

WHAT BRAIN SCIENCE HAS TO TELL US ABOUT CONNECTION AND LONELINESS ©¹

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INTRODUCTION

WHY IN THE WORLD WOULD AN ATTORNEY BE WRITING AND SPEAKING ABOUT WHAT BRAIN SCIENCE HAS TO TELL US ABOUT CONNECTION AND LONELINESS?

After a decade teaching social-psychology at Boston University, I applied to a local law school across the not-so-mighty Charles River as a back-up to my quest for tenure. Given that fate seems enamored of complexity, I ended up having to elect between these two quite disparate careers. I chose the law school route, with some vague notion that I would meld the two careers into one.

Against all odds this came true. After training as an Associate Attorney in one of Boston's largest law firms², I was recruited by a smaller firm that was about to lose a dream client: Boston's largest and the country's oldest children's social service agency, which at the time carried an 18th century name, "The New England Home for Little Wanderers." The wanderers were indeed little, but the Home was huge: it ran twenty different social service programs, many of them residential treatment centers, and had an annual budget of just over \$60,000,000. It was expressly searching for a General Counsel who would be able to handle not only traditional legal issues, but also the ever-increasing need of its hundreds of clinicians to seek legal consultation on issues that arose in their clinical sessions. More precisely, they were requiring that their new legal counsel should also have training and experience in psychology, or psychiatry. While the fact that no one from the latter category showed up in competition was undoubtedly the reason for my being offered the position, the Home did take note of the role I had played as a consultant to the Commissioner of Youth Services in the process of shutting down Massachusetts' bizarrely out-of-date reform schools.³

Within months of switching law firms and becoming the Home's general counsel, word of my double training spread, and I soon became general counsel to a significant percentage of Boston's other large-scale children's social service agencies,⁴ a dozen adoption agencies, and scores of private practices of the city's psychiatrists, psychologists, and clinical social workers. Even Carney Hospital with its vast, century-old psych ward asked me to serve as its backup counsel. And that was that: for the remaining thirty-five years of my law practice, I delivered both the general legal services these agencies and clinical practices required, as well providing legal consultation for the better part of a thousand clinicians.

In the very first week of my training as an attorney I was instructed to take careful and extensive telephone notes on every phone call, and to create a separate telephone note spindle at the front of each case file. So, every time one of my clinician clients would call about a new

matter, I would insist upon a background description of their clinical client or patient, including the details of their demographics, family status, socio-economic setting, diagnoses carried, and the clinician's general impressions of their client. Only then would we turn to the specifics of the particular legal issue that had prompted the clinician to seek my consultation.

As the years passed, it became ever more prevalent for clinicians to report — and my notes to reflect, along with other DSM diagnoses that the clinicians' clients might carry— the extreme isolation and disconnection that affected their client's lives and complicated their treatment. It wasn't so much that the word "lonely" was used more and more often to describe their clients; it was more that the clinicians would describe how their clinical efforts were complicated—and often undermined-- by the absence of viable support systems in the lives of their clients.

Roughly a decade ago as I began the gradual process of winding down my law practice and handing over the day-to-day law work to younger attorneys, I began to conceive of a project that would absorb my time and—hopefully—prove of interest to others. While I had taken down the telephone notes as an attorney, I had also heard what I was being told with the ears of a social psychologist. I began to conceive of the value of reading "across" my case files, and doing so led me to realize that I had, in effect, collected data— in fact, a great deal of highly detailed data about the lives of many hundreds of children and their families. The question wasn't whether to do something with all this data: the question was *what* to do with it.

To answer to this question, I reread straight through hundreds of these law case files— some of which contained hundreds of pages. Besides legal documents and my afore-mentioned telephone notes, many files contained detailed psychological reports written by the clients' treating clinicians. Moreover, many of these files constituted longitudinal studies, as they reported on the lives of children and their families over considerable periods of time—sometimes decades. It was this concentrated read-through of all the files that underscored for me that many—not all, but many—of these cases exhibited how thoroughly disconnected and tragically isolated were the patients of my clinical clients. Moreover, it became clear in rereading the records that as the thirty-five years of my law practice had passed by, there was an ever-increasing frequency of clinicians reporting on their clients' debilitating loneliness.

It was after this read-through that I realized that what I had of interest in my law-case notes wasn't really "data"—it seemed better characterized as life-histories-- *stories*. Real life, three-dimensional, life-and-death stories. I began to conceive of the book I would write as a collection of case stories about the children and families I had "met" in my work. I decided that it was through recounting their real-life stories that I could highlight the role chronic loneliness played in exasperating the traumatic stress that so many of them had suffered, usually in the framework of very difficult circumstances.

And so was born *Four Seasons of Loneliness: A Lawyer's Case Stories*. When the book appeared in 2016, I expected to give it to friends and family as a gift—and little else. But I had greatly miscalculated: the ever-increasing isolation and disconnection in today's urban societies meant that there was an audience hungry to read about loneliness. Or perhaps it was simply the

fact that everyone loves a good story. Whatever the reason, the book sold well and went on to win multiple prizes.⁵ That was the good news.

The bad news was that in the scores of book-signing events, radio, and pod-cast interviews that followed, people didn't really want to talk about—or have me talk about—the stories, as such. They wanted to talk about loneliness itself, about what it arises from, about why its prevalence in society seems to be increasing so rapidly, and about what could be done about it on both individual and societal levels. I couldn't even get book clubs that usually selected literary works to ask me questions about the real-life stories *as stories*. I was, to be honest, somewhat heartbroken. (I think perhaps my disappointment was the effect of having seen the remarkable Italian film, *Il Postino*, particularly the scene where Pablo Neruda disembarks from a two-propeller airplane onto an old-fashioned tarmac where police had cordoned off scores of admirers who were hoping for a view- or even an autograph.) I wanted to talk about the wording I had used, and the phrasing I had crafted-- about the foreshadowing and character development. Alas, no one else did. All anybody wanted to discuss was why and how the collective, communal life of the past was fading away so rapidly, why their children didn't call them often enough, and why their friendships faded to nothing if someone moved to another city. In the face of these incessant inquiries, I quickly came to realize that I didn't know the answers to their questions—I had done little more than to describe my client's patients' sad, lonely lives. Period.

I literally had no choice but to become more of a scholar on the topic of loneliness—late in life or not. So, I set out to read and absorb the journal articles and monographs published on the topic by academics and clinicians who wrote about the why's and how's of the disintegration of the communal life of past times. I was fortunate however: what I thought would be a thankless and unremunerated imposition turned into a passionate inquiry, and so it has remained to this very day.

One of the first, and more daunting things I learned from these scholars was that the law-cases I had selected for *Four Seasons of Loneliness* had not said a single word about fully half of all the people who become chronically lonely. Given my naiveté on the topic, I had only chosen cases that exhibited clinical clients whose isolation and disconnection were the principal precipitating cause of the loneliness they experienced. This was a major error on my part, as my reading soon taught me that fully half of all chronically lonely persons live enmeshed in what looks to the outside world like a normal network of relationships – but which is experienced by them as so thoroughly unfulfilling and unrewarding that these chronically misconnected individuals feel just as lonely as do those who live alone, always alone, year after year after year. This revelation led me to do another read-through of my case-notes-- and sure enough—there were the cases that I had missed. I chose five of the cases that best typified the differing sub-types of unrewarding relationships that leave people feeling so lonely, and in 2020 published another book on loneliness, which I called *Surrounded By Others and Yet So Alone*. Once again, the well-timed appearance of the book was greeted with robust sales, scores of invitations to book signing events and book club presentations, and yet more prizes.⁶ Alas--it was still the case that no one wanted to talk about literary subtleties in my writing style. No one. But at least by this point I was able to answer their questions about what loneliness is, and how it operates.

A new problem arose, however. I couldn't for the life of me divine how to synthesize what the scholarly works on loneliness were reporting. Each study, each book, espoused its own perspective on how much loneliness there is, how people become lonely, what effect isolation or unrewarding relationships were having on people's lives, and so on. I couldn't put it all together in a coherent way. Not even close. Then one evening my law client-- and favorite forensic trial witness—Bessel van der Kolk, M.D.-- came over for dinner, and, in lieu of bringing a bottle of wine, he brought a copy of his new book about trauma, *The Body Keeps the Score*. I opened it the next morning, and quite literally couldn't put it down. For me, it produced a true “ah ha” experience. Suddenly, all the disparate scholarly and research literature on loneliness that I had been unable to integrate fit together like the pieces in a puzzle. What follows in this brief essay is why van der Kolk's book had that effect on me, and how I have gone on to apply its perspective on trauma to my study of loneliness.

THE NATURE OF SCIENTIFIC REVOLUTION

When I was an undergraduate in the early 1960's at Cal Berkeley, there were twenty or thirty books that were de rigeur to read and discuss—completely irrespective of whether they had been assigned in a class. Among them was Thomas Kuhn's brief but important work, *The Structure of Scientific Revolutions*.⁷ The book's principal contribution to the philosophy of science was its clear distinction between ordinary and revolutionary science. Ordinary scientists work only within—and are restricted by-- the framework of their era's dominant conceptualization of how things work in their field of inquiry. Their entrapment in that framework, it turns out, is not merely intellectual. Quite to the contrary, throughout scientific history one can discern many instances where scientists' efforts to challenge the then ruling framework in their field of inquiry were met with either academic roadblocks or overt socio-political repression. Often, both. But why, one might ask: isn't scientific inquiry all about the replacement of paradigms burdened by inexplicable anomalies that later disappear when illuminated by the introduction of a new paradigm with greater explanatory power? Isn't that how science works? While the answer is mostly “yes” for ordinary scientific advancements, it is all too often “no” when an entirely new paradigm is proposed by a “revolutionary” scientist. Why so? Because proposed “scientific revolutions,” as Kuhn labels them, can at times be so potentially momentous that they threaten the status quo, both in their field of inquiry, and in society at large. Within their field of inquiry, these rare reconceptualizations require senior professors and those controlling research funding to reformulate their entire approach to performing and funding research. That's not an easy ask.

