COMING BACK TO A SQUARE ONE:
“TALK THERAPY”
and ITS NEUROBIOLOGICAL VICISSITUDES

Prepared by
Dr. Uri Amit and Dr. Inna Rozentsvit, NYC, US
In the 17th century, René Descartes was the first to articulate the mind–body problem in a form that has lasted well into the later part of the 20th century. The impact was such that neurological processes were differentiated from the “talking cure” even though the latter evolved from the former. Neuroscience, broadly construed, has been generating evidence for 20 or so years that has shattered the dualistic view of mind-brain (-body) and compelled to consider a single mind-brain(-body) system. The emerging data has been indicating that the brain is elastic and responsive to non-medicinal therapeutic interventions. According to the ever enlarging body of knowledge, those who, for example, have endured trauma, or complain of medically unsubstantiated somatic discomfort, or present with neurodevelopmental deficits – are treatable and redeemable when offered the opportunity to engage in “talk therapy.” The surfacing information from neuroscience further suggest that those identified to suffer from personality disorders, or engage in fetishistic and paraphilic behaviors, or have relationship difficulties, – can also greatly benefit from the “talking therapy.”

‘There is no greater agony than bearing an untold story inside you.’ Maya Angelou
Dr. Inna Rozentsvit, a New York City based neurologist and neurorehabilitation specialist, also trained in psychoanalysis and psychotherapy, will be the first speaker. Dr. Rozentsvit is also affiliated with New York University/Neurorehabilitation Department and is on the faculty at the Object Relations Institute for Psychotherapy and Psychoanalysis. Dr. Rozentsvit will review the emerging data from neuroscience and speak to the link between the “talk therapy” and the brain.

Dr. Uri Amit is a diplomate of the American College of Forensic Examiners and certified group and family therapist. He was a chief psychologist at a forensic unit in Massachusetts, an attending clinician in a general psychiatric hospital and is now again a senior clinician in a forensic facility. Dr. Amit is also a psychology faculty member at a large research university in New Jersey, and a learner at the Object Relations Institute. He will speak to the nature of change with “difficult patients” via “talk therapy.”

Both have presented in the United States and internationally.
Brain vs. Mind
or
Brain & Mind?

Nature vs. Nurture
or
природа против –
или-
и воспитания (e)

"The brain is a very big place in a very small space." (Carl Sagan, "The Cosmos")
Socrates (born in about 470 BC), one of the first Ancient Greek philosophers, was a mind-body dualist. This means he thought that the human mind is composed of a different substance to the brain, one that does not obey the same physical laws.

Rene Descartes (born in 1596), French philosopher, mathematician, and scientist, was a rationalist. He argued that true knowledge is only gained through introspection and that the senses cannot be trusted. Descartes was also a mind-body dualist: he could conceive of his mind existing without his body, and he concluded that the mind must be made of an entirely different substance, a substance that thinks.

In Meditations on First Philosophy (first published in 1641), Descartes argued that the mind differs from physical substances in three ways:

1) the mind experiences sensations that cannot be explained mechanically; 2) the mind does not exist in physical space like the brain does; and 3) the mind is a necessary whole, it cannot be divided or replicated in the same way that a physical object can.

Descartes' conception of the mind also differs from physical matter because there is currently no room for subjectivity in physics.

http://www.thestargarden.co.uk/Descartes.html

“The distinction between diseases of "brain" and "mind," between "neurological" problems and "psychological" or "psychiatric" ones, is an unfortunate cultural inheritance that permeates society and medicine. It reflects a basic ignorance of the relation between brain and mind. Diseases of the brain are seen as tragedies visited on people who cannot be blamed for their condition, while diseases of the mind, especially those that affect conduct and emotion, are seen as social inconveniences for which sufferers have much to answer. Individuals are to be blamed for their character flaws, defective emotional modulation, and so on; lack of willpower is supposed to be the primary problem.”

