was a theory popularized by Ronald Melzack and Patrick Wall[[25]](#endnote-24). After introducing acupuncture to the West, gating was hypothesized to be its primary or only mechanism of action. Gating suggests that you can occupy pain receptors or "gates" with non-painful stimuli such as rubbing or vibration or small needles, which will lead to less pain. For a simple example of gating, when you hit your head on an open cupboard door, the initial instinctive reaction often is to rub the spot on your head. This natural reaction to acute pain DOES actually help. Rubbing occupies nociceptors (pain receptors) with the non-pain input of rubbing, which competes in the spinal canal for the pain signals to the brain[[26]](#endnote-25). Gating remains an important mechanism or model for acupuncture's pain-relieving effects but, as we now know, far from the only mechanism. If gating were the only mechanism of action, then acupressure, tapping, or any number of similar modalities that occupy the pain receptors would be enough.

Cross talk and feedback

In the ensuing decades since Melzack and Wall, what has changed is an extensive body of research detailing the neurotransmitters, cytokines, and other biochemical compounds that modify how pain is perceived, modified and mitigated. From acupuncture and pain science, we have found that nociceptors responsible for detecting pain and other noxious stimuli like heat, cold, and pressure message the Central Nervous System (central nervous system=spinal cord + brain.) In the course of this transmission, they interact with different stimuli, which then feedback to the site of injury, damping inflammation and increasing opioid receptor response. In addition, there are signals from the brain that can also override the perception of pain—this why athletes and soldiers can keep going despite painful injuries.

We know from animal experiments for example, that needling is analogous evolutionarily to a bite or splinter. The body reacts with macrophages and cytokines which stimulates an immune response in the periphery.

The small injury of needling leads to a decrease in inflammatory markers, leading to less pain mediated through the autonomic nervous system and other homeostatic systems. A primary feedback pathway is through the autonomic nervous system, including sympathetic and parasympathetic fibers. Both arms of the autonomic nervous system act together to achieve an increase in vagal activity (rest and digest) and a decrease in flight/fight, which decreases inflammation, induces relaxation, and improves blood flow. In the context of ongoing acupuncture treatment, where the body gets challenged at regular intervals, this calming effect can affect the body as a whole, promoting better mood and better sleep. Better sleep leads to improved healing, leading to less pain and the virtuous cycle set into motion. The small input of needling gets outsized or asymmetric results an example of the nonlinearity of the system. In this light, we can see that the ancient doctors were correct, in a way. In seeing pain as "stagnation" and using needles to “unblock the meridians,” they were unwittingly stimulating a cascade of self-correcting, healing homeostatic mechanisms by introducing a minor but real injury. [The brain processing of these signals can be measured in animals in real-time with functional Magnetic Resonance Imaging or fMRI.] (put elsewhere?)

Let's look a bit deeper at our favorite feedback system, the autonomic nervous system, or stress response. Research shows that increased stress can affect most types of pain, from migraine to back pain. In an acute setting, the increase in fight/flight can override pain signals as we discussed with soldiers and athletes. However, if this pattern of high fight/flight persists, it worsens pain because the vagus withdrawal (a decrease in rest/digest) causes an increase in inflammation. We know, for example, if you take away the vagus nerve in mice with induced colitis (induced irritation of the colon), the mice exhibit much more pain despite acupuncture treatment which alleviates the pain in the control group with an intact vagus nerve[[27]](#endnote-26). This study shows that a portion of acupuncture's analgesic or pain-killing effect is through the autonomic nervous system and vagus in particular.

An intact and balanced autonomic nervous system an increase in vagal activity leads to profound sleep and a general withdrawal of fight/flight to ensure healing. Often, with enough treatment, or skillful treatment, the overall stress levels decrease, leaving the person resistant to recurrences and other stressors. This process represents prevention in action, the sort of radical prevention that is that hallmark of Dr. One. In addition, the patient requires less medication leading to fewer side effects, and a more balanced system which is less likely to spin out of control.