Kuhn reminds us that paradigmatic changes in science can at times have far grander effects than disturbing entrenched academic careers. And when they do, they can elicit repression of an entirely different order of magnitude, especially when the new paradigm threatens to alter how the public will perceive, interpret, and understand the world in which they live. The paradigmatic revolutions associated with Copernicus and Darwin are perhaps the ultimate examples of this. In 1616 the Roman Catholic Church placed Copernicus's *De revolutionibus* on its Index of Forbidden Books, and when a decade later Galileo ignored the Church's warning not to teach Copernicus' heliocentric model of the universe-- and published a

popularized version and defense of the new cosmological paradigm-- he was put on trial, forced to recant, and sentenced to home imprisonment for the remainder of his life.

The mid-nineteenth century reaction to Darwin's *On the Origin of Species* was more muted, to be sure, but it was very much front-page news. The Church of England's scientific port-paroles railed against the new paradigm, leading up to the infamous confrontation of 1860 that took place at a highly publicized meeting of the British Association for the Advancement of Science. The Bishop of Oxford argued vehemently against Darwin's explanation but was openly opposed by others who were strongly in favor of adopting the new perspective. The debate turned out to be pivotal in the general struggle between religion and science, and even more important in engendering steps that were soon taken to decrease the authority of the clergy in scientific education. Darwin, weakened by significant health issues at the time, found a way to outmaneuver the Church by turning his attention to the study of plants: his stunningly revealing book *Fertilization of Orchids* completely escaped the Church's attention even though it significantly advanced his theory of evolution. As Darwin phrased his ploy "...my chief interest in my orchid book, has been that it was a 'flank movement' on the enemy."⁸

The revolutionary view of trauma that van der Kolk and his colleagues have championed has, of course, a far less generalized impact than did the introduction of heliocentrism and evolutionism: it merely attempts the reconceptualization of how traumatic stress afflicts its victims, and what clinical treatment techniques might conceivably offer relief. But what evidence is there, you might well ask, that this new perspective on traumatic stress can be classified as an instance of a Kuhnian "scientific revolution"? Perhaps the most convincing evidence is found in the reaction to the appearance of *The Body Keeps the Score: Brain, Mind, and Body in the Healing of Trauma*: It has sold nearly four million copies in English. These crazy sale numbers kept it at the top of the non-fiction best-seller lists of both The New York Times and Amazon for well over a hundred weeks. These sales are *two orders of magnitude* beyond what book sales are even dreamed of by non-fiction authors, where selling thirty thousand copies is considered a noteworthy success.⁹ Another fascinating fact to account for is that *The Body Keeps the Score* currently has over 65,000 reviews on Amazon—a number equaled by few, if any, non-fiction authors. Additionally, the work has been translated into dozens of foreign languages, the sales of which are not even included in the above numbers. To my mind, the astonishing magnitude of these sales and review numbers for a scientific work is evidence that there is something quite profound taking place.

Moreover, and consistent with historical precedent, there is additional evidence that what van der Kolk and his colleagues propose indeed constitutes a Kuhnian instance of revolutionary science. I am referring to the vigor and sustainability of the opposition with which van der Kolk has been confronted, on both academic levels and in the streets. The latter is a reference to the picketing mounted in the 1990's by "False Memory Syndrome" militants outside of Boston's federal district courthouse. These activists were vehemently opposed to testimony that van der Kolk was offering at the time in numerous pre-trial "Daubert Hearing" motion sessions preceding the jury trials of some of the city's infamous pedophile priests. His testimony was that the victims' recovered memory of their long-ago abuse had been repressed and had thereby been unavailable to their memory (which meant that the statute of limitations that would otherwise have barred their lawsuits, was not in play). Moreover, he argued to the Court that his theory of

traumatic memory was derived from a new theoretical paradigm that clarified how the part of the brain that stores memories of traumatic stress—the “limbic system”—cannot be directly accessed absent an effective trigger-- sometimes for decades. The point of a Daubert Hearing is to determine if a proposed expert witness should be allowed to testify to a jury at trial that their opinion testimony about the case at bar is true “to a reasonable degree of scientific certainty.” Astronomy can pass that test; astrology cannot. The Court ruled in favor of van der Kolk and his scientific theory of repressed and recovered memory, to no small effect: it has cost the Catholic Church in lawsuit settlements more than \$4,000,000,000.¹⁰ And that is just in the United States. Add to this enormous outlay of cash the fact that scores of Dioceses that have had to file for bankruptcy, and also that the Church has paid additional billions in legal fees. More recently, many states have enacted “lookback” statutes that make exceptions in their statutes of limitation for such cases, which means there are thousands of additional plaintiffs filing new cases, and that this same phenomenon is occurring throughout Europe, and you can get some idea of why the Church is no great fan of van der Kolk’s work.

Galileo’s heliocentric model of the universe, Darwin’s theories on evolution and the descent of mankind, and Freud’s early work on hysteria all met similar sociopolitical opposition, each in their own way. What is clear in their cases—and in van der Kolk’s-- is that entrenched defenders of the *status quo* – whether scientific or religious—are often no more easily displaced than are entrenched soldiers on battlefields, and it follows that introducing a significantly innovative new paradigmatic approach in a scientific field all too often resembles a protracted military campaign.

VAN DER KOLK’S USE OF CONTEMPORARY BRAIN SCIENCE:

THE LIMBIC BRAIN

The Body Keeps the Score begins with a brief but important exposé of the structure and functionality of the limbic brain precisely because van der Kolk’s viewpoint is that there is no way to understand how traumatic stress works—or how clinical treatment of trauma victims might possibly be effective—if one fails to distinguish the limbic brain from the cortical brain. Without this distinction, one cannot perceive that traumatic memories are stored as sensations and emotions in the limbic brain—not as articulated ideas in the cortical brain. The memory function of the cortical brain—of the prefrontal cortex in particular-- is what we mean by memory in everyday parlance. “Dad,” my son called out years ago running into my home office, “I’ve done it: I’ve memorized the capital cities of all the states.” Formulation of that announcement—and his accomplishment itself—all took place in his cortical brain.

In contrast, the memory functions of the limbic brain that record the sensations and emotions present at the time a trauma victim experiences their traumatic stressor, operate in an entirely different manner. It is, accordingly, hardly a surprise that memory recall works quite differently in these two entirely distinct areas of the brain. Cortical memory is worded; that’s why we make up word schemes to help us remember peoples’ names, or facts we need to recall for an exam. In contrast, limbic memory consists of recorded sensory data: sights, and sounds,

and smells, and textures. It operates quite similarly for other animals, especially other social mammals. In the talk from this essay I will give at the 34th annual conference of the Trauma Research Foundation, it's at this point that I will show PowerPoint visuals of wild animals reunited with the humans who raised them, and these photographs clearly demonstrate how the limbic brains of simian primates—but also of lions, cheetahs, bears, camels, and even wild wolves --retain the closeness and immutability of the bond these animals had formed with their human caretakers. Even after years of separation, these greatly varied social mammals physically embrace their cherished humans no differently than would another human. These photographs demonstrate that the limbic brain—and its memory functions—long predate the appearance of the enhanced cortical brains that later in evolutionary history were to take their place atop the ancient limbic brain in the hominid skull.

THE UTILITY OF DISTINGUISHING THE LIMBIC BRAIN FROM THE CORTICAL BRAIN IN INQUIRIES OTHER THAN THOSE OF TRAUMA PSYCHIATRY

The usefulness of contemporary brain science's understanding of the functioning of the limbic brain is far from being limited to trauma psychiatry. We know, for example, that the limbic brain functions in quite the same fashion at the opposite end of the continuum of sensory experience: it is also the part of our brain that stores our sensory memories of our most sensually pleasurable sensations. Importantly, as I shall later point out, it records and remembers our mother's soothing touch—but it also retains our memory of the exquisite beauty of Monet's impressionist paintings, the mesmerizing tunes of Beethoven's violin concerto, the pungent milky smell of young puppies, and the vanilla flavor and silky texture of *crème caramel*. You see this at work when a musician plays from memory—it's limbic memory, not cortical memory, that impels the violinist through a "memorized" musical score. The great violinist Itzhak Perlman teaches in his Master Class tapes that when learning a new score, a musician needs to practice from the score until it becomes embedded in their "muscle memory."¹¹ That is a reference to the unique capacities of the limbic brain.

But perhaps no one has revealed the role of limbic memory more succinctly—or more charmingly-- than did the Pixar Animation Studios in their delightful, animated film for Disney studios, *Ratatouille*. The film depicts the story of a rat with a penchant for cooking who lives hidden away in a French three-star restaurant. For years he observed the master chef at work, and when *le grand chef* passed away, the rat took over the cooking responsibilities by working under the *toque* of a young, skill-free assistant chef. By pulling at the boy's hair, he steers him from spice to spice, pan to pan, and together they begin to reproduce the *haute cuisine* of the deceased master chef. Their true test comes when Paris' principal food critic, the perfectly named "Anton Ego," offers the young chef one shot with one dish to prove his merit. The scene shows the famously unforgiving critic sitting alone at his table, awaiting service of whatever single dish the new chef thinks will best show off his skills. And what is he served? One of the simplest, peasant vegetable dishes in all the French culinary repertoire: *ratatouille*.

