

## Transcript of Cerebrum Podcast—[Building the Thermometer for Mental Health](#)

Guest: **Thomas R. Insel**, M.D. is a psychiatrist and neuroscientist, and the co-founder and president of a California-based startup company called Mindstrong. Having served as director of the National Institute of Mental Health from 2002 to 2015, Insel then joined the Life Science Division of Google X, which is now known as Verily Life Sciences. From there, he joined Mindstrong, where he has been since. Prior to serving as NIMH Director, Insel was a professor of psychiatry at Emory University where he was founding director of the Center for Behavioral Neuroscience in Atlanta. He is a member of the National Academy of Medicine and the National Academy of Sciences. Insel has received several awards throughout his career, as well as an honorary degree from the University of Edinburgh in 2014.

Host: **Bill Glovin** serves as editor of *Cerebrum* and also executive editor of the Dana Foundation. He was senior editor of *Rutgers Magazine* and served as managing editor of *New Jersey Success*, editor of *New Jersey Business* magazine, and as a staff writer at *The Record* newspaper in Hackensack, NJ. Glovin has won 20 writing awards from the Society of Professional Journalists of New Jersey and the Council for Advancement and Support of Education. He has a B.A. in Journalism from George Washington University.

Bill Glovin: Hello and welcome to the *Cerebrum* podcast. I'm Cerebrum editor, Bill Glovin and today's very special guest on the phone with us from California is Tom Insel, coauthor of our recent *Cerebrum* article, "[Building the Thermometer for Mental Health.](#)" You can find Tom's article at [dana.org](#). It's right in the middle of the page. Tom is a psychiatrist, neuroscientist, and co-founder and president of Mindstrong Health, a startup looking to transform the future of mental health care by developing better ways to measure and detect changes in a person's mental health state. From 2002 to 2015, Tom served as director of the National Institute of Mental Health, otherwise known as NIMH, the component of the NIH committed to research on mental disorders. Previously, Tom was professor of psychiatry at Emory University and he's on the board of directors of the International Neuroethics Society, which has numerous ties to the Dana Foundation, the sponsor of this podcast and my employer.

Bill Glovin: Welcome, Tom, and thanks for being here. In 2017, *The Atlantic* called you "[The Smartphone Psychiatrist.](#)" Is that something you get teased about?

Tom Insel: You know, maybe in the week after that came out but not since. And I'm not sure it's such a bad moniker. I think that concept of using technology to transform our discipline is long overdue and smartphone will be an important part of that.

Bill Glovin: Tom, your article's title is "Building the Thermometer for Mental Health" but essentially, it's about digital phenotyping. For listeners who might not know what digital phenotyping is, can you explain it?

Tom Insel: Yeah, the easiest explanation is that it's a way of taking signals from a wearable or a phone and making sense of which signals are good measures of how we're thinking, how we're feeling, how we're behaving. And since all of us use these too such an extreme degree right now, there's an enormous amount of information, just a huge amount of data that these little pocket computers are collecting. The question then is how can you take those signals and identify the ones that will be accurate for telling you or someone you love when they're getting depressed, when they're getting psychotic, when they're suicidal. Can we create, from these devices, tools that are actually more objective, more continuous, potentially even passive measures that will improve the way that we manage these chronic illnesses.

Bill Glovin: *The Atlantic* article points out that at any given moment roughly one in seven of the world's 7.5 billion people is struggling with mental illness. That's a billion people. In your view, is mental illness on the rise or has other progress in understanding more about the brain helped?

Tom Insel: Well it's hard to know. We don't have optimal kind of data to say that incidents is changing in any particular population. We have this in infectious diseases and we have it in many parts of medicine. It's tough to know when you try to get your hands around both the incidents and prevalence in mental illness, partly because most of the people with a mental disorder are not coming in for care. The only way to do that is with population based epidemiological studies and that gets challenged by not having a great diagnostic test. So, you end up then doing a phone interview or a door to door survey. Hard to know whether you're getting the entire picture and all the information you'd want to be able to know what the prevalence of any given illness is. So for that reason, it's hard to say whether increasing, decreasing or about the same.