[In](https://ksparrowmd.com/altered-sympathovagal-balance-and-pain-hypersensitivity-in-tnbs-induced-colitis/) human studies, we can see this exact correlation of worse pain with lower vagal tone as measured by Heart Rate Variability, both in patients with headache[[28]](#endnote-27) and premenstrual syndrome[[29]](#endnote-28).

Evidence [[30]](#endnote-29)<https://ksparrowmd.com/autonomic-nervous-systemacupuncture-and-low-back-pain/>There is evidence that patients with low back pain, for example, have a higher stress profile reflected in their autonomic nervous system that decreases with acupuncture. The control group treated with only anti-inflammatory medication did not show a decrease in their stress levels.

We also see altered autonomic activity in patients with sciatica versus controls going in for surgery[[31]](#endnote-30). In this study, we don't know which came first, sciatica or the decreased parasympathetic activity, but as we know, it all spins together. Possibly by increasing their parasympathetic activity (rest and digest), we might also lessen their pain ahead of surgery. Given the iffy results of back surgery, it certainly might be worthwhile first improving their autonomic balance.[[32]](#endnote-31)

 Dr. One's advice to manage stress, sleep well and lead a balanced life **can** help with pain management overall and lead to fewer instances of feed-forward vicious cycles of pain. Dr. One would, of course, give acupuncture too, but other means are at everyone's disposal. Acupuncture isn't the only way to increase parasympathetic activity. Meditation, breathing techniques, massage, and being in nature can increase parasympathetic activity and help with a state of calm that heals.[[33]](#endnote-32)

 An article in a popular press journal interviews Dr. Audette, a clinical acupuncturist. "Acupuncture also has a dramatic effect on your nervous sys­tem, calming you down so your body can rejuvenate faster," Dr. Audette says. When a needle is inserted, it stimulates small nerves beneath the skin, setting off a chain reaction that shuts down your fight ­or­ flight response. As a result, your stress lev­els plummet. "It's basically what's supposed to happen when you meditate, except it's even stronger and faster," Dr. Audette says. "Acupuncture relaxes your muscles, slows your heart rate, and reduces inflammation to promote healing." [[34]](#endnote-33) [[35]](#footnote-2)

In this study, there is clear evidence that reducing pain with acupuncture in patients with shoulder pain and dysfunction correlated with salivary stress markers, the hormonal aspect of the stress response.

<https://ksparrowmd.com/acupuncture-for-pain-and-salivary-stress-markers/>[[36]](#endnote-34)

There is animal evidence that even breaks down where precisely, electroacupuncture achieves its results according to frequency of stimulation <https://ksparrowmd.com/low-frequency-electroacupuncture-suppresses-carrageenan-induced-paw-inflammation-in-mice-via-sympathetic-post-ganglionic-neurons-while-high-frequency-ea-suppression-is-mediated-by-the-sympathoadrenal/>

Evidence that moxibustion[[37]](#endnote-35) influences the TRPV1 receptors and leads to mechanisms of action of moxibustion for gut pain [[38]](#endnote-36)

It all spins together[[39]](#endnote-37) Here, the main takeaway is that pain is not a simple system even in the case of direct cause (injury) and effect (pain perception.) As previously discussed, man is not machine in this context. Man is a complex system of interacting feedback loops of nerve loops, immune feedback loops, stress🡪brain, and brain🡪gut.

Keeping that in mind, let's consider two disabling but non life-threatening types of pain.

Fibromyalgia (consider skipping this topic altogether)

Fibromyalgia is a chronic condition characterized by pain throughout the body associated with fatigue, depression, mood disorders, and sleep disturbance. The etiology is unknown, but it clearly has autonomic dysfunction and impaired recovery from exercise as a hallmark. It is thought that there is peripheral pain hypersensitivity (and maybe central? Look up)

HRV fibromyalgia study <https://ksparrowmd.com/electroacupuncture-and-hrv-in-fibromyalgia-patients/>

 In this study acupuncture actually increased sympathethic tone maybe in the zone>

<https://ksparrowmd.com/pain-modulation-in-patients-with-fibromyalgia-undergoing-acupuncture-treatment-is-associated-with-fluctuations-in-serum-neuropeptide-y-levels/>