As Monsieur Ego goes to place his first bite in his mouth with his left hand, his right hand holds an expensive-looking fountain pen poised over a notepad. When he tastes the delights of the rat's culinary skills, Pixar's animated film does what perhaps no other medium could match: it shows the flavor acting as a trigger, throwing the critic back in time to when he was a five-year-old boy, being served ratatouille by his mother, who as she served it, gave him a loving stroke on his cheek. The boy smiles in delight at the depth of flavor in the rich mix of vegetables, at which point the film swooshes us back to the present, where we see Monsieur Ego exhibiting the seventy-year-old version of the same smile. But the moment I love the most, the moment that best depicts how the critic's limbic brain has taken over from his cortical brain, is that the critic's hand gently opens, allowing the fountain pen to tumble to the floor.

Allow me to give another example of the limbic brain at work in another sphere of pleasurable sensory memory. I have asked those present at talks I have given to raise their hand if they have ever experienced the following-- and I am certain that nearly every single hand went up every time I did this. And now I ask the same of you, my reader. Have you ever heard an "oldie but goodie" song from your teenage years and been instantly flashed back to when you first heard it? Did you reexperience the circumstances of your earlier hearing of that tune, and, more specifically, did you suddenly have a flash back of whom you heard it with, whom you danced to it with, and how you felt about that person?

Permit me a final example of my own experiencing of the direct and vibrant nature of the limbic brain that involves something other than its remarkably powerful memory functions for each of our senses. As an undergraduate at Cal Berkeley in the early 1960's there were certain other things that were de rigueur above and beyond reading Thomas Kuhn, Paul Goodman, Herbert Marcuse-- and knowing who Raskolnikov was. And that was experimenting at least once with LSD. My own experience took place in Marin county's extraordinary Muir Woods, where ancient and massive redwoods—surrounded by ferns that seem to come from the era of dinosaurs-- have survived thanks to the thick fogs that are periodically trapped in the sea-facing, sharply sculpted mountain valley where the woods is located. Sixty years have passed since, but I have a perfectly clear recall of the sensory experience of being among such primordial beauty with my own (Anton) ego being chemically suppressed for two or three hours. That's what psychedelics do: they quiet all the conversational noise ricocheting around in the cortical brain— if only briefly-- allowing one far more direct access to the sensory functions of the limbic brain.

The point of this discussion has been to serve as an introduction to my following efforts to apply the tri-partite brain paradigm van der Kolk uses to such great effect in his study of traumatic stress, to my own efforts to understand the neurobiology of interpersonal connection. Loneliness, in my model, is the perception of the cortical brain of the sensation of inadequate connection generated by the limbic brain. Loneliness, accordingly, is a uniquely human and hence social-psychological phenomenon, but we shall see that earlier primates and many other social mammals exhibit reactions appropriate to their species when their limbic brains warn them of inadequate connection, and hence of danger.

THE LIMBIC BRAIN'S ROLE IN BOTH ENABLING CONNECTION

AND IMPEDING LONELINESS

A Thumbnail Description of the Biology of the Homo Sapien Tri-Partite Brain

While nearly all multicellular animals have a neural concentration we can, in some cases with some significant generosity, call their “brain,” vertebrates are characterized by having a spinal column which culminates in a “brain stem.”¹² We homo sapiens have our version—sort of a clenched fist looking affair at the terminus of our spinal column, and this “reptilian brain,” as it is sometimes called, runs the myriad of interrelated bodily organs that we need not concern ourselves with, either in everyday life, or in this article. Behind the brainstem one finds a somewhat spherical construction called the cerebellum, which orients us in space – as it does all other vertebrates.

In front of and above our brainstem lies our limbic brain, which, while made up of multiple identifiable pieces and parts, operates as a bioelectric system, rather analogous to the laptop I am writing on. My laptop is also made up of many pieces and parts, but it also is useful only insofar as it operates *as a system of interconnected circuitry*. So, while there are identifiable key elements in the limbic brain (the hypothalamus, the amygdala, etc.) they cannot be thought of like organs in the body, each with a particular function. Each of them is cross wired into many differing neural pathways, and they each play their role in many different brain functions. Hence the limbic brain is often referred to as the “limbic system,” which term is intended to remind one that it is not so much an object as it is a working system. The limbic system contains bioelectric circuitry involving trillions of interconnections which act as the seat of our sensations, the locus of our sense-based functioning and memories, and the generator of the urges and impulses that cause us to do the things we need to do to survive both as individuals, and as a species. We share the morphological structure and functional activity of our limbic brain with earlier phyla, especially with other mammals, and most especially with other social mammals.

Finally, above our limbic brain, we find the various lobes and structures of the cortical brain, and most especially the prefrontal cortex—the site of language, executive planning, self-awareness, and self-identification. This is the part of the brain that spoke through the French enlightenment philosopher, René Descartes, to famously claim its own primacy, *cogito ergo sum*—I think therefore I am. The three-brain perspective, however, takes quite the opposite view, and would switch the phrasing around to, *sum, ergo cogito*. The brain, it seems clear, is an organ before it is a mind, both phylogenetically and ontogenetically. This is precisely why it is unwise to attempt to use mind games to keep yourself awake at the wheel when you are terribly sleepy while driving: the cortical brain with which you make the attempt is not in control of the limbic brain which is urging you to sleep—I had a law case once where a truck driver made just this mistake, with terribly tragic consequences.¹³

Not surprisingly, these three differing brains housed in the human skull develop at significantly different rates. The brainstem is largely fully developed at the birth of a healthy child: it is quite capable of regulating the child’s bodily functions. The limbic brain is also

functional in a normal newborn: they see, they hear, they smell, they taste. But, of course, it will take a great deal of experience and learning-- and the creation of billions of neural connections in the child's limbic brain-- to refine for the child *what* it is seeing, hearing, smelling, tasting, touching, and feeling. A fascinating experiment of just this issue involved covering kittens' eyes during a critical period in their early life. Deprived of visual experience, the necessary neural connections failed to form in their limbic brain, and when the eye coverings were removed, the grown cats exhibited a striking absence of normal visual skills.¹⁴

But while it takes years for the billions of neural connections to form in a child's limbic brain, it takes decades for the trillions of neural connections needed to form a fully developed adult human cortical brain. This differential growth of the limbic system's production of urges and drives vis-a-vis the cortical brain's imposition of rational consideration of consequences goes a long way to explaining why teenagers so often exhibit such outrageously risky and dangerous behavior. Recent neurological research has plotted the limbic system spurt of development as a shallow bell curve, which during childhood and adolescence is far advanced over the straight-line development of the cortical brain—and this period of limbic brain overlap is when impulse overcomes reason, and adolescents are most at risk.¹⁵

Years ago, I had a law case derived from the differential time it takes for the cortical brain to overtake the faster development of the limbic brain. The case involved a seemingly bright fifteen-year-old whose parents were both professors at M.I.T. The boy was with his friends on the top floor of an office building when he dropped a full soda can from a window in an attempt "to scare" an older couple walking on the sidewalk far below. The act failed to cause fright: instead, it caused injury, which led to the juvenile delinquency proceedings in which I represented the boy. When I asked him what in the hell he was thinking, with all the contrition in the world, and utter sincerity, he looked me straight in the eyes and responded, "That's the problem. I wasn't." It took me thirty years to realize how meaningful his response was.

The Evolutionary Development of Connection

Loneliness, as I have suggested, is the cortical brain's perception of the of sensation of inadequate connection generated by the limbic system. The cortical brain of many poets has waxed eloquent about love and friendship since pen was first put to paper. But the origins of the sensation of safety we feel in the presence of family and friends goes far further back in history than the first such poem, or even the appearance of homo sapiens.

I think it's fair to say that of all the survival mechanisms developed throughout phylogenetic history— massive size, armored plating, ferocious teeth, poisonous venoms – you name it—none of these ending up competing with the power of cooperative enterprise. Chance and good fortune played a role as well, no doubt— one could argue that if the dominance of the dinosaurs had not been ended by the centuries-long-winter that followed a massive meteorite strike in the Yucatan peninsula, the small and unimportant mammals of that era might never have had the chance to develop into anything of importance. But the natural history of the planet has always gone through massive climate changes with enormously impactful environmental alterations being the rule, rather than the exception. So, if we picture the background as always dynamic and seldom static, and we look at which survival mechanisms have proven to this point

in time to be the most effective against this ever-changing background, arguably nothing compares with the power of the development of the cortical brain and the wildly expanded capacity to communicate and cooperate that this has allowed.

The evidence for this is that we homo sapiens have been successful to the point where today, by entomological standards, we formally constitute an infestation on the face of the planet. But it is important to note that we are far from the first species to employ the survival mechanisms available when individuals in a species employ connection to engender cooperation. The archaeological record of earlier hominid groups that emigrated north out of Africa long before our homo sapien ancestors did so, tells us that they too relied on cohesive, family-based, small groupings. So, if we know that the earliest of hominids exhibited connection, we are led to ask just how far back this survival mechanism goes in evolutionary history.

