

# Brain to Bedside

## Using Neuroscience to Cultivate Empathy in Medicine

BRAININFO 2026 Valencia, Spain

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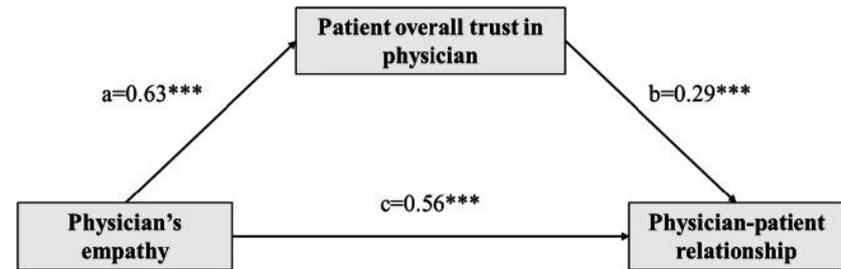
## Empathy in Physician Education

**Overlooked** and **deprioritized** element of medical training, with consistently **low empathy scores** in physicians from training into practice

Historical Overview	Current State	Why It Matters	Can Empathy Be Taught?
<i>“Dangers of empathy”</i>	<i>Leicester Empathy Declaration</i>	<i>“It is a crucial ability... building trust between patients and providers... this trust can serve as the catalyst for effective shared decision-making and improved patient outcomes.”</i>	Yes...

## Building Trust through Empathy

- According to patients, building trust is based on physician empathy during interactions
  - Paying attention to patient feelings and emotion
  - Understanding of patient perspectives
  - Putting patients at ease
  - Providing care consistent with patient needs
- Empathy decreases distrust
- Improving physician empathy may effectively rebuild patient trust and improve deteriorated physician-patient relationships
  - This improves health outcomes



Mediation results of physician empathy on physician-patient relationship through patient overall trust in physician. All paths are presented in standardized regression coefficients. The indirect path  $ab$  is a product of the  $a$  path and  $b$  path. \*\*\* $p < 0.001$ . Direct effect= $c$ :  $\beta=0.56$ ,  $SE=0.017$ , 95% CI: 0.53–0.60. Indirect effect= $ab$ :  $\beta=0.18$ ,  $SE=0.014$ , 95% CI: 0.15–0.21. Total effect= $ab+c$ :  $\beta=0.74$ ,  $SE=0.014$ , 95% CI: 0.72–0.77.

## Types of Empathy

**Affective**

Resonance or emotional empathy

*I feel what you're feeling.*

**Cognitive**

Theory of mind or perspective-taking

*I can understand what you're feeling but don't share those feelings.*

**Empathetic  
Concern**

Compassion

*I understand what you're feeling and want to support you any way I can.*

## Foundations in Neuroscience

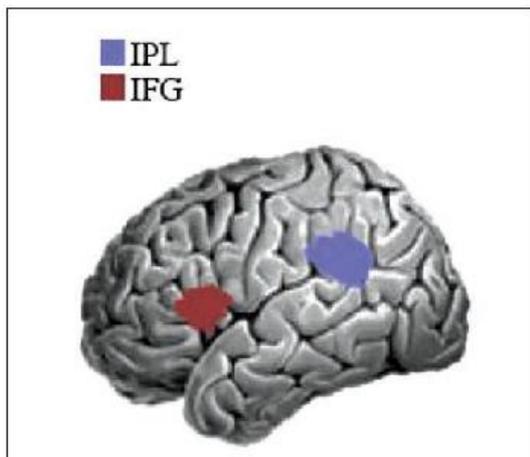


Figure 2. The emotional contagion network.