**Migraine**

Case Study: *NB is head of one of the largest institutions in San Francisco. Not only has he overseen new construction of the flagship space, but as director needs to be responsive to major donors and trustees, special events and acquisitions. He takes his responsibility to employees very seriously and functions at an extremely high level. Pre-Covid, he would travel constantly to meet with other leaders worldwide, in addition to international junkets shepherding monied donors to help them indulge their interests and guide their purchases. He, unfortunately, suffered from migraine, up to 3 per week. Often they were triggered by poor sleep, another chronic condition of his. He manages his tress as an avid cyclist and devotee of spin classes, but it wasn't enough. He would "work through them" for the most part, but with misery and loss of productivity nonetheless. His wife found my information and encouraged him to try acupuncture. He was careful in scheduling always keeping appointments. (Interestingly, migraine patients are often organized and meticulous, demonstrating some of the personality traits that go along with the Chinese constellation of symptoms that comprise the liver imbalance causing migraine.) I also discussed with him the goal of trying to keep medications to a minimum if at all possible since they can keep the system out of balance. Migraine patients have a very finicky system to begin with, and are hypersensitive to all kinds of inputs, from food to smells to light. After about 6 treatments we started seeing real results. From 3 migraines per week he was down to 1 per month and has stayed that way since. Of course, travel is a particularly pernicious challenge with time zone changes poor sleep and intense responsibility. But, for the most part, changing nothing else the intermittent hormetic challenge of the needles, and the calming of the nervous system that goes along with that has helped him to remain sturdier, stronger, balancing the yang of heaven and yin of earth. . I monitored his sympathetic/parasympathetic activity while receiving treatment and saw a consistent decrease within each treatment and over weeks to months.*

Migraine is one of the most intense of non-life-threatening pain syndromes. Characterized by searing pain in the head, often behind the eyes in many people, often requiring that they retreat to a darkened room and sleep. Sometimes migraine is accompanied by vomiting, sometimes by an "aura" that warns of the oncoming torment. Some patients, like NB, were able to "work through" the migraines. But for many, they cannot work once a migraine starts, so their work, weekends, and family life suffer incalculably. In Chinese medicine, migraine is seen as an imbalance with excess yang in the head and liver stagnation, among other etiologies. The treatment of migraine with acupuncture can be tricky. Using needles to nudge and provoke the system by providing small injuries so that it is more resilient to outside triggers, we can inadvertently trigger the neurologic wave that sweeps across the brain during a migraine. Migraine patients typically have a hypersensitive system[[40]](#endnote-38), so the treatment itself can trigger a migraine.

*Migraine is associated with derangements in perception of multiple sensory modalities including vision, hearing, smell, and somatosensation. Compared to people without migraine, migraineurs have lower discomfort thresholds in response to special sensory stimuli as well as to mechanical and thermal noxious stimuli. Likewise, the environmental triggers of migraine attacks, such as odors and flashing lights, highlight basal abnormalities in sensory processing and integration. These alterations in sensory processing and perception in migraineurs have been investigated via physiological studies and functional brain imaging studies. Investigations have demonstrated that migraineurs during and between migraine attacks have atypical stimulus-induced activations of brainstem, subcortical, and cortical regions that participate in sensory processing. A lack of normal habituation to repetitive stimuli during the interictal state and a tendency towards development of sensitization likely contribute to migraine-related alterations in sensory processing*.

But in using acupuncture as hormesis, we need to nudge the system enough to get the system accustomed to triggers. As we have seen, the needling invokes a cascade of healing responses, including increased vagal activity. Triggering a migraine is unlikely but can occur, but it can be well worth that risk.

If the patient can refrain from taking migraine medication, even over-the-counter medications, that helps keep the system stable and less reactive. Medications, of course, are often required in the case of severe migraines, but if minimized, the overall rate of migraine is lower. When patients come in for a first visit saying that they don't take medication either because they don't work for them or they don't want to, I feel like my job is more than halfway done.