We now have abundant research documenting the fact that connection as a survival mechanism extends well back beyond primates to many species of social mammals such as dolphins, whales, and the other cetacean mammals.¹⁶ Elephants and hyenas also live, hunt, and frolic when young in close knit family based networks.¹⁷ Above and beyond the evidence of connection and cooperation in mammalian species that predated the appearance of hominids, there is growing evidence that natural selection often favored species in earlier phyla that exhibited some degree of inter-individual cooperation.¹⁸ Moreover, we now understand that the hormonal secretions that play an important role in human connection, such as oxytocin, the so-called “love-hormone” that is present in both human mothers and babies during breast-feeding, also play a similar biochemical role in other social mammals. Studies of voles have shown that oxytocin strengthened all forms of attachment—above and beyond the attachment between mother and off-spring and between mother and her mate.¹⁹ Other studies have shown that it is possible to manipulate a mouse’s genetic structure so that it no longer produces oxytocin, and that subsequently the mouse’s established social relations with its mate and cage-mates fall entirely apart.²⁰

Research into the prevalence and importance of connection in the lives of our closest primate cousins, chimpanzees and bonobos, is even more convincing that not only is sociability the key to primate survival, but also that is biochemically based and thereby heritable. These primates live in social systems characterized by tight and selective social bonds based in part on family relations, but also on choice, and in addition these extra-family social bonds can be adjusted by changing “social” circumstances.²¹ That sounds familiar, doesn’t it? Moreover, studies have shown that the better integrated and connected a female baboon is, and the larger and more extended her circles of female intimacy are, and the better was her reproductive success.²²

Other research into our primate cousins, from whom we are separated by some seven million years, shows that their sociability varies between individuals-- within any of their species. It turns out that all primates have—and presumably need-- friends and allies, and that within each of these species, there is significant variation between individuals as to their capacity to form and keep such alliances and relationships. And the primate equivalent of “friendship” is important: research has shown that bonobos’ friends and allies serve to buffer stress, just like human friendships. The better bonobo individuals are at forming connections, the longer they

live and the more offspring they have. These studies have shown that the skills that allow a simian primate individual to make these kinds of connections are biologically based, and thereby heritable.²³

I doubt whether the late nineteenth century saying—quite an insight at the time—that “ontogeny recapitulates phylogeny” is heard much these days, but it still bears a certain degree of truth. The reference was, I believe, to certain morphological developments in a human embryo that appeared to reflect earlier stages of evolutionary development— briefly present gill-like structures, for example, that suggested the long-ago times when our ancestors swam in the seven seas. But whatever grain of truth might lie in such observations, the old saying certainly rings true with respect to how each human infant goes about building out the trillions of neural connections that will interconnect its billions of nerve cells into mature limbic and cortical brains. So, let’s now turn to a brief exposé of that process, and how interlinked it is to the development of sociability in the human child.

The Development of Neural Connectivity and Social Connections in a Human Child

Neurological research has advanced by leaps and bounds in recent years, and now neurologists have equipment that allows them to peer unobtrusively through the skull and into the brain. One area of brain research that has advanced particularly significantly concerns the process by which neuronal development takes place in early childhood.²⁴ We now know that in the very first few months of life there is an explosion in both the number of brain cells and the process of cellular connecting between them beginning the process of establishing the interconnective neuronal networks that will form both the limbic and cortical brains. These cellular interconnections in a baby’s developing brain get laid down at the rate of as many as a million per second.²⁵ Neurologists have also significantly advanced their earlier understanding of how the brain’s biochemistry operates to reinforce those neuronal pathway developments that experience repetitive use. (Hence the saying, “Neurons that fire together, wire together”.) This process operates through nerve cells releasing what are sometimes referred to as the “happiness hormones”: oxytocin, the endogenous endorphins, dopamine, and serotonin all of which serve to positively reinforce the formation of species-preserving neuronal pathways, while at the same time other nerve cells release stress hormones such as cortisol to discourage the formation of disadvantageous neuronal pathways.²⁶

A great deal of this intercellular creation of neuronal pathways occurs as the child’s brain works to interpret the life with which the child is confronted—to learn, for example, that the world is three dimensional, or that objects have not disappeared and reappeared when they move across the visual field-- and hundreds of thousands of other orienting lessons that the child’s unimaginably active brain is teaching itself. But the part of the infant’s intercellular neuronal linking—learning on a cellular level-- that concerns us in our discussion of social connection, is the neuronal patterning processes in the limbic brain that are engendered by the child’s mother (or parents, if both are actively involved in the early days). When I ask people how many kisses and nurturing, soothing, and calming hugs they shared with their young children, they invariably answer with something like, “Oh, a million. Easily a million.” And add to this a mother’s nursing, where the unmatched softness of her breast is experienced simultaneously with both

the intake of warm milk and the secretion of oxytocin. In humans-- and to a significant extent in other social mammals as well—these successive, repetitive, waves of soothing, nurturing pleasure experienced by the nursing offspring is the beginning of sociability. It is, in other words, the beginning of training the human child's brain— if only on a neuronal level at first-- to associate warm, calming, soothing touch (and the peacefulness that follows a full tummy of warm milk) with *safety through connection*. Not surprisingly, one study found that human mothers' voices on the phone could calm their young children by measurably reducing their cortisol levels, and that this effect was even more pronounced if the mothers were present in person to add soothing touch to their comforting voice. Over the first three years in the life of a human child, there is a steady and robust process of neuronal specialization that trains the child about the benefits of being social.²⁷

After the critical role played by affectively normal parents in stimulating the formation of the neural pathways that will both motivate and equip their children to seek the soothing effect of friendly interaction with other children, human children—like mammalian young of many species—further build out their neuronal pathways of connection by playing with other children. Free play is enormously important for mammalian young, and the larger a mammalian brain is relative to body size, the more a species exhibits development play.²⁸ By the age of five, play helps human children begin to develop cognitive empathy—the ability to take the perspective of the other. This allows children in the greatly elongated human developmental process to make use of their play to develop ever increasing aptitudes in forming and developing peer relationships, all the while etching new neuronal pathways as they learn the myriad of skills it takes to form differing relations with a variety of playmates and schoolchildren, how to avoid interaction with bullies and aggressive children, and so on.²⁹ Play for children of all mammalian species, but particularly for human children, is an enormously important biological process in that it furthers the production of neuronal pathways of connection in ways that parents cannot contribute after the early years.³⁰ Other studies have shown the long-term effect on children who for various reasons do not have the opportunity to play and learn these skills through childhood relationships; these children are at increased risk for anxiety, depression, and low self-esteem.³¹ Needless to say, the nearly two years of peer play lost by many of the world's children during the recent Covid-19 pandemic will take its toll on many children.

Where I live by the sea in Massachusetts, summertime brings many an osprey to nest in the tallest of trees—or on a phone pole if necessary. These massive birds are the size of small eagles, and their yearly patterns of raising and training their young are easily observed. They have only three months to teach the young how to fly and how to catch their only prey: fish. About halfway through that period, I am treated each year to the quite comical efforts of the fledglings as they learn to flap their young wings while standing on the edge of their nest. The parents exhibit remarkable patience flapping their massive four-to-five-foot wingspan in slow motion to exhibit—apparently—how to flap correctly. Training the youngsters to dive into the sea and come up with a fish in their talons is yet another comical lesson they impart with remarkable perseverance. I mention this because flying and fishing are precisely what a young osprey *must* learn to survive, just as human parents *must* train their toddlers to connect and search soothing, calming relations with others if their children are to thrive in the social framework they will enter as they gradually, step by step, move out from their nest—the family home.

Compared to other mammals, including all other primates, childhood among humans is exceedingly extended. The limbic brain in non-primate mammalian species quickly generates the newborn's basic neuronal connections: many mammals must stand and be able to walk within a matter of days, some within hours. Our closest living primate relatives—chimpanzees and bonobos—are limbic adults, and sexually mature, in roughly half the time it takes human young.³² So, we homo sapiens are extreme outliers in the slowness of our maturation in every way-- including in the development of the brain. But while this slow march toward homo sapien viability burdens the parents—and imagine the degree of that burden thousands of years ago when the world was a far more dangerous place for small, helpless human children—the extremely slow rate of development of the human brain clearly had an evolutionary pay off. In other words, the cost (the significantly elongated burden placed on parents—and the loss to predation and accidental death of what must have been an appreciable percentage of children) was outweighed by the benefit (the time that was needed for the trillions of cellular interconnections required to form adult limbic and cortical brains).

What might we surmise was the operative advantage that selected in favor of those hominid groups that delayed adulthood? Presumably, it was that the extra maturation time allowed for the enriched neuronal circuitry in the human limbic brain that permitted increased sociability, thereby allowing ever more sophisticated communication, coordination, and cooperation. At the same time, the elongated maturation period allowed the cortical brain to thicken and make room for the development of infinitely richer interconnective circuitry, thereby allowing ever more plasticity, creativity, and innovation. Taken together, this meant that ever larger groupings of hominids created and employed ever better tools and weapons in increasingly more inventive ways. This changed everything. Whereas earlier, smaller groups of hominids such as homo floresiensis and Denisovans stood in the face of nature—and perished from the Earth—now nature stood increasingly in the face of ever more numerous and better equipped hominids. By 40,000 years ago all earlier hominids, including even our nearest hominid cousins with whom we could and did interbreed-- the Neanderthals-- had perished. Only one species remained: homo sapiens. By this point in time, we had created enough advantage in our remarkable brains to overcome the costs associated with the abnormally long maturation period our brains required. In turn, our significantly enhanced limbic system and our revolutionarily expanded cortical brain permitted the development of the complex sociability and inventive creativity that would soon allow us to thrive in radically different environments as we rapidly spread across the planet.

Connective Success, Better Health, and Longer Life

As discussed above, the limbic brains of affectively soothed, stroked, smiled at, calmed, cared for—in short, loved—babies create the neuronal pathways of connection that serve to both motivate and enable human children to set out as toddlers in early attempts to connect with others. As they age, their play with peers furthers this process of reinforcing their neuronal pathways that will permit ever more powerful friendships to develop, which, when puberty appears, leads to “crushes” and ever more emotionally loaded early efforts at what will develop into mate selection. Except for the recent capacity of neurological science to explain what's

behind this familiar scenario, there certainly is nothing new whatsoever in laying out the cycle of life so visible to us all.