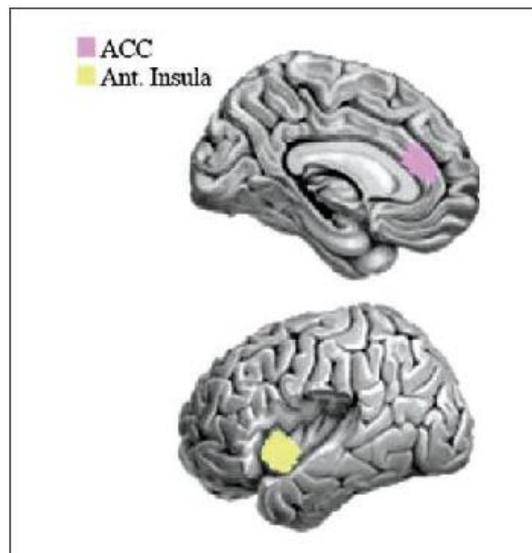


Figure 3. The empathy to pain network.

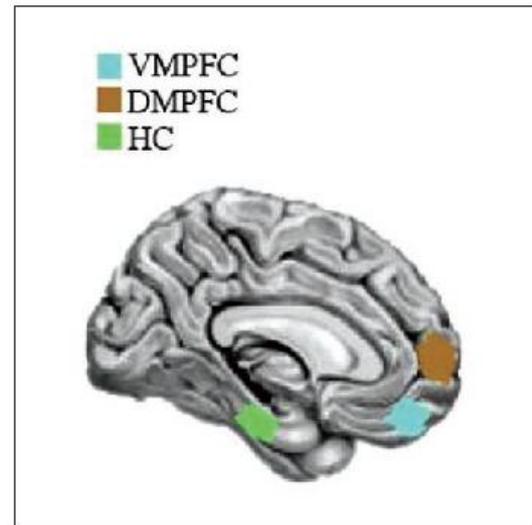
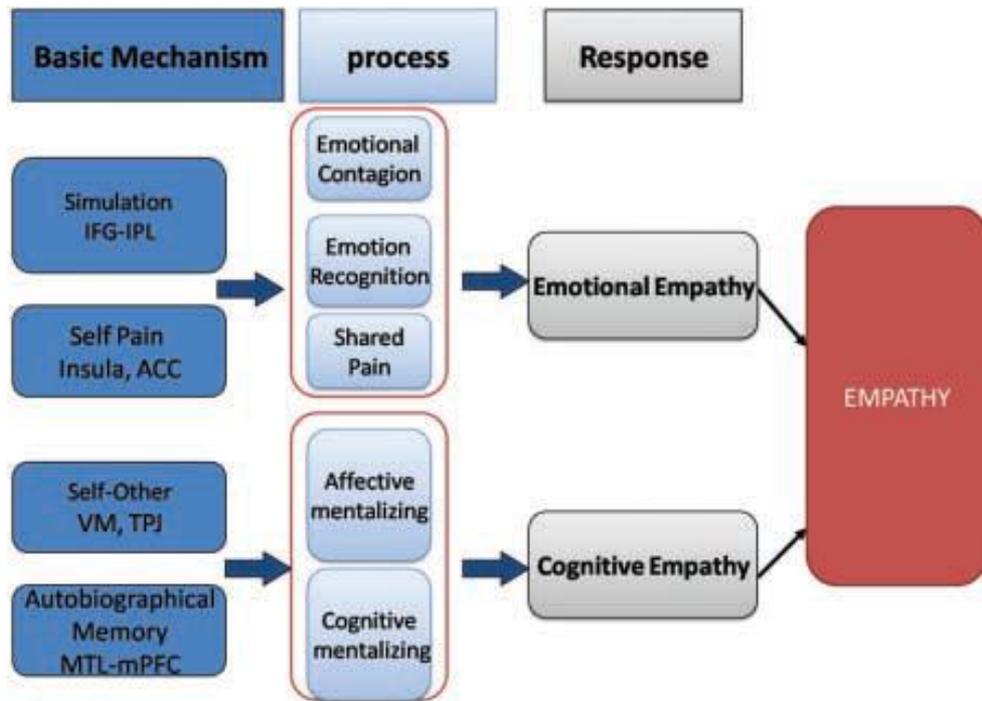


Figure 4. The cognitive empathy network.