(triptans mode of action[[41]](#endnote-39)

It all spins together

The systems are all interrelated as we’ve seen. A remarkable example of Dr. One’s law comes from the study of neuroimmune interface. Neuroimmune refers to the interaction of nerves with the immune system. Mast cells, which we discussed in the Immunology chapter, are involved in nociception or pain perception.[[42]](#endnote-40) Not only are mast cells an important part of pain perception, but mast cells feature prominently in the mechanisms behind acupuncture's effect.[[43]](#endnote-41)

If you recall, mast cells reside in various tissues and constitute a first line of host defense analogous to the “wandering cells” discovered by Metchnikov. They can release many different messengers that affect the immune system, vascular system, and [[44]](#footnote-3)growth factors in response to allergens, viruses, and bacteria. Because of their proximity to vasculature and nerve fibers, mast cells are key players in orchestrating inflammation-associated pain.

Mast cells also play a crucial role in the potency of acupuncture points. They also explain some of the more curious experiences associated with acupuncture needling, such as the appearance of a "weal" (a reddening) around the inserted needle, as well as the sensation of itching. When acupuncture needles are placed on the back in particular, redness can be seen around the needle in many instances. (It can be witnessed on the opposite side of in a mirror region even if a needle is not places there.) Then there is the curious phenomenon called "de qi." De qi, is a sensation of heaviness on needling. So we can see how the model of "gating" does not entirely explain the mechanism behind acupuncture needling.

Keep in mind that mast cells originally were associated with allergies. Mast cell stabilizers like cromolyn have been used to keep mast cells from releasing histamine during exercise *(find reference for this*.) Empirically, needling on the inside surface of the wrist can lead to intense itching. Itching can occur in any acupuncture point, but where tissue is dense and sensitive, such as the inside of the wrist, this phenomenon is heightened. Though electroacupuncture is popular in practice and in research, it does not activate mast cells to the same extent as manual acupuncture. The activation of mast cells with mechanical stimulation reinforces a few traditional aspects of ancient acupuncture. The concept of De Qi, is the sensation of a "grabbing" of the needle by the skin on manipulation of the needle by the practitioner. This can be explained by the interaction of the needle with collagen fibers. This also explains the empirical observation and scientific one that "rougher" needles work better. (find reference)

These mast cells are implicated in both migraine and fibromyalgia.

Fibromyalgia

*Fibromyalgia syndrome (FMS) is a neurobiological disorder characterized by pressure-induced pain in specific tender points in the muscles in all four quadrants of the body [*[*200*](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4691098/#B200-ijms-16-26151)*,*[*201*](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4691098/#B201-ijms-16-26151)*] and is associated with sleep disturbances, morning stiffness, fatigue, paresthesia, headache and anxiety—possibly induced by stress and other psychological factors [*[*202*](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4691098/#B202-ijms-16-26151)*]. The idea of MC[mast cell]-mediated peripheral and central sensitization in FMS originates from a line of studies showing increased MC infiltration [*[*203*](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4691098/#B203-ijms-16-26151)*] and increased MC degranulation with increased PAR2 activity [*[*204*](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4691098/#B204-ijms-16-26151)*] in skin biopsies, and increased levels of IL-1, IL-6, IL-8 and MCP-1 in the serum of FMS patients vs. healthy controls [*[*205*](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4691098/#B205-ijms-16-26151)*,*[*206*](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4691098/#B206-ijms-16-26151)*].* (Remember we saw that Il-1, and Il-6 are inhibited by acupuncture)

*A mechanism of MC-mediated nociception in FMS as a hypothesis for pain in FMS patients in addition to hypothalamic-pituitary-adrenal (HPA*)[the hormonal part of the stress response] *axis involvement has been put forth [*[*205*](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4691098/#B205-ijms-16-26151)*]. The thesis speculates that MCs may be activated by local release of corticotropin-releasing hormone (CRH) and SP(substance P) via CRH and NK1 (Natural Killer) receptors, respectively, and can lead to a feed-forward neuroendocrine sensitization of the peripheral and central nervous system. More than five decades ago,*