But now we have solid evidence that successful progression along the pathway described above is strongly associated with better mental and physical health. Studies have shown that it is extremely unhealthy to have few connections with others, or unrewarding connections—on par with other health stressors such as heavy smoking, obesity, and a sedentary lifestyle.³³ Looking at this the other way around, do we have objective evidence that chronically lonely persons exhibit poorer health or shortened lives as a direct effect of the inadequacy of their connectivity with others? Let's review some of studies that for the better part of a century have attempted to answer this very question.

Back in the 1940's, a fascinating study was designed to uncover whether, and to what extent, the presence of an attentive mother was critical for the healthy development of her child. The study followed 164 children for the first year of their life; 61 of the children were cared for by nurses in a traditional orphanage; the rest lived with their birth mothers in various settings. At the end of the year, there was a distinctly clear differential between the two groups: the orphanage babies had deteriorated notably, exhibiting a markedly greater susceptibility to infection and illness. The delta between the two groups was so extreme that the study was extended for two years to follow the institutionalized children through their toddler years. At the end of that period, the study found that the institutionalized children's mental development was severely delayed, and 37% of the original orphanage babies had died.³⁴

Back in the 1990's a significant percentage of babies adopted in the United States were of international origin, a great many of whom came from China. Then, quite suddenly, the Chinese government determined to end this practice, causing panic in American adoption agencies that had no other sources to fill the gap this created between supply and demand. Five of my adoption agency clients formed a consortium to deal with the crisis, and because of a happenstantial relationship I had with an American who had lived in China for over forty years and who had at one point been very close to Mao Tse Tung and Zhou Enlai³⁵, they tasked me if I might do what I could to rectify the situation. Indeed, this contact of mine was able to set up a meeting in Beijing for me with a ministerial level state official who had the authority to override this change in policy. Three weeks later, I visited three Chinese state orphanages, met with the minister, and pleaded my clients' case. Happily, the policy was indeed reversed. But what is relevant for our discussion is the visit I paid to two of these orphanages, the first of which was in Beijing. The orphanage housed thousands of children, who, apart from a few boys with cleft palates, were all little girls, seized by the state or abandoned by their parents because of the then strictly enforced "one child rule."

The enormous building that housed the orphanage had the children divided by age, and as long as I live, I shall never forget the three rooms that held cribs for the babies. Each room was the size of an airplane hangar, and the cribs were laid out in neat rows. I would estimate that each room held in the magnitude of two-hundred cribs. At the time of my mid-morning visit, most of the babies were awake. What struck me was how remarkably quiet they were—very unlike my grandchildren, who, when they awakened, immediately insisted upon being held. I asked my translator if she would inquire if I could hold a few of the children, and the answer was

an enthusiastic “Yes, of course.” We have all held babies who don’t know us, and at least my experience has been that they have almost universally protested— loudly. But the three or four of these institutionalized babies that I held neither objected nor related to me; they seemed affectively neutral. This reaction—or lack of reaction—puzzled me, and I posed the same request at the two subsequent orphanages that I visited. The first, in Hangzhou, declined my request, while the second, in Shanghai, agreed to again let me hold four different babies. Three of the four babies I held in Shanghai exhibited an identical degree of affective neutrality. While my brief experience certainly does not constitute science, it was entirely consistent with our earlier discussion of how babies learn to connect-- and with the studies discussed and cited above.

So, what additional evidence is there that successful connection with others is protective of mental and physical health, and predictive of longevity? We know that the calming effect of spending time with a close friend is entirely measurable: it lowers our stress response, lowers our cortisone level, lowers our blood pressure, and increases the expression of our immune cells.³⁶ A 2010 meta-analysis combined 148 studies with data on 308,000 people and reported a 50% increased likelihood of survival for those with stronger social relationships.³⁷ Studies of widows and widowers who live in neighborhoods with other widows and widowers show them to live longer,³⁸ as do those who live in a communal setting who find themselves enmeshed in tight networks of family and friends.³⁹

Good health and a long life are indisputably good things, but what do we know about whether well-connected, older survivors indeed remain happy during their extra years? One large-scale study found that having strong family relationships correlated well with life satisfaction in later years, while having solid friendships had an even stronger predictive value with age increase.⁴⁰ Two quite famous studies give us additional evidence on this issue. The Framingham heart study found that the happiest people were those with the most social connections.⁴¹ But perhaps the single most fascinating of all such studies is the nearly ninety-year-old longitudinal study launched in 1937 by a medical doctor at Harvard, Arlie Block, M.D. The study, often called the “Waldinger Study” after its’ current supervisor, followed a sizable cohort of Harvard graduates throughout their lives, finding that “The clearest message we get from this 75-year study is this: good relationships keep us happier and healthier. Period.” As you might imagine, the Harvard men followed in the study experienced, on average, disproportionate financial and worldly success in their lives, but these accomplishments did not correlate nearly as strongly with reported happiness as did high quality interpersonal relationships.⁴²

Again, looking at connection the other way around, i.e., at loneliness, what evidence is there that loneliness— defined as few or low-quality relationships—leads to excess health problems and a shorter life span? The late University of Chicago Professor, John Cacioppo, used the UCLA Loneliness Scale, which we shall look at in the final section of this essay, to identify chronically lonely persons, and found that lonely older persons had significantly higher blood pressure than their well-connected peers.⁴³ Another study concluded that the lonely were significantly more likely to show cognitive decline and had a greater risk of developing dementia.⁴⁴ A recent study concluded that people with strong support systems did significantly better with respect to the frequency and accuracy of cell reproduction, levels of inflammation,

cellular aging, and coronary artery calcification.⁴⁵ We now know that there is a genetic fingerprint of loneliness: genes in the white blood cells of the immune system, called leukocytes, are expressed differentially in lonely persons as compared with well-connected persons. In the loneliest subjects, genes that governed inflammatory responses were up-regulated (i.e., more likely to be expressed), while those that handled antiviral response were down-regulated, or less likely to be expressed.⁴⁶

Another particularly insightful study by Professor John Cacioppo and his colleagues found a way to actively create an equivalent of loneliness in experimental monkeys to test if this would influence their immune systems. The study created stress in monkeys injected with SIV (simian immunodeficiency virus--the simian equivalent of HIV) by removing them from cages where they were fully integrated with long-term mates and peers and placing them in cages where they were ill-treated as invaders. The findings were clear: their SIV replicated significantly faster than was the case with the control monkeys.⁴⁷ This study shed light on the previously known fact that HIV progressed significantly more quickly in closeted gay men than in their fellow HIV victims who were openly gay: the only difference that could be identified was the additional stress experienced by the former group given that their progressing illness would soon expose what had previously been their private sexual preference.⁴⁸

The expertise on HIV and SIV in the above referenced study was provided by UCLA Professor Steve Cole, a genome specialist. The following quote of Dr. Cole—to my mind-- bears a great deal of weight as to why the health of those who are afflicted with chronic loneliness is so compromised: “When we looked at the genes that were under-active in the white blood cells of lonely people, [they were] chock full of genes involved in the antiviral response that I just happened to have been studying for the last ten years. I looked at all those things and I was like, Holy Cow! No wonder these people get sick more often. This is a recipe for disease.”⁴⁹ And Professor Cole adds to this grim outlook on the etiology of loneliness: “Quiet suffering may be how people experience loneliness, but at the molecular level it ranks right up there with poverty, trauma, [and] bereavement.... loneliness is one of the most effective ways we know to make a body feel threatened and insecure.”⁵⁰

Taken together, these studies show clearly that social isolation—loneliness-- is associated with, and likely causes, stress, inflammation, immune system dysregulation, higher blood pressure, vascular system calcification, overactivity in the sympathetic nervous system, up-regulation of inflammatory genes, and down-regulation of viral protection. It is, accordingly, not at all surprising that those among us who suffer either unwanted social isolation or thoroughly unfulfilling social relations, are overrepresented in morbidity and mortality statistics when compared to those of us whose adult social networks provide much of the soothing, calming support that our parents loving touch provided us when we were young children.

IDENTIFYING CHRONICALLY LONELY PERSONS IN YOUR CLINICAL PRACTICE

I am pleased to report that we are blessed with a long-since proven valid and reliable tool, the UCLA Loneliness Scale, Version 3.⁵¹ This twenty-item scale is designed to measure a

subject's subjective feelings of social isolation, and it is written to be straight forward and easy to read and comprehend so as to increase its availability to all educational levels. The Scale has been shown to have "...high internal consistency (coefficient alpha = .96) and a test-retest correlation over a two-month period of .73.⁵²

As you can see from the Scale, reproduced below, participants are asked to rate their personal reaction on each of the questions on a scale from 1 (Never) to 4 (Often). This remarkable tool allows clinicians to learn a great deal about the level of connectedness of a client who presents with potential issues of disconnection or misconnection. In addition, having a client retake the Scale over time should produce feedback for both the client and their clinician as to the effectiveness of any ongoing clinical counseling.

As for interpreting the numerical scores of clients, clinicians must take note that almost half of the questions are reverse scored. Please go to my website, *thelonelinessbooks.com* and click on Articles. Then choose the article entitled "Chronic Loneliness and What You Can Do About It," where page 3 discusses the scoring system and the suggested scale for the interpretation of the respondent's numerical scores.