# Foundations in Neuroscience



## Foundations in Neuroscience

### Affective Empathy (Resonance)

IPL, IFG, AI, ACC

Oxytocin,  
serotonin, cortisol

Simulation,  
narrative medicine,  
VR, mindfulness

### Cognitive Empathy (Theory of Mind)

TPJ, STS, TP  
mPFC, PC

Dopamine

Simulation,  
narrative medicine,  
mindfulness

### Empathetic Concern (Compassion)

VS, VTA, mOFC,  
sgACC, PAG

Serotonin, opioids

Simulation,  
narrative medicine

## Linking Neuroscience and Curriculum Design

- Alignment between educational interventions and neural systems
  - Support empathy, social cognition, prosocial motivation
- Targeted curricula can build and refine specific capacities
- Enhance communication while protecting against empathic burnout
- Successful empathy education integrates affective, cognitive, and compassionate processes and their regulation rather than privileging any single domain

Didactic Method	Neural Correlates
Neurofeedback	Synaptic efficiency, functional connectivity in socioemotional networks
Spiral curriculum	Pre-frontal limbic pathways (mPFC, ACC, AI)
Deliberate Practice	Dopaminergic reinforcement learning mechanisms
Feedback-based learning	Reward prediction error signaling in ventral striatum/coupling with frontal cortex
Formative assessment	Hippocampal-vmPFC circuits
Quantitative tools	TPJ, AI

## Role-Play and Simulation

- Engages all categories of empathy circuits
- Action observation and embodiment
- IFG, IPL, insula, mirror neuron system, interoceptive systems
- Peer vs standardized patients (SPs)
  - SPs may elicit more authentic encounters and processing
  - ACC, AI, neuroendocrine markers of affiliative behavior (oxytocin)
- High-fidelity simulations evoke strong autonomic and limbic responses
  - Amygdala, insula, periaqueductal gray, brainstem autonomic nuclei
  - Dopaminergic reinforcement in ventral striatum
  - Emotionally arousing learning episodes are preferentially consolidated in memory
- Artificial intelligence-driven conversational agents: real-time feedback on empathic markers
  - mPFC-striatal coupling (social feedback processing)

# Narrative Medicine

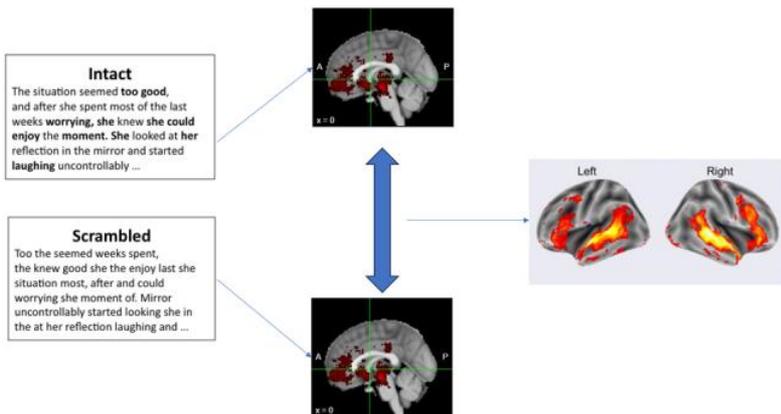
## Oxytocin's Role in Narrative Response



## Oxytocin's Effects on Narrative Response and Behavior

Experimental Condition	Neurochemical Response	Behavioral Outcome	Statistical Significance
<b>Emotional Narrative</b>	Increased oxytocin and cortisol	Higher empathy and donations	Positive correlation
<b>Control/Neutral Story</b>	No significant hormone changes	Minimal empathy or donations	Not significant
<b>Oxytocin Infusion</b>	Artificial elevation of oxytocin	56% more donations	Statistically significant
<b>Placebo Administration</b>	No artificial hormone changes	Baseline donation levels	Control baseline