Migraine

 *Sicuteri suggested vasoactive and neuro-sensitizing roles for MCs in the complex pathology of migraine [*[*46*](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4691098/#B46-ijms-16-26151)*]. Years after this claim, increased histamine levels in migraine patients were observed [*[*47*](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4691098/#B47-ijms-16-26151)*,*[*48*](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4691098/#B48-ijms-16-26151)*,*[*49*](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4691098/#B49-ijms-16-26151)*] which could be antagonized by prophylactic anti-histamines [*[*50*](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4691098/#B50-ijms-16-26151)*,*[*51*](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4691098/#B51-ijms-16-26151)*,*[*52*](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4691098/#B52-ijms-16-26151)*] in a H1-receptor-specific manner in human subjects [*[*53*](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4691098/#B53-ijms-16-26151)*]. Other molecules usually associated with MC degranulation, such as endothelin-1 [*[*54*](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4691098/#B54-ijms-16-26151)*], TNFα and IL-6 [*[*55*](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4691098/#B55-ijms-16-26151)*], and leukotrienes [*[*56*](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4691098/#B56-ijms-16-26151)*], have been found to be associated with migraine in human subjects. Thus, MCs may contribute to migraine pain via several mechanisms.and central nervous systems in FMS [*[*208*](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4691098/#B208-ijms-16-26151)*,*[*209*](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4691098/#B209-ijms-16-26151)*,*[*210*](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4691098/#B210-ijms-16-26151)*,*[*211*](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4691098/#B211-ijms-16-26151)*,*[*212*](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4691098/#B212-ijms-16-26151)*,*[*213*](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4691098/#B213-ijms-16-26151)*,*[*214*](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4691098/#B214-ijms-16-26151)*].*

Future studies will be neces-sary to determine the precise mechanisms of activation and whether this type of mechanical stimulation is similar to that of endothelial cells in arteries mediated by the stress-activated protein kinase (SAPK)/Jun amino-terminal kinase (JNK) pathways [33,34]. The SAPK and JNK pathways can activate mammalian immune and endothelial cells to produce inflammatory factors such as TNF and IL-6 that can cause antinociception [33,35,36]. Indeed, preliminary studies indicate that acupuncture induces mechanical stimulation of rat mast cell degran-ulation, which causes antinociception by releasing TNF and IL-6 [28]. The potential of these factors to prevent nociception has been demonstrated in several studies showing that intra-plantar injection of either TNF or IL-6 prevents nociception in rodent paws [35,36[[45]](#endnote-42)

*How can* acupuncture in the periphery affect the meninges or dura which surround the brain? Some clues come from animal studies on Alzheimer’s in rats that showed that acupuncture decreased levels of TNF, IL6 in the hippocampus of afflicted rats, most likely decreasing inflammation and improving their results in a memory challenge .[[46]](#endnote-43) Another study showed electroacupuncture attenuated Il6 levels and increased parasympathetic activity in post burn animals.[[47]](#endnote-44)

And when it comes to migraine we see that molecules associated with Mast Cell degranulation are TNFα, and Il 6. Both SP and CGRP increase in concentration with a migraine. As we saw in the Inflammation chapter acupuncture decreases both of these neuropeptides. Keep in mind that recent studies show The present study investigated in a rat model of hypertension whether the high conductance at acupoints is a result of the release of the neuropeptides substance P (SP) and calcitonin gene-related peptide (CGRP) during neurogenic inflammation in the referred pain area[[48]](#endnote-45)Find citation *circulation [*[*63*](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4691098/#B63-ijms-16-26151)*]. Also find where in inflammation chapter*

[It all spins together. In a lecture from his systems biology class on the interactions of the HPA hypothalamic Pituitary axis a homeostatic feedback system involved in the acute hormonal stress response, Uri Alon concludes.

"More generally, the body can be considered as an ensemble of interacting organs that constantly adjust their size and activity to changing conditions and to the state of other organs."[[49]](#endnote-46) ] This doesn’t exactly belong here, but it may be pertinent elsewhere in the jigsaw puzzle.

As we move into the next chapter on mood and mood disorders, we will see how even mood is subject to homeostasis, nonlinearity and of course, it allspi nning together.