THE UCLA LONELINESS SCALE – Version 3

UCLA LONELINESS SCALE - VERSION 3*				
Statement	Never	Rarely	Sometimes	Often
1. How often do you feel that you are "in tune" with the people around you?	1	2	3	4
2. How often do you feel that you lack companionship?	1	2	3	4
3. How often do you feel that there is no one you can turn to?	1	2	3	4
4. How often do you feel alone?	1	2	3	4
5. How often do you feel part of a group of friends?	1	2	3	4
6. How often do you feel that you have a lot in common with the people around you?	1	2	3	4
7. How often do you feel that you are no longer close to anyone?	1	2	3	4
8. How often do you feel that your interests and ideas are not shared by those around you?	1	2	3	4
9. How often do you feel outgoing and friendly?	1	2	3	4
10. How often do you feel close to people?	1	2	3	4
11. How often do you feel left out?	1	2	3	4
12. How often do you feel that your relationships with others are not meaningful?	1	2	3	4
13. How often do you feel that no one really knows you well?	1	2	3	4
14. How often do you feel isolated from others?	1	2	3	4
15. How often do you feel you can find companionship when you want it?	1	2	3	4
16. How often do you feel that there are people who really understand you?	1	2	3	4
17. How often do you feel shy?	1	2	3	4
18. How often do you feel that people are around you, but not with you?	1	2	3	4
19. How often do you feel that there are people you can talk to?	1	2	3	4
20. How often do you feel that there are people you can turn to?	1	2	3	4

Alright, now let's talk about totaling your score. It's a bit more complicated than just adding up the numbers, because the following questions are reverse scored: 1, 5, 6, 9, 10, 15, 16, 19, and 20. So, for these nine questions, if you circled "1," on a separate sheet of paper, give yourself a "4," if you circled "2," give yourself a "3," if you circled "3," give yourself a "2," and if you circle "4," give yourself a "1." Total the new scores. Add to this the total of your circled scores on the other holes.

Just to make certain this is clear, after making the "reverse score" changes on the nine questions listed above, (indicated below by an asterisk) the loneliest person on the planet would have the following scores on questions 1 through 20, in order: *4, 4, 4, *4, *4, 4, 4, *4, *4, 4, 4, *4 and *4. So, this fictional loneliest person would have a total score of 80, while a person who considers himself to be a genius of connective skills, would have a score of 20. Your score, my score—everybody's score—falls somewhere in between, because the questions are designed to probe the different levels of confidence each of us has in our connective capacities, and few among us—if any—live their life utterly confident that they are always in tune with everyone they know, that they never lack companionship or feel alone, that they are always outgoing and friendly, and so on.

*The Russell, D., Pezalla, L. A., & Ferguson, L.L. (1978). Developing a Measure of Loneliness. *Journal of Personality Assessment*, 42, 290-294. Russell, D., Pezalla, L. A., & Cutrona, C. E. (1988). The Revised UCLA Loneliness Scale: Concept and Descriptive Validity Evidence. *Journal of Personality and Social Psychology*, 55, 472-480. Mukherjee, K. Y. A., S., & Gleason, M. E. J. (2002). Relationship Formation on the Internet: What's the Big Attraction? *Journal of Social Issues*, 58, 9-31.

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But the good news for clinicians looking for analytical tools to be of use as they work with clients who present with chronic loneliness does not stop here. An equally stunning analytical tool has been developed by psychiatrist Amy Banks, M.D.; it allows participants and their clinicians to gain an extraordinary wealth of insight into the specifics of the quality of the connectedness experienced by respondents in their relationships with others in their lives.⁵³ I

strongly suggest that before clinicians considering using Dr. Banks’ “Relational Assessment Chart,” which is reproduced below, they read her brief but insightful book before using the Chart to work with clients on how they are experiencing the quality of their connections with others. I say this because the Chart is best understood in the framework of its derivation from a coherent theory of interpersonal connectivity that is based on an analysis of four rewarding returns that can be derived from successful interpersonal relationships: Calm, Acceptance, Resonance, and Energization. Each of these, in effect, designates a continuum of return, depending on the quality of a relationship:

- Calm (neutral) Stress
- Acceptance (neutral) Rejection
- Resonance (neutral) Misunderstanding
- Energization (neutral) Indifference

Given the many studies previously discussed and cited, there is abundant evidence that a relationship wherein one feels calm, accepted, understood, and energized is a boon for one’s psychological and physical health-- in sharp contrast to a relationship that engenders stress, and makes one feel rejected, misunderstood, and numb. The reality, however, is that most honestly judged relationships fall short of perfection on one or more of these continua for several reasons, including the fact that while we get to choose our friends based on their compatibility, we do not get to choose our work associates, our neighbors, our in-laws, and so on. Moreover, we vary significantly in our individual connective skills, so even our relationships with those whom we elect to relate to, we do not always find ourselves totally compatible in everything we do with them. Such is life.

What is important in working with a client to improve both the quantity and quality of their connections with others, is that both the clinician and the client have an analytical tool that enables and promotes an honest assessment of just where the client stands along these four continua in each of their principal relationships. Enough said: here is Dr. Banks’ Relational Assessment Chart:

RELATIONAL ASSESSMENT CHART

By Dr. Amy Banks, M.D.

RELATIONAL ASSESSMENT CHART*

Answer the questions on a 1 to 5 scale:	Name #1	Name #2	Name #3	Name #4	Name #5	Total Statement Score	C.A.R.E. Code
1-None or never							
2-Rarely or minimal							
3-Some of the time							
4-More often than not; medium high							
5-Usually, very high							
1. I trust this person with my feelings.							Calm
2. This person trusts me with his feelings.							Calm
3. I feel safe being in conflict with this person.							Calm
4. This person treats me with respect.							Calm
5. In this relationship, I feel calm.							Calm Accepted
6. I can count on this person to help me out in an emergency.							Calm Accepted
7. In this relationship, it's safe to acknowledge our differences.							Calm Accepted
8. When I am with this person, I feel a sense of belonging.							Accepted
9. Despite our different roles, we can trust each other as equals.							Accepted
10. I feel valued in this relationship.							Accepted
11. There is give and take in this relationship.							Accepted
12. This person is able to sense how I feel.							Resonant
13. I am able to sense how this person feels.							Resonant
14. With this person I have more clarity about who I am.							Resonant
15. I feel that we "get" each other.							Resonant
16. I am able to see that my feelings impact this person.							Resonant
17. This relationship helps me be more productive in my life.							Energetic
18. I enjoy the time I spend with this person.							Energetic
19. Laughter is a part of this relationship.							Energetic
20. In this relationship, I feel more energetic.							Energetic
Safety Group Score							

*Reprinted with consent of author. See Amy Banks, M.D. with Leigh Ann Hirschman. *Wired to Connect: The Surprising Link Between Brain Science and Strong, Healthy Relationships.* Jeremy Tarcher / Penguin (2015). P. 95, ff.

Participants answer each question by responding on a scale of 1 (None, Never); 2 (Rarely, Minimal); 3 (Some of the time); 4 (More often than not); 5 (Usually, Very High). To answer, the respondent must have a specific relationship in mind, since the responses are particular to that one relationship. Subsequently, the respondent can proceed to grade the quality of the connection they have with other important people in their life.

The elegance of this relational assessment tool is that it can be read in two directions. Assume, for illustration's sake, that a clinician has worked with his client to methodically go over each of the twenty questions to collectively come up with accurate responses for the one of the client's principal relationships. The mutually derived numerical answers fill column #1 from top to bottom. By adding the numerical answers at the bottom of the column, and then comparing the derived number to a scale worked out by Dr. Banks, both the clinician and their client will derive an accurate picture of the quality of the client's perception of the quality of the relationship under review.⁵⁴

Now imagine that the clinician and the client repeat this process for a second time to review a second of the client's important relationships and put the twenty answers down column #2, and then repeat the process for a third, fourth, and fifth relationship, with scores placed, respectively, in columns #3, #4, and #5. With this information, besides being able to judge each of the relationships at the bottom of each of the columns, the clinician and the client will have information as to the overall connectivity of the client to the principal people in their life.

But above and beyond the usefulness of this relational assessment tool as discussed above, one comes to appreciate its' elegance in that it can be read in an entirely different manner if multiple relationships are analyzed for a given respondent. Namely, it can be read *sideways*

across the rows. This allows both the client and their clinician to assess how the client is doing *across* their principal relationships with respect to each of the twenty questions. For example, if a respondent answers the first question “In this relationship I feel calm” with “Never” for all of their key relationships, the patient would be reporting that they do not have even a single emotionally calm, safe-harbor relationship available to them. This “across-relationships” potential use of the Chart would seem to be a powerful analytical tool: a great deal of important information would be revealed about the overall quality of the connectivity present—or absent—in the respondent’s life. So, what is a therapist to do with such potentially revealing information? That is the topic of the final section of this essay.

CLINICAL WORK WITH THE CHRONICALLY LONELY: THE TEAM APPROACH TO RELATIONAL COACHING

To the extent the sensation of loneliness is generated in the limbic brain, it follows that treatment strategies for helping chronically lonely clinical clients will need to be designed to account for this fact. What we have learned from van der Kolk and his colleagues from their efforts to treat traumatic stress victims is that they face precisely the same challenge in their efforts to help a client move on from their traumatic stress: how might a trauma therapist go about communicating with that part of the human brain that is not language based? Sometimes, words just don’t do the job. You can read a poem about a rose, but it doesn’t bring up the aroma. Or think about those useless 3 x 5 cards one sees pinned up in wine shops that purport to describe the flavor of a wine: “a hint of raspberry.” How does that help? I certainly know a raspberry when I smell or taste one, but saying, hearing, or reading the word “raspberry” does not—*because it cannot*-- bring the flavor of the fruit to my pallet or its’ aroma to my nose.