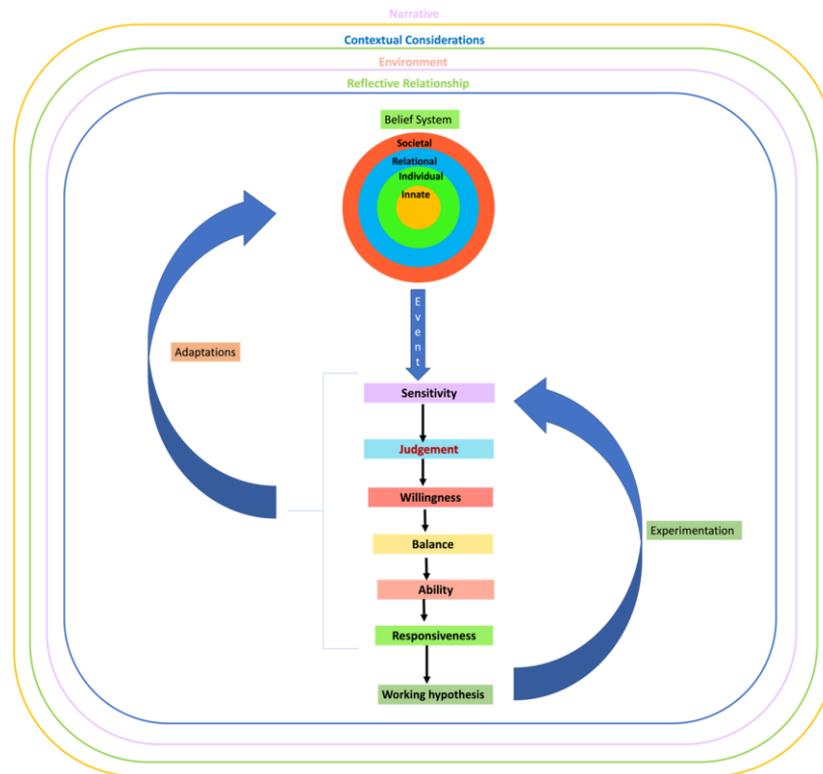
# Narrative Medicine



Eighteen participants listened to a natural story, or to a scrambled version of it

We compared activity in the reward system between two experimental conditions

We found a significant difference in activity between conditions, thus exemplifying the relation between the reward system and natural story processing