1. Ahn AC, Nahin RL, Calabrese C, et al. Applying principles from complex systems to studying the efficacy of CAM therapies. *J Altern Complement Med*. 2010;16(9):1015-1022. doi:10.1089/acm.2009.0593 [↑](#endnote-ref-1)
2. https://www.managedcaremag.com/dailynews/20190116/sackler-family-makers-oxycontin-come-under-intense-fire-court

https://www.nytimes.com/2022/02/18/health/sacklers-opioids-lawsuit.html?searchResultPosition=2 [↑](#endnote-ref-2)
3. 1. D is in her late 70's. She started having some gastric irritation, and was placed on \_. She was also having \_\_\_ and was placed on Neurontin in her 50's. Weight gain ensued. Bowels still with issues, marijuana, \_\_\_\_\_\_\_\_\_\_\_ followed. Now restless leg syndrome, lethargy, difficulty walking. This is the cautionary tale of spinning out of control.Let's consider DJ. Though she's not addicted to opiates, which of course, is the ultimate in spinning out of control, she still has multiple issues many of which are caused by the medications and [↑](#endnote-ref-3)
4. Case Study DA is an (overly) diligent COO of a prominent law firm. When she presented to the clinic she was suicidal. She had debilitating nerve pain in her feet. She was on large doses of Neurontin for the nerve pain, but she was suffering one of the listed side effects which was a severe mood disorder. She came to me out of desperation. She needed to wean off the Neurontin, which we did. She came in twice weekly religiously and I treated her with manual and then electroacupuncture. Her pain subsided and she's been fully functioning ever since. She still comes frequently to the clinic because she wants to take no chances with her mood or the threat of disability from pain. She's joined a gym which helps with her overall biodynamics and is able to enjoy her young grandsons and continue working into her 70's which makes her who she is. [↑](#endnote-ref-4)
5. https://www.howtogermany.com/pages/spas.html [↑](#endnote-ref-5)
6. https://www.nytimes.com/2019/05/15/sports/how-tiger-woods-pga-back-surgery.html?searchResultPosition=1 [↑](#endnote-ref-6)
7. https://www.newyorker.com/magazine/2020/04/20/do-some-surgical-implants-do-more-harm-than-good [↑](#endnote-ref-7)
8. https://www.nytimes.com/2019/05/15/sports/how-tiger-woods-pga-back-surgery.html?searchResultPosition=1 [↑](#endnote-ref-8)
9. <https://www.newyorker.com/magazine/2020/04/20/do-some-surgical-implants-do-more-harm-than-good> The New Yorker 4.20.2020 [↑](#endnote-ref-9)
10. <https://www.health.harvard.edu/blog/a-new-look-at-steroid-injections-for-knee-and-hip-osteoarthritis-2019122318430?utm_source=delivra&utm_medium=email&utm_campaign=BF20200106-Knees&utm_id=1826946&dlv-ga-memberid=94939006&dlv-emuid=c36d80de-9517-4547-8dfb-1ce02a5a326b&dlv-mlid=1826946> <https://ksparrowmd.com/steroid-injections-not-as-safe-as-previously-thought/> [↑](#endnote-ref-10)
11. https://www.health.harvard.edu/blog/a-new-look-at-steroid-injections-for-knee-and-hip-osteoarthritis-2019122318430?utm\_source=delivra&utm\_medium=email&utm\_campaign=BF20200106-Knees&utm\_id=1826946&dlv-ga-memberid=94939006&dlv-emuid=c36d80de-9517-4547-8dfb-1ce02a5a326b&dlv-mlid=1826946 [↑](#endnote-ref-11)
12. https://www.painscience.com/articles/mri-and-x-ray-almost-useless-for-back-pain.php [↑](#endnote-ref-12)
13. https://ksparrowmd.com/insights-on-physiology-of-acupuncture-and-pain/ [↑](#endnote-ref-13)
14. The Yellow Emperor’s Classic of Medicine. A new translation of the Neijing Suwen with Commentary/ Maoshing Ni, PhD Shambala Boston and London 1995 ISBN 1-57062-080-6 [↑](#endnote-ref-14)
15. JT is a slender, bookish academic who has had debilitating back pain for a year. Sitting is difficult for any length of time. The exercise that he loves the most, swimming, seems to aggravate it. Physical therapy seems to aggravate it too. While treating him he is extremely sensitive to needling so I need to use the finest needles I have. After a few visits, though the pain isn't gone, he's able to walk further distances and is cautiously encouraged. He has a few more visits and is determined to go on a trip to Greece (he's a Greek scholar/professor) that he had planned. Europe, in general, can be challenging because of the cobblestones and uneven surfaces and the necessity to walk sometimes great distances. To his relief and delight, he did well on the trip. He withstood the plane trip, the walking and the general rigor of travel. "No way I could have done that 6 months ago." He continues treatment, but at longer and longer intervals. He's back to swimming and exercising. [↑](#endnote-ref-15)
16. Chapman CR, Tuckett RP, Song CW. Pain and stress in a systems perspective: reciprocal neural, endocrine, and immune interactions. *J Pain*. 2008;9(2):122-145. doi:10.1016/j.jpain.2007.09.006  [Pain and Stress in a Systems Perspective\_reciprocal Neural, Endocrine and Immune Interactions](https://ksparrowmd.com/wp-content/uploads/Pain-and-Stress-in-a-Systems-Perspective_reciprocal-Neural-Endocrine-and-Immune-Interactions.pdf) [↑](#endnote-ref-16)
17. [↑](#footnote-ref-1)
18. **Mechanism of electroacupuncture on inflammatory pain: neural-immune-**