But we know even if there's no change there's an enormous prevalence of this set of problems and the NIMH figures have been generally one out of five effected in the US. But about one out of 17, maybe one out of 20, effected with what we call "serious mental illness." That is being truly disabled by a severe syndrome.

Bill Glovin: Along those same lines, in a *TED Talk* you gave in 2013, you were highly critical of psychiatry saying it hadn't progressed very much in decades. We have seemed to figure out so much about the brain, as I said, in the last 20 years. Why haven't we done a better job treating mental illness?

Tom Insel: You know, that is one of the central questions I think for our field. We've had great advances in the science but that has not translated to improvements in employment for people with schizophrenia, to reductions in suicide for people with depression and in spite of the fact that we have more people in treatment and we have more treatments than we've ever had before, at least in terms of medications and psychological treatments and now devices. There's this great repertoire of services and of interventions. We have a pretty robust population of people in the field as a workforce. Certainly more robust than any other

specialty in medicine except for internal medicine and yet, it's been pretty difficult to show that there's any reduction in morbidity or mortality. In fact, the most recent CDC numbers from a couple of weeks ago show that there's been a 33% increase in the rate of suicide since 1999.

In that same period, we've had enormous breakthroughs in the science so what's the disconnect here? Why is it that all of the spectacular neuroscience, clinical neuroscience and the developments that we've seen through NIMH funding and NIDA funding, why has so little of that actually bend the curve on morbidity and mortality? Again, I think part of it comes back to the fact that most of the people who end up making a suicide attempt, many of the people who end up as homeless or incarcerated, the real epidemiological and public health crisis is just outside our purview. I don't think we're seeing that most of the people who are struggling with these most severe illnesses are actually in our care. That's a problem. I think we have to, as a profession, as a discipline, we have to ask ourselves, "How are we missing this? How could we be doing so much spectacular research on the risks of suicide while the rate of suicide's going up 33%? What are we doing wrong here and how are we missing the targets that we really should be caring about?"

Bill Glovin: Another question that you've probably been asked 500 times but that I have to ask is why you left NIMH and decided to focus first on Google's Varily spinoff and then on Mindstrong?

Tom Insel: Well the timing of NIMH was really a great gift and a really special experience for me. I was working with some of the most talented and committed people that I've known any time in my career. But I was there a long time and I believe strongly that every agency needs new leadership about every 10 years. I ended up staying for 13 just because there was so many fun things to do with the President's Brain Initiative and the Opening End caps and lots of other projects that I had a change to contribute to while I was there. But there was also, at the same time in that period, the first decade of the century and getting into these last seven or eight years it became clear that tech industry was changing so many aspects of the way we live, and that so many parts of our lives, whether it was through how we get information or how we bank or how we get entertainment or how we communicate was being transformed. It just felt to me like, "Gosh, is there a way that this same set of tools and these same set of insights and the power of machine learning and AI. Is there a way we could apply that to try to fix this very tough problem that in spite of, as we were just saying, all this great science it had been so difficult to bend the curve?"

Especially part of the problem is that people are outside the domain of care, where we are, they aren't coming to a brick and mortar mental health care system anymore because they live in a world where things are available really through a screen and goods and services are rendered with convenience, just in time, with lots of choices and transparency. All of which doesn't really describe either the health care or the mental health care system. So, it just seemed to me that we had hit this moment in time where we should be asking, "Is there a

way to take that kind of a culture and to take that set of tools and begin to create a mental health care system that was far more proactive, more responsive? Gave people more agency and insight and maybe could get us better outcomes."

Bill Glovin: Is it hard to innovate when you're at a big government entity like NIMH or is that even the role of NIMH?

Tom Insel: Well I don't think government is going to lead on innovation, especially innovation that involves software and even hardware. Sometimes they can do the hardware piece but software is a different beast which generally requires a group of people who are not likely to be lifelong government servants. I mean, people who are coders, designers, a range of different kinds of engineers. I didn't have people like that in the world that I knew within the federal government. There may be parts of the federal government where they reside but if those people are really good, they can get paid a lot more and given equity in companies like Alphabet or Apple or Microsoft.