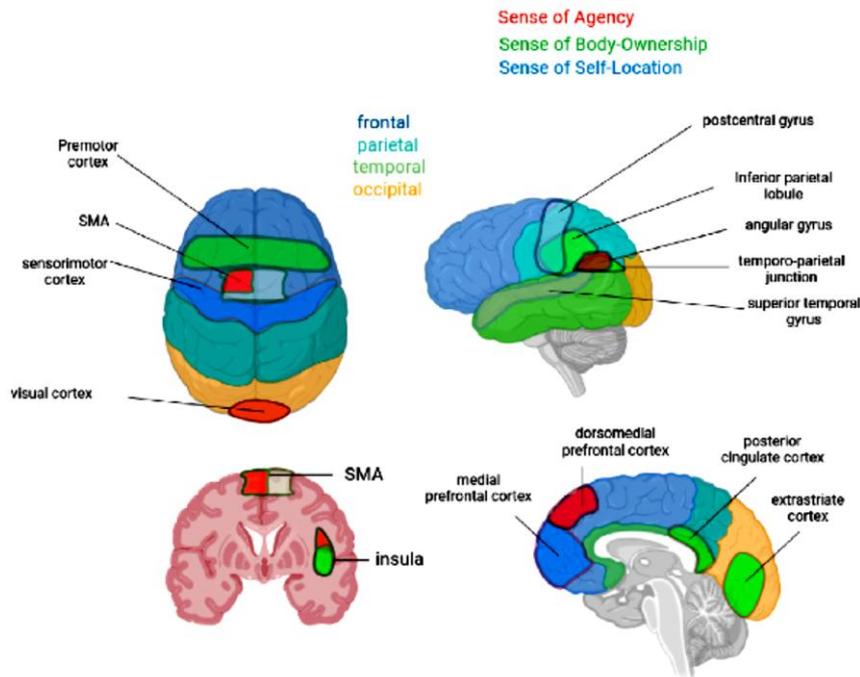
## Mindfulness and Reflective Practice

- Meditation strengthens prefrontal regulation of emotional and autonomic systems
- Increased activation and functional connectivity: dorsolateral PFC, ACC, insula
- Reduced reactivity: amygdala
- Neurochemical shifts
  - Increase GABAergic tone
  - Decreased cortisol and sympathetic arousal
- Modulate dopaminergic tone in reward-related regions
  - Ventral striatum



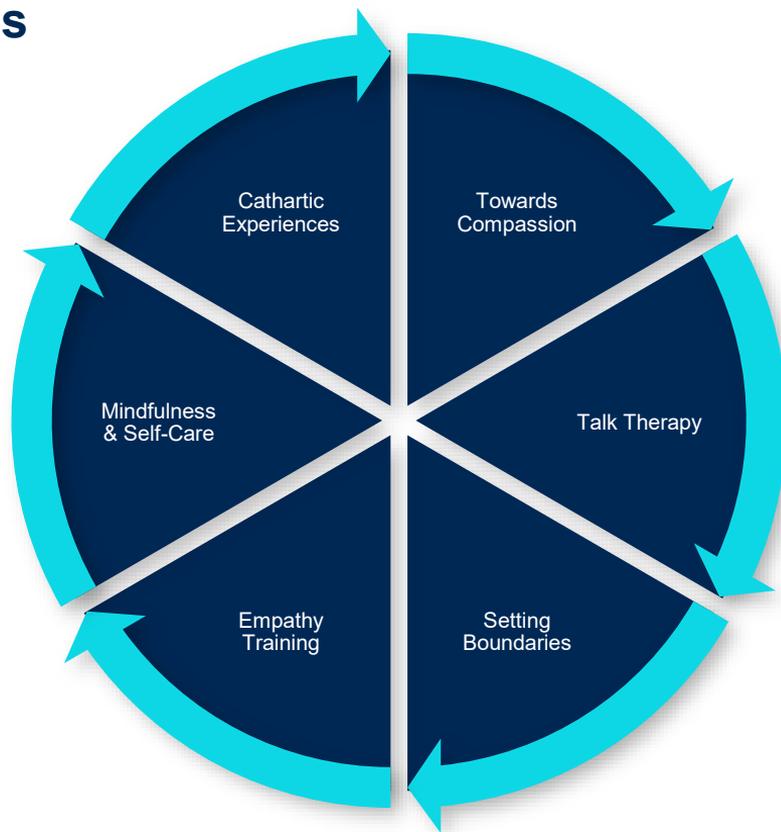
## Digital and Immersive Technologies

- Varying views on VR as a tool to teach empathy
  - Recruits overlapping neural systems
  - Enhances embodied perspective-taking: AI, ACC, TPJ
    - Increases affective resonance
    - Variably impacts cognitive empathy
    - Increases salivary oxytocin and dopamine-mediated reinforcement learning
  - Critiques: oversimplification of complexities of empathy, lack of rigorous research
- AI-driven conversational agents provide real-time feedback: mPFC coupling
  - Social feedback processing



## Shielding Against Empathetic Distress

- Empathic distress: emotional exhaustion from consistent exposure to/identification with trauma, suffering, and pain of others
- Can lead to burnout, fatigue, indifference and apathy
  - Significant impact on mental health and job performance
- Balint groups/reflective dialogue: oxytocin-mediated affiliative circuits, vmPFC-amygdala pathways
- Compassion training: ventral striatum, pregenual ACC, mOFC