Accordingly, successful clinical strategies for treating chronic loneliness must be able to go where words cannot go. They will need to communicate through sensory and somatic input. This doesn’t mean that words can play *no* role; it just means that they cannot by themselves work to bring about the changes that are needed in the neuronal pathways of connection in the client’s limbic brain. Perhaps this becomes clearer if we consider for a moment an extreme case of necessarily wordless limbic brain reform: bringing home from the pound and rescuing a horribly mistreated dog. While dogs certainly respond to the *tone* of the human voice, they do not respond to the *content* of your language. This is because their consciousness is almost entirely a function of their limbic brain—and the limbic brain for dogs—as for humans—does not process language. Let’s assume the dog you are rescuing was beaten and kicked in the worst possible way, and that it was raised in an outside cage without ever being allowed inside a human home. (By the way, I once posed this example to van der Kolk and asked if this hypothetical dog would be in pretty much the same limbic brain circumstances as a deeply traumatized person, and without any hesitation he responded “yes, indeed.”⁵⁵)

So, how would you go about training your new pet that because its circumstances have completely changed, it should cease its cowering, cringing, and trembling? Phrased differently, how would you go about rewiring its limbic brain's neuronal connections to the point where, when you reached out your hand, it would no longer flinch and recoil, but instead would come forward to savor the petting you were offering? The only strategy you would have beyond your soothing tone of voice would be somatic interactions. You would pet, you would groom, and you would nuzzle close with your new pet. You might decide to feed the dog while continuing your gentle and reassuring touch to train it on a neuronal level to associate the comfort of satisfying its hunger with the pleasure of your soothing touch. You might decide to let it sleep inside, perhaps even in your bedroom.

While a clinician most certainly cannot pet his lonely client back to a tolerable level of connectivity with others in the client's life, there are nevertheless lessons to learn from the hypothetical dog rescue example cited above. Namely, you need to get the client's body and bodily sensations involved in the treatment process. Van der Kolk, in suggesting treatment techniques that might prove useful in working with trauma victims, makes the same point. In fact, fully the final third of *The Body Keeps the Score* is devoted to discussing early-stage developments in this sphere. Some of these techniques involve helping the traumatized client to "inhabit [their] body" through yoga and aiding the client to "find [their] voice" through communal rhythms and theatre. The general logic of requiring sensory and somatic involvement in treatment should play out the same for both trauma and loneliness victims, because both traumatic stress and the sensation of loneliness are limbic brain matters. The limbic brain doesn't listen-- it just hears. And it feels. And it tastes, and it fears, and—for all social mammals, and especially for the most social of all social mammals-- it senses disconnection and warns of danger by generating feelings of anxiety about excessive disconnection. Just as you can't do talk therapy with a client who doesn't speak your language, you can't do clinical counseling for chronic loneliness with a part of the brain that also doesn't speak your language.

I do not mean to completely conflate viable treatment techniques for traumatic stress with those likely to prove effective in working with clients who present with chronic loneliness, because these two limbic-brain-based dysfunctions are very different. Traumatic stress is the limbic brain's reaction to violent stressors, while chronic loneliness is the cortical brain's awareness of feelings generated by the limbic brain of excess disconnection. These feelings are entirely parallel to the feelings of hunger and thirst—all of them are the limbic brain's call to action, each in their respective sphere.

What follows is just a quick sketch of what one potential clinical approach designed to work with chronically lonely clients might look like. Clearly, what is called for is the development by experienced clinicians of a panoply of clinical approaches to helping clients connect more rewardingly with others in their lives, just as van der Kolk and his colleagues set out to identify a set of viable approaches for clinicians to use when working with victims of traumatic stress.

THE TEAM APPROACH TO RELATIONAL COACHING

Step One:

Explaining the Team Approach

Almost by definition, a relationally impaired chronically lonely client lacks the ally they would need to even have a chance of leveraging their way into relational competence. At least in this aspect of the clinical relationship (i.e., the client might present with additional issues for which other clinical treatment logics might take precedence), my suggestion would be that the clinician explain to their client that they will be serving as an ally, as a team member, as a coach.

There is an analogy for the clinical relationship that I want to suggest: the crime of conspiracy, and it might well be worthwhile for the clinician to share this analogy with their client, because it emphasizes the raw power that a well-thought-through conspiracy wields. If two or more individuals plot and plan together to accomplish a criminal act, from a criminal statutory point of view, they have committed *two crimes*, not one. They can be separately indicted for both crimes, tried for both crimes, and sentenced for both crimes. Why does the law take such a tough position on conspiracy, and why does it extract a double toll? The answer is clear: when strategic planning is added to criminal intent, the ensuing criminal act is far more likely to be successful.

While it is illegal to conspire with another party to commit a crime, it is not at all illegal to conspire with a client to work together as an active team in both reviewing the client's relational status, and in planning strategies and designing and practicing tactics aimed precisely at helping the client take real-world action aimed at improving their relational status in life. Another image that might prove useful, perhaps especially for sports-oriented male clients, is to envision the clinician as “the coach on the sidelines” -- while the client is “the player out on the field” carrying out the mutually determined strategies with mutually planned (and even rehearsed) tactics. In sports, the coach can help a player train, plan strategic approaches, and design and practice associated tactics-- but only the player is on the field—only the player can score. And that real-world, physical involvement of the client in this suggested clinical approach is *precisely* what distinguishes this approach from pure talk therapy.

Assume, for example, that the client and the clinician determine that the client's network of relationships has been numerically reduced over time, and that the client is anxious about putting their ego and self-worth on the line by trying to strike up new relationships-- often because past efforts have led to failures and rejections. Assume further that the clinician and the client work on expressly this issue and develop specific strategies, and associated tactics. One could argue that nothing distinguishes this approach from traditional talk therapy—*until the client takes the leap, and, to speak metaphorically, rings the doorbell*. It is the client's real-world efforts that can potentially make the difference; that is what I am getting at with the suggested team approach.

Step Two:

Managing Expectations

I know from practicing law, that managing a client's expectations is key. If you exaggerate to a client the likely result of their law case, it is almost impossible for the client to end up satisfied with the outcome. Chronic loneliness has mushroomed in many Western societies since WWII because numerous structural factors have drastically changed the field of play.⁵⁶ In the U.S., we now have a society where about a third of adults live alone, and the like-minded communities of yesteryear having long since become the cold and uncaring world of strangers one experiences in today's urban environments.⁵⁷ In addition, today's endemic geographic mobility means that we are less and less likely to grow up and make our lives in the cities and towns—and sub-cultures--into which we were born. On top these structural realities, not far from half of all new relationships are now formed on the Internet⁵⁸ and somewhere between a third and a half of all biographical information on dating sites is materially false.⁵⁹ So, forming new relationships is harder today than it once was, even for relationally competent individuals, and ever higher percentages of young people fail to meet, pair with others, marry, and have children.⁶⁰ Accordingly, a clinician is well advised to take affirmative steps to manage the expectations of chronically lonely clients, as connecting meaningfully with others becomes more and more difficult even for individuals with significant interpersonal competency and self-confidence.

Step Three:

Determining The Source of the Client's Relational Malfunctioning

As I have suggested earlier in this essay, it would seem highly advantageous for the clinician work patiently with their chronically lonely client over a matter of months-- *as a team*--to progressively fill out and analyze the twenty questions on the UCLA Loneliness Scale Version 3, and especially the twenty questions in Dr. Banks' Relational Assessment Chart. Besides providing a detailed initial assessment of the quality of the client's relational functioning, these questions—or a sub-set of them that the clinician deems appropriate for a particular client—could be retaken from time to time to reassess whether and how the client is progressing in the formation of new relationships, and the nurturing of their existing contacts.

Step Four:

The Strategy of Relational Coaching

My suggestion for a fourth step in the process would be for the clinician and their client to undertake what might be called "relational counseling." The concept is that the two form a team to work together-- *patiently, and over time*-- on what has been learned, to review what real-world efforts the client has attempted, to consider the feedback from these efforts, and to think through what strategic reforms and tactical improvements can be made in the client's approach to forming and strengthening their relationships.

Clinicians might also think through whether certain clients would be well-served to be invited to accomplish some of the steps suggested above in a group setting. In some cases, a clinician might find not only an efficiency in managing the formation of such an intentional group

of individuals but might even envision that those working in common on their relational issues in the real-world, might serve as potential *ongoing* “assistant coaches” for each other.

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And one final point to end this essay: I’d love to hear from anyone who reads this, or hears my talk based on it, and who has feedback and critique to share. I’m easy to reach through my website, thelonelinessbooks.com.

End notes

¹Talk given at the 34th Annual Trauma Conference of the Trauma Research Foundation, May 17, 2023

²The firm was then called “Hale & Dorr,” which subsequently became “Wilmer-Hale.”

³ Jerome Miller became Massachusetts’ Commissioner of Youth Services in 1969, with the express intend of deinstitutionalizing the Commonwealth’s Dickensian-novel-like reform schools, Lyman School for Boys and Shirley Industrial School for Boys. In my first year as Assistant Professor at Boston University, I was thrilled that he hired me as a consultant to lend academic credibility to his project. See his excellent book on the project, *Last One Over the Wall: The Massachusetts Experiment in Closing Reform Schools*. Ohio State University Press: (1998)

⁴ The larger institutional children’s social service agencies included: The Italian Home for Children; Child and Family Services; Stevens Children’s’ Home; New Bedford Child and Family Services; and Walker Home for Children.

⁵ *Four Seasons of Loneliness: A Lawyer’s Case Stories*. Boston: Philia Books, Ltd. (2016) took the Gold Prize for best book of the year in Psychology / Psychiatry (2017) of the Independent Publisher Book Awards (the IPPY’s); the Gold Prize for best book of the year in health sciences of the Eric Hoffer Book Awards; the Gold Prize for best book of the year in Psychology (2017) of the Beverly Hills Book Award; the Gold Prize of the National Independent Book Awards (2017) for best book of the year in Psychology / Psychiatry; and the Davinci Eye Award for 2018.