So frankly, if you want the very, very best software developers it probably wouldn't go to the federal government to find them. There are some pretty outstanding people in companies like Alphabet and also in startup companies like the one we have now. There's a lot of talent and if you want to create great software, you want to be in a place where you've got really good engineers.

Bill Glovin: And I guess it's been about two, two and a half years since you started Mindstrong?

Tom Insel: Yeah, Mindstrong started a little less than two years ago. We, and I left government exactly three years ago so I've been in Silicon Valley for three years now.

Bill Glovin: So can you tell us a little about the structure of Mindstrong? How many employees? Is it a private company? Who is driving the technology side of things?

Tom Insel: Mindstrong is a private sector company. It's a tech startup. We are increasingly thinking of ourselves as a health care company, not just a tech or software company. We have about 50 employees based in Palo Alto and the structure is pretty interesting. It's like a lot of other startups, we've got a team based structure which includes engineering, design, data science, product development. We've got the clin-ops group, so we've recently spun out a separate company called Mindstrong Health Services, which has psychiatrists, psychologists, a range of therapists in it. So we have our own clinical services. The company itself, as many of these startups, is highly focused on product development.

For us, the product in this case has two pieces. One was creating the tools we need for digital phenotyping. So understanding those signals from the smartphone that can help to manage depression, psychosis, help predict PTSD. A whole range of serious mental illness issues that we think will be better managed with better data. The second piece has to do with taking those signals, which we sometimes call "digital smoke alarms" and creating the interventions that can be applied just in time. So rather than saying, "Oh this is someone who looks like they're depressed. They should get an appointment in three weeks to see somebody."

We want to be able to respond within three minutes to be able to connect with people through digital tools and provide solutions online and sometimes offline that can begin to engage. It's a very different kind of system. We think of it as a closed loop approach and we think of it as also something driven by better measurement, so it's measurement-based care, but it's also driven by very proactive interventions that can be a whole range of different kinds of approaches. Coaching, tele-psychiatry and when necessary, offline interventions. But most of all, they're just in time and they're done in a way that you can measure the impact so that gives you a kind of learning mental health care system that we've really never seen.

Bill Glovin: I think for most people it seems logical that an Apple Watch or a Fit Bit is connected to the body and can measure such things as heart rate and sleep but how can a phone app measure emotions such as depression or even elation?

Tom Insel: Bill, that's a great question and I was, when I got into this, I was reminded that somebody once said to me when I was at NIMH that the best biomarker for mania was your credit card report. I think there's a lot of truth to that but it just reminds us that if we're interested in behavior or we're interested in cognition then we have an opportunity like we've never had before to get insight into this by the data collected on the phone. For better or for worse, we are living on our phones. If you don't believe that, just try putting your phone away for a day or worse, facing a day when you've lost your phone. As many people have said to me, it's like losing your memory, it's like losing your identity, it's like losing all of the things that you have become so dependent upon.

Those things actually are incredibly good windows into how you're thinking, feeling, behaving. What we do at Mindstrong is we actually don't collect the words you type or we don't collect your searches or your social media posts. What we do collect is how you type. So we're interested in using the reaction times for how you interact with the keyboard as a pretty good indicator of various cognitive functions and even of mood. It sounds like it would be difficult to do, and it would be if we didn't have enormous amounts of data, every day, from people while they type on their phones. So while we don't actually collect what you type, by looking at how you type and looking at the interaction, literally the motor actions on the phone, we're able to get remarkably good insights into measures like executive function, processing speed, something about your changes in mood.

We do this because we're collecting the data passively so we're not asking people to fill out forms or to report how they're feeling. We look at the data every day over many, many days, weeks and months and look for individual patterns that are good reflections of gold standard measures that we collect in validation studies. The first part of the company was really a research phase where we had to collect all those clinical assessments that are kind of a high burden and take time and effort at the same time we had the phone data. Now we have enough of the phone data we can begin to apply it and we're in that phase of actually now testing this out in a clinical environment to figure out both its validity and its utility for reducing re-hospitalization or for preventing suicide or in the case of substance abuse, preventing relapse.