“The neural basis for the self, as I see it, resides with the continuous reactivation of at least two sets of representations. One set concerns representations of key events in an individual's autobiography, on the basis of which a notion of identity can be reconstructed repeatedly, by partial activation in topologically organized sensory maps. ... In brief, the endless reactivation of updated images about our identity (a combination of memories of the past and of the planned future) constitutes a sizable part of the state of self as I understand it. ...The second set of representations underlying the neural self consists of the primordial representations of an individual's body ... Of necessity, this encompasses background body states and emotional states. The collective representation of the body constitute the basis for a "concept" of self, much as a collection of representations of shape, size, color, texture, and taste can constitute the basis for the concept of orange.”
How Did the “Talk Therapy” Started?
Sigmund Freud: Married to Neurobiology, Fathering Psychoanalysis

I am tormented by two aims: to examine what shape the theory of mental functioning takes if one introduces ... a sort of economics of nerve forces; and, second, to peel off from psychopathology a gain for normal psychology.

(S. Freud, 1895, letter to W. Fliess)

The hatched areas correspond to the language field, and the darkened portion to the so-called language centers:
1. the region in which lesions evoke agraphia (border zone adjacent to the center for the hand);
2. Broca's area, where lesions cause motor aphasis (alongside the centers for the vocal and laryngeal musculature);
3. Wernicke's area, where lesions produce word-deafness (alongside the terminal field of the acusticus or at least a part thereof);
4. the region where lesions cause alexia (immediately alongside the cortical center for vision).

A large part of the *central language field* lies in the depths of the Sylvian fissure.

Comment:
This is Freud's only clinical neurological (or neuropathological) drawing. It identifies the four areas of the brain in which damage produces major language disorders. These anatomical areas can be mapped onto the functional zones and elements that Freud had identified in Figs. 8 and 9 (Plate 30). The distinction between those (functional) images and this (anatomical) one coincides with an important theoretical distinction that Freud drew in his neuropsychological studies from this period: lesions can be localized anatomically but functions cannot. This was the fundamental premise upon which he eventually shifted from clinical neurological to purely psychological ground. Psychical locality is a functional locality (see Plate 38). Moreover, the functional localities associated with neurotic disorders, unlike neurocognitive ones, cannot be mapped onto anatomical areas on the basis of lesion studies. It is definitional of neuroses that they are not caused by structural brain lesions. Neuroses are functional disorders of the nervous system. But they exist, and they are disorders of the nervous system nonetheless. Therefore Freud had to grapple with them, like it or not.
Freud to Fliess (1895): “We cannot do without men with the courage to think new things before they can prove them.”

Фрейд в письме к Флиссу (1895): “Мы не можем обойтись без людей, которые имеют смелость думать о новых идеях, прежде чем они могут доказать эти идеи.”

What’s most important in “talk therapy,” as per Freud? It is to bring awareness about unconscious struggle, and to make it conscious. What are the vehicles?
- Free associations;
- Dream interpretation;
- Exploring the relation between the analyst and the patient.
We can add today:
- Exploring the analyst’s feelings towards the patient.
The brain is a physical matter, which – in the process of coordination/negotiation/modulation of all the inputs (from genes, culture, sensations, emotions, experience, etc., etc.) – produces the mind.

One’s brain and mind are inseparable, although brain has “boundaries,” while mind – does not. Brain is where one’s mind lives, and the mind is what the brain does.

The brain and the mind are two aspects of one system, interdependently arising.

One’s brain and mind inform and change each other constantly (this called neuroplasticity and neurointegration).

The brain-mind science (neuroscience) is relevant to each of us → we are all neuroscientists...
This image shows the neck of God in the *Separation of Light From Darkness* by Michelangelo Buonarroti (1475–1564). The odd depiction (A) bears a striking resemblance to a brainstem, seen in tissue from a cadaver (B) and outlined in the painting (C). Images courtesy of the journal *Neurosurgery*.

Was Emily Dickinson a Neuroscientist?

The Brain - is wider than the Sky -
For - put them side by side -
The one the other will contain
With ease - and You - beside

The Brain is deeper than the sea -
For - hold them - Blue to Blue -
The one the other will absorb -
As sponges - Buckets - do

The Brain is just the weight of God -
For - Heft them - Pound for