⁶ *Surrounded By Others and Yet So Alone: A Lawyer’s Case Stories of Love, Loneliness, and Litigation* Boston: Philia Books, Ltd. (2020) won the Gold Prize of the Readers’ Favorite Book Awards (2021); the Gold Prize for best book of the year in Psychology / Psychiatry (2021) of the Independent Publisher Book Awards (the IPPY’s); the Gold Prize of the National Independent Book Awards in Psychology (2021); and Honorable Mention in the Eric Hoffer Book Awards (2021)

⁷ Kuhn, Thomas. *The Structure of Scientific Revolutions*. University of Chicago Press: (1962)

⁸ Darwin wrote this in a letter in the 1850’s to the famous Harvard botanist, Asa Gray. Cited in Oliver Sacks. *The River of Consciousness*. New York: Alfred A. Knopf (2017): p. 14; Darwin quotes Gray as replying “...if the Orchid-

book...had appeared before the 'Origin' [you] would have been canonized rather than anathematized by the natural theologians...". Charles Darwin. London: John Murray. *Life and Letters* (Vol. III, p. 274)

⁹ *The Body Keeps the Score: Mind, Brain, and Body in The Transformation of Trauma*. Penguin: (2014). Sales numbers and foreign language translation numbers from interview with author (2023)

¹⁰ See the charts and references in "The Catholic Church Sexual Abuse Cases in the United States."

¹¹ See Master Class / Itzhak Perlman on the Internet; quote is from September 24, 2021.

¹² A very young Sigmund Freud, who was a passionate Darwinian, began his career as a physiologist in Vienna. He was particularly interested in comparing the nerve cells of invertebrates and vertebrates and was able to demonstrate that their nerve cells were entirely similar. He was perhaps the first to grasp that the morphology of nerve cells and their functionality—the dendrites, axons, and the biochemical processes at their synapses—didn't qualitatively change as evolution advanced: what altered were the quantities and organization of the cells. A jellyfish has a thousand nerve cells whereas homo sapiens have a hundred billion; the cells themselves, however, are essentially identical. See the discussion in Oliver Sacks. *The River of Consciousness*. New York: Alfred A. Knopf (2017). p. 65

¹³ See "The Truck Driver's Library." J. W. Freiberg. *Four Seasons of Loneliness: A Lawyer's Case Stories*. Ibid. (p. 131.

¹⁴ David H. Hubel and Torsten N. Wiesel. "Receptive Fields, Binocular Interaction and Functional Architecture in the Cat's Visual Cortex," *Journal of Physiology* 160, no. 1 (1962): 106-54

¹⁵ B.J. Casey. "Twelfth Jeffrey Lecture on Cognitive Neuroscience," UCLA, January 26, 2012. Cited in Lydia Denworth. *Friendship: The Evolution, Biology, and Extraordinary Power of Life's Fundamental Bond*. W.W. Norton & Company (2020); See also https://ielc.libguides.com/sdzg/fact_sheets/bonobo

¹⁶ Robert M. Seyforth and Cheney, Dorothy L., "The Evolutionary Origins of Friendship." *American Review of Psychology* 63 (2012): 153-77.

¹⁷ Ibid.

¹⁸ Ibid.; See also the film, *Les Guardians de la Terre*, with its remarkable underwater footage of every aspect of the lives of baleen whales.

¹⁹ Paul J. Zak. *The Moral Molecule: How Trust Works*. Penguin (2013) p. 23

²⁰ Jennifer N. Ferguson et al. "Oxytocin in the Medical Amygdala Is Essential for Social Recognition in the Mouse." *Journal of Neuroscience* 21 no. 20 (2021); 8278-85; See also Zoe R. Donaldson and Larry J. Young, "Oxytocin, Vasopressin, and the Neurogenetics of Sociality," *Science* 322, no. 5903 (2008): 900-4.

²¹ Michael Laskassuo et al. "The Company You Keep: Personality and Friendship Characteristics," *Social Psychological and Personality Science* 8, no. 1 (2017): 66-73.

²² Joan B. Silk et al. "The Benefits of Social Capital: Close Social Bonds Among Female Baboons." *Proceedings of the Royal Society Biological Sciences* 276 no. 1670 (2009):3099-104.

²³ Lauren J.N. Brent et al., "The Neurobiology of Friendship," *Annals of the New York Academy of Sciences* 1316, no. 1 (2014): 1-17

²⁴ Jay N. Giedd et al., "Brain Development during Childhood and Adolescence: A Longitudinal MRI Study," *Nature Neuroscience* 2, no. 10 (1999): 861.

²⁵ Center of the Developing Child. "Five Numbers to Remember about Early Childhood Development." Harvard University, www.developingchild.harvard.edu.

²⁶ See the discussion in Stuart Brown, *Play: How It Shapes the Brain, Opens the Imagination, and Invigorates the Soul*. Penguin Group (2009), 39

²⁷ Sarah Lloyd-Fox et al. "Cortical Specialization to Social Stimuli from the First Days to the Second Year of Life: A Rural Gambian Cohort." *Developmental Cognitive Neuroscience* 25 (2017): 92-104.

²⁸ Described in Stuart Brown, *Play: How It Shapes the Brain, Opens the Imagination, and Invigorates the Soul* Penguin Group (2009): 33-34; See also Marc Bekoff and John A. Byers, eds., *Animal Play: Evolutionary Comparative and Ecological Perspectives*. Cambridge University Press. (1998)

²⁹ Ibid.

³⁰ Stuart Brown. Ibid. p. 95

³¹ Leah M Lessard and Jaana Juvonen "Friendless Adolescents: Do Perceptions of Social Threat Account for Their Internalizing Difficulties and Continued Friendlessness?" *Journal of Research on Adolescence* 28, no. 2 (2018): 277-83.

³² See https://ielc.libguides.com/sdzg/fact_sheets/bonobo

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- ³³ John T. Cacioppo and William Patrick, *Loneliness: Human Nature and the Need for Social Connection* (New York: W.W. Norton and Company (2008): passim
- ³⁴ René A. Spitz. "Hospitalism: An Inquiry into the Genesis of Psychiatric Conditions in Early Childhood". *The Psychoanalytic Study of the Child*. 1, no. 1 (1945): 53-74.
- ³⁵ This gentleman was Sidney Rittenberg, whose entirely remarkable life in China is set forth in stunning detail in his autobiography *The Man Who Stayed Behind*. Duke University Press. (2001)
- ³⁶ Roman M. Witting et al., "Social Support Reduces Stress Hormone Levels in Wild Chimpanzees across Stressful Events and Everyday Affiliations," *Nature Communications* 7 (2016): 13361; See also Janes A. Coan, Hillary S. Schaefer, and Richard J. Davidson, "Lending a Hand: Social Regulation of the Neural Response to Threat," *Psychological Science* 17 no. 12 (2006): 1032-39.
- ³⁷ Julienne Holt-Lunstad, Timothy B. Smith, and J. Bradley Layton, "Social Relations and Mortality Risk: A Meta-Analytic Review," *PLoS Medicine* 7, no. 7 (2010):e1000316.
- ³⁸ Susan Pinker. *The Village Effect: How Face-to-Face Contact Can Make Us Healthier and Happier*. Spiegel & Grau: (2014) p. 54
- ³⁹ Susan Pinker. Ibid. p. 51-54
- ⁴⁰ William J. Chopik. "Associations among Relational Values, Support, Health, and Well-Being across the Adult Lifespan," *Personal Relationships* 24, no. 2 (2017): 408-22.
- ⁴¹ The Framingham study is discussed in Nicholas A. Christakis and James H. Fowler, *Connected: The Surprising Power of Our Social Networks and How They Shape Our Lives*. Little, Brown: (2009)
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- ⁴³ Ibid. passim.
- ⁴⁴ Laura Fratiglioni et al. "Influence of Social Network on Occurrence of Dementia: A Community-Based Longitudinal Study," *The Lancet* 355, no. 9212 (2000): 1315-19.
- ⁴⁵ Quoted as an author interview by Lydia Denworth of Bert Uchino at University of British Columbia, October 30, 2014, as cited in Lydia Denworth, *Friendship: The Evolution Biology, and Extraordinary Power of Life's Fundamental Bond*. W.W. Norton (2020): p. 86
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- ⁴⁷ Erica K. Sloan, et al., "Social Stress Enhances Sympathetic Innervation of Primate Lymph Nodes: Mechanisms and Implications for Viral Pathogenesis," *Journal of Neuroscience* 27, no. 33 (2007): 8857-65.
- ⁴⁸ Erica K. Sloan et al, *ibid*.
- ⁴⁹ Quoted as an author interview by Lydia Denworth. *Friendship: The Evolution, Biology, and Extraordinary Power of Life's Fundamental Bond*. W.W. Norton (2020) p. 201.
- ⁵⁰ Steven W. Cole, "Human Social Genomics," *PloS Genetics* 10, no. 8 (2014): e1004601
- ⁵¹ Russel D. et al. UCLA Loneliness Scale (Version 3): Reliability, validity, and factor structure. *Journal of Personality Assessment* (1996) no. 66: 20-40
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- ⁵³ Amy Banks M.D. with Leigh Ann Hirschman. *Wired to Connect: The Surprising Link Between Brain Science and Strong, Healthy Relationships*. Jeremy Tarcher / Penguin (2015). P. 95, ff
- ⁵⁴ See Amy Banks, M.D. *ibid.*, for her discussion of how to interpret a respondent's score; See also J. W. Freiberg. "Chronic Loneliness and What You Can Do About It. [thelonelinessbooks.com.](http://thelonelinessbooks.com/) / Articles/p. 6.
- ⁵⁵ Author's personal interview of Bessel van der Kolk. (2022)
- ⁵⁶ Please see J.W. Freiberg. "Chronic Loneliness and What You Can Do About It." *Ibid*.
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- ⁵⁹ Ryan Anderson, Ph.D. "Statistics in Online Dating." *Psychology Today*: September 6, 2016.
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