Bill Glovin: Tom, can you tell us a little more about testing? How many people were involved? How long it's going to take? Were there cultural considerations?

Tom Insel: The first phase of development was feasibility. Is this even possible? We did that in relatively small groups of patients with lots of measures that we could collect. We've now moved on to putting this into a whole range of clinical testing environments. My goodness, I think we have now over 10 projects like this with many thousands of patients currently collecting data. It's not, by the way, this is not a consumer app so while it's on the app store, you can't download it, test it out. It has to be done through an approved research study.

The kinds of studies we're looking at include an NIMH funded study called Aurora, which is looking at 5000 people following a traumatic event to pick up the signals that will identify which people are on the trajectory to develop a post traumatic syndrome, like PTSD or depression. Now we've got studies, patients with serious mental illness in the public mental health system trying to identify which signals are predictive of relapse and the need for re-hospitalization. We've done some interesting work in depression, identifying the signals that are associated with both recovery and relapse in people receiving Ketamine, rapidly acting antidepressant where patients get better quickly but then they relapse within two to three weeks. We thought it would be helpful to figure out which signals could predict that.

A range of other areas, substance abuse, lots of interest in trying to find signals that are relevant to suicide and to just other major aspects of public health. Generally Mindstrong's philosophy has been to focus on patients with the most severe illnesses and that has to do partly with the fact that these are some of the most expensive disorders, conditions. Since we're a company, we're looking at a way of saving health care system money but secondly, and maybe even more important to us, this is where the need is the greatest. Honestly, most other companies that are getting into this space are looking at mild to moderate depression. Important area, no problem with that but we thought that someone, somewhere, should be focusing on those patients with the greatest need and the greatest unmet need. That's one place where we hope to really make a difference.

Bill Glovin: So there are competitors in this industry and I guess that's probably a good thing 'cause competition drives better research?

Tom Insel: Well it is a good thing. It's not because it's driving, for me, better research. It's because this is a really hard problem and there's not one app or one individual or one company that's going to solve it. It's going to take a village and it's going to take lots of different kinds of solutions being developed. Some will be like what we're doing, which are focused on this human computer interaction, you know, the nature of the tapping and scrolling and clicking. Others will focus on speech and voice and picking up those signals. Some may be looking at activity and sleep. All of these are going to help us. All of them will create a digital phenotype that will get us to this measurement based care that we've been missing because every one of those uses the phone but it, importantly, these are passive measures so they can scale quickly. They're continuous measures so that you can get data every day and you're collecting data ecologically, you're collecting it in someone's real world, not in the clinic once every four weeks.

So, all of these kinds of data will really transform the way that we monitor and manage these chronic illnesses but I don't think any one channel, I don't think any one company is going to figure this out completely. It's going to take a village and I'm so excited to see lots of different attempts to do this.

Bill Glovin: The *Cerebrum* article says there are more than 300,000 digital health apps currently on the market but there are fewer than 5,000 installs. How do you plan to change that number?

Tom Insel: Yeah, so if you think about it there's over two million apps in the app store. The health app industry has grown pretty quickly and in lots of directions. A huge part of that, by the way, is just sort of wellness and fitness. That's the vast majority of what are identified as health apps but there are also, you know, many, many thousands of apps for management of chronic disease and specifically many that have to do with mental health, mental illness. I don't think that the future is going to be direct to consumer apps that people download and use to monitor their illness. That just simply hasn't worked for us. When I say "us" I mean the entire industry. Last year, 67% of the direct to consumer companies switched to becoming direct to payer, direct to insurer, direct to provider because the market is saturated. Nobody's actually using most of the apps that are on their phones or if they use them they use them for a very brief time.

So what you have to do, I think, is create something that people find really does make a difference for them. It solves a problem for them in a way that doesn't create extra burden. We spend a lot of time in the way we think about this problem on three aspects of creating value, where value mean something that works. One is trying to understand does it actually give us better outcomes? Second is, is it actually something people will use? Even if it's passive, still has to be on a device that people are using. So if when people get depressed they stop using their phones, we don't get any data so we have to know that, in fact, this

is engaging, that people are using it and it's gonna be effective in that sense. The third and one that I think we have to get much better at is demonstrating that this builds efficiency into the whole system. That to the extent that we're working in a health care system, and that's still an assumption, maybe, that some of the future digital companies will not.