**endocrine interactions**

Li Yuan, Yang Mingxiao, Wu Fan, Cheng Ke, Chen Haiyong, Shen Xueyong, Lao Lixing

release of inflammatory cytokines through various path

ways.

During inflammation, EA promotes peripheral

immune cells to release opioids, cannabinoids (CB)

and adenosine (A), which further exert anti-inflamma

tory

effects via binding with µ-opioid receptors or

CB2, A1 and A2A receptors that are expressed on noci

ceptive

neurons or immune cells, respectively, to inhib

a, IL-1ß,

it

the release of TNF-

IL-

and IL-6.39

EA inhibits peripheral sensitization by modulating the

neural, immune and endocrine systems (Figure 2). At

the peripheral level, EA can inhibit the production and [↑](#endnote-ref-17)
19. Filshie, J, White A Medical Acupuncture A Western Scientific Approach Churchill Livingstone 1998 ISBN 0 443 04976 9 [↑](#endnote-ref-18)
20. Front. Neurosci., 11 July 2019 | <https://doi.org/10.3389/fnins.2019.00498>

**High Temporal Summation of Pain Predicts Immediate Analgesic Effect of Acupuncture in Chronic Pain Patients—A Prospective Cohort Study**

[Petra Iris Baeumler](https://www.frontiersin.org/people/u/653725)1\*, Peter Conzen2 and Dominik Irnich1 [↑](#endnote-ref-19)
21. Joshi GP, Janis JE, Haas EM, Ramshaw BJ, Nihira MA, Dunkin BJ. Surgical Site Infiltration for Abdominal Surgery: A Novel Neuroanatomical-based Approach. *Plast Reconstr Surg Glob Open*. 2016;4(12):e1181. Published 2016 Dec 23. doi:10.1097/GOX.0000000000001181 [↑](#endnote-ref-20)
22. [↑](#endnote-ref-21)
23. Latremoliere A, Woolf CJ. Central sensitization: a generator of pain hypersensitivity by central neural plasticity. *J Pain*. 2009;10(9):895-926. doi:10.1016/j.jpain.2009.06.012 [↑](#endnote-ref-22)
24. AUTHOR=Baeumler Petra Iris, Conzen Peter, Irnich Dominik

TITLE=High Temporal Summation of Pain Predicts Immediate Analgesic Effect of Acupuncture in Chronic Pain Patients—A Prospective Cohort Study