## Putting It All Together: Simulation Project

- Pre-simulation online interactive didactic module
- Simulation-based exercises to apply Narrative Medicine for inpatient neurologists
  - Communication in the clinical setting for stroke patients/loved ones/caregivers
  - Standardized patients/loved ones/caregivers
  - Three 20-minute scenarios + 30-minute debriefing
- Pre- and post-simulation surveys
  - Jefferson Scale of Empathy - Healthcare Providers Version
  - Modified Physician Fulfillment Index
- Compare pre- and post- survey results
- Next phase: trainees, other specialties, outpatient and inpatient providers

# Narrative Medicine Online Module

Below is an image from the article "Decisional Control Preferences in Patients with Advanced Cancer: An International Multicenter Cross-Sectional Study"

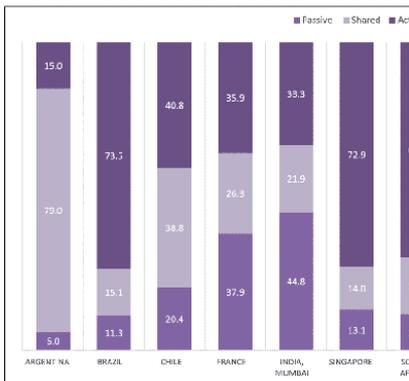


Figure 1. Decisional control preferences by country.

Click to enlarge

Active = patients prefer to make decisions themselves

Shared = collaborative between patient, physician, and family

Passive = patients prefer decision are made by physician

Reflect on the image below, how does it make you feel? What attributes come to mind?

Once you have had a chance to reflect, click the blinking dots at the bottom of the image below.

## Transforming Experience into Connection

The goal of utilizing narrative medicine in patient-provider discussions is not shared suffering but shared perspective. Clinicians can manifest personal experience into behaviors that signify active engagement and connection: slowing down, naming uncertainty, tolerating ambiguity, and practicing compassion with boundaries.

### Practice compassion with boundaries

Set boundaries of time, create structured communication frameworks (below) and mentally "close the chart" at the end of a tough encounter.

- NURSE:** NAME the emotion, UNDERSTAND what they're saying makes sense, RESPECT their choices, SUPPORT them, EXPLORE their insights by inviting to share more
- SPIKES:** SETTING: create a private space, everyone sitting, minimize interruptions, PERCEPTION: ASSESS what the patient/caregivers understand about their condition, INVITATION: ask how much information they want, KNOWLEDGE: deliver the information clearly, compassionately, and in parts, EMPATHY: use empathetic responses (like NURSE above), STRATEGY & SUMMARY: summarize the discussion, state next steps and plan



DNR = Do Not Resuscitate

Original image: Lu, E., & Nakagawa, S. (2020). A "Three-Stage Protocol" for Serious Illness Conversations: Reframing Communication in Real Time. Mayo Clinic Proceedings, 95(5), 589-593. <https://doi.org/10.1016/j.mayocp.2020.02.005>

### Anchor: "Kindness" Naomi Shihab Nye

You know what kindness really is  
 you know how things  
 that you treasure  
 suddenly dissolve in a moment  
 and you are left with  
 a weakened broth.  
 What I hold in my hand,  
 what I have counted and carefully saved,  
 all that I have been  
 tending, tendering,  
 watching and worrying,  
 comes apart and goes away,  
 leaving behind  
 a web of stringless  
 beads, a broken  
 bowl, a leaking  
 cup, an overturned  
 teapot, some  
 dried soup, a clag  
 of rice, a few  
 shreds of dried  
 egg-flower.

icken

## Conclusions

- Empathy is supported by robust neural networks
  - Mirror neuron system, limbic, paralimbic pathways
  - Neurochemicals regulate empathic emotions and behaviors
- Mapping didactic methods to neural architecture may bridge gaps in empathic medical care
- Empathy in all its forms can be taught, reinforced, sustained with evidence-based methods
- More research needed in this realm to:
  - Improve patient outcomes
  - Enrich provider experiences



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# Thank you

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