But Mindstrong is very embedded in the health care system and to the extent that we're in that system, we can't create an additional burden. We have to do everything we can to build efficiencies. Or as someone in large health care land said to me at one point, "Don't give me anything that just provides more data. I need more time." We have to be thinking not just about, "Does it work? Is it effective? Is it engaging?" But we have to know that it's also building efficiency.

Bill Glovin: Along those lines, will, and I'm gonna throw a few things at you. Will the app cost anything? Is the app something that clinicians, maybe, can prescribe? Will health care insurance play any part?

Tom Insel: Well that is the business model for most digital companies at this point. They're kind of divided into two camps. There are a lot of companies that are going with self-insured employers where they create something that an employer can have on their list of employee options. So in that case, the company gets paid a per member, per month fee for providing this to the thousands of employees for a big company. The second option is to say, "oh no, let's work with a payer. Let's work with an insurer and potentially even go at risk." We could say, you know, "we know this insurer is spending X dollars every month on behavioral health and they're not getting very much for the money they're spending. They're not happy with the results, the patients are really not happy with the results. Often the providers are pretty miserable." So if we could find a better way to do that, could we take on that risk of that population and provide a whole set of end to end solutions that will be both online and offline.

I think that's where the digital health industry's going in diabetes, in heart disease and ultimately in mental health, as well. My own bias is that mental health is probably the best example of that. It's the place that will make the most progress because so much of what we do on the mental health side can be done outside of a brick and mortar intervention.

Bill Glovin: In terms of your involvement with the International Neuroethics Society, let me throw out a hypothetical. So I'm a teenager and I don't want my parents to know that I'm feeling depressed or any which way or I might be a prospective employer or an educator, a financial institution. Do I have a right to privacy even if it's not the best thing for me?

Tom Insel: So Bill this is one of lots of really interesting and thorny questions that we are wrestling with. I got involved with the International Neuroethics Society partly because it's obvious that we're in this new frontier that will have a whole series of challenges. Some of which we can see and a lot of which we can't yet foresee. I wanted to engage the INS and now others in helping us to think about this.

Like, what are the unintended consequences that we can't yet see and how should we be trying to understand them? How should we try to preempt the most adverse consequences? Privacy is one of them. There's a range of issues. Some of them are ethical, some of them are legal, some of them are social.

There are concerns by some that the information on the phone, which we call a way of monitoring for chronic illness, could become a form of surveillance and could be used to discriminate. There are concerns about how the data are collected and where the data are stored and who has access to the data. These are really important issues about consent. How informed are the users and how much agency does a user have over the way the data are collected, how data could stop being collected and then access to the data that exists. There are just, you know, a whole range of really interesting problems. We engage the Stanford Center for Biomedical Ethics. Right at the very beginning of forming Mindstrong we brought in our friends from that Center to help us start to think about this.

We ended up actually creating a, what we call an "ELSI" board: ethical, legal, social implications board. That has not only experts from Stanford in ethics but it has family members, people with lived experience, people who have wrestled with similar questions in genomics and that board has been incredibly helpful to us, again, to surface the questions, to help us think about the right approaches. We're in a space that has no regulatory framework, really. There's just not an FDA, there's not a group that oversees much of this. It's uncharted territory and a lot of what we need to do now is provide that kind of framework for how we think about it, who should be thinking about it, and creating a pathway forward to make sure that we do this in a way that both gains and retains public trust.

Bill Glovin: Hmm that seems as much of a major frontier as the actual engineering of the app in terms of how it gets used and the legal ramifications.

Tom Insel: Yeah and I'll tell you that in some ways it's more difficult because if you don't get this right, it doesn't matter how good your engineering is. If you violate public trust in any way, shape or form, no one will or should use the app. So it's really important to think this through and to get it right.