JOURNAL=Frontiers in Neuroscience

VOLUME=13 https://www.frontiersin.org/articles/10.3389/fnins.2019.00498/full

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**Spectral Analysis of Heart Rate Variability During Trigger-Point Acupuncture of Various Muscles**

[Yoji Kitagawa](https://www.liebertpub.com/doi/10.1089/acu.2020.1414)

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A schematic illustration of the gate control theory of pain proposed by Melzack and Wall ([1](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4676495/#b1-prm-20-285)), demonstrating how the gating mechanism in the spinal dorsal horn modulates transmission of nerve impulses from afferent fibres to spinal cord transmission cells. The gating mechanism is affected by the relative activity in large- and small-diameter fibres, with the former inhibiting transmission (closing the gate) and the latter facilitating transmission (opening the gate). Notably, the spinal gating mechanism is also modulated by descending nerve impulses from the brain. The authors proposed that the spinal transmission cells activate an action system in the brain comprising regions that underlie the experience and behaviours characteristic of pain. Reproduced with permission from Melzack and Wall ([1](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4676495/#b1-prm-20-285)) [↑](#endnote-ref-25)
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35. “But a growing body of research reveals that its bene­fits are more wide-ranging than doctors thought. For instance, allergy sufferers who started acupuncture at the beginning of pollen season were able to stop taking antihistamines nine days sooner on average than those who didn’t use it, according to a study from the Charité—University Hospital Berlin. (Here are more [***ways to get rid of seasonal allergy symptoms***](https://www.shape.com/lifestyle/mind-and-body/how-to-get-rid-of-seasonal-allergy-symptoms).) Other studies have indicated that the practice may be useful for gut issues, including irritable bowel syndrome.

Recent research has uncovered powerful mental bene­fits of acupuncture as well. It can decrease feelings of stress for up to three months after treatment, according to a study from Arizona State University. The reason for its long­-lasting effects may have to do with the HPA axis, a system that controls our reactions to stress. In an animal study at Georgetown University Medical Center, chronically stressed rats that were given electroacupuncture had significantly lower levels of hormones known to drive the body’s fight ­or­ flight response compared with those that didn’t get the treatment.

And that may be just scratching the surface of what acu­puncture can do. Scientists are also looking into the practice as a way to reduce migraine frequency, improve PMS symp­toms, ease insomnia, boost the effectiveness of depression meds, lower blood pressure in people with hypertension, and reduce side effects of chemotherapy drugs. While much of the research is still in the early stages, it points to a pretty bright future for this ancient treatment.  [↑](#footnote-ref-2)
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41. ###  **The mechanism of action of triptans**

Triptans are selective 5-hydroxytryptamine (5-HT) receptor agonists with high affinity for 5-HT1B and 5-HT1D receptors.13 Stimulation of the 5-HT1B receptors on smooth muscle cells of blood vessels causes cranial vasoconstriction. This was originally thought to be the main mechanism of action of triptans in relieving migraine.13 5-HT1D receptors lie on the perivascular trigeminal nerve terminals and in the dorsal horn. It is thought that stimulation of these receptors blocks the release of vasoactive peptides from trigeminal neurons and of neurotransmitters in the dorsal horn, which convey nociceptive information to the thalamus.13

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44. pai*ast cells are tissue-resident immune cells that release immuno-modulators, chemo-attractants, vasoactive compounds, neuropeptides and growth factors in response to allergens and pathogens constituting a first line of host defense. The neuroimmune interface of immune cells modulating synaptic responses has been of increasing interest, and mast cells have been proposed as key players in orchestrating inflammation-associated pain pathobiology due to their proximity to both vasculature and nerve fibers* [↑](#footnote-ref-3)
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49. **Systems medicine Lecture notes**

**Uri Alon (Spring 2020)** **Li Y, Yu Y, Liu Y, Yao W. Mast Cells and Acupuncture Analgesia. *Cells*. 2022;11(5):860. Published 2022 Mar 2. doi:10.3390/cells11050860**

**Lecture 4**

**Two-gland feedback in the stress-hormone axis generates**

**seasonal clocks and explains clinical phenomena with a**

**timescale of months** [↑](#endnote-ref-46)