Bill Glovin: On this past Sunday, *60 Minutes* did a segment on preliminary results on a long term study that has so far revealed that too much video screen time can effect brain development in toddlers. I bring that up because there seems to be a bit of what your article calls a backlash against technology, against Facebook. We've heard about hackers, ad nauseam, getting into your accounts. When you have speaking engagements around the country, is kind of backlash something that you encounter?

Tom Insel: I didn't when I started in the U.S. You know, when I was at Alphabet at the company that's now called Verily, I did quite a bit of travel. I spent some time in Australia and in Europe as well as various places in the U.S. There was a very,

just a differential that was so obvious. People were very skeptical and concerned about technology in Europe. A little more so in Australia, and in the U.S. almost not at all. That was two years ago or three years ago. I think all that's changed in only one direction since then which is that the U.S. looks a lot more like Europe. Almost every place you go, one of the first questions that people ask me is about the tech lash. It's about all of the information that's coming out about Facebook and about YouTube and whether it's fake news or lack of privacy.

The meeting I was at last week, someone said, "Yes but isn't A.I. actually biased in all sorts of ways because the algorithms are ultimately written by humans who have biases?" There's a lot more awareness about these critical issues and I think people are a bit more skeptical. Oddly enough, I don't see that reflected in reduced use of technology. People seem to be asking a lot of questions, seem to have lots of concerns but I don't see people no longer using search or YouTube or Facebook. I think there's still an enormous appetite for this and frankly, a real dependence on it for better or for worst.

Bill Glovin: Lastly, what is your day to day involvement with Mindstrong? Is it, are enough hours in a day for you to do all you need to do? Are you enjoying it? Do you have any plans to retire? Where are you at with it?

Tom Insel: Yeah I've tried to retire a couple times and I'm just not very good at it. Each time I get interested in something that sort of pulls me back in. I don't have an operational role within Mindstrong itself. Being president of a company means that you don't really have a job in a sense that you don't actually write code or help on design or you're not part of the product pipeline, and that's what the company's all about. We have people who are much, much better at all of those things that I could ever be. My role is largely on the strategy side and on helping on the external side. Whether that's building partnerships or helping to make sure people understand this whole broad area of digital mental health.

I am deeply interested in how technology's going to affect this area of medicine and I'm spending a lot of my time these days working on a book about just that topic. That is about how can we bend the curve on morbidity and mortality? I don't think it's all gonna be technology but I think we already have good indications from projects that have been done on a smaller scale that we know can work, we know can really make a difference. And I guess as a, kind of, final point here Bill, this is something I'm so passionate about, is that in contrast to so many other areas of medicine where we're struggling to develop new treatments, this is an area where we have really good treatments. Except that almost no one gets them and very, very few people within our workforce are trained to provide them with the kind of quality that's required to get good outcomes.

My passion right now is trying to figure out how to change that scenario and how to ensure that either with technology or with different kind of mental health care system that more people are getting care and getting the kind of

care that really does make a difference. I have no doubt that we can bend the curve, we can reduce suicide, we can reduce disability with the treatments that we have right now. But we are not doing that and my next five years I want to devote to figuring out how to change that.

Bill Glovin: Well at the Dana Foundation, we're certainly rooting hard for you in this very noble quest and I can't thank you enough for the article, co-written by Joshua Javon, who did a great job, as well and for taking the time to explain all of this. It's a lot. Tom, it's a great honor, actually, to talk to you. Thanks again.

Tom Insel: Thanks so much, Bill. Thanks for doing this. Take care. Have a great day.

Bill Glovin: Alright. Okay. Bye bye.

And that's our *Cerebrum* podcast for this month. Thanks again to Tom Insel, long considered one of the brightest and most influential people in the brain research field. He's had enormous impact on the field and has had an unbelievable career. As Yogi Berra once said, "It's tough to make predictions. Especially about the future." But I think we can safely predict that mental health services will soon be coming to a smartphone near you. How effective it will be remains to be seen but I wouldn't bet against Dr. Insel.

This podcast is brought to you by the Dana Foundation. You can read Tom's article on digital phenotyping and all of our content at [dana.org](http://dana.org) or listen to our podcast by linking to our multimedia page. You'll find my recent podcast with jazz legend Pat Metheny, also at [dana.org](http://dana.org). Thanks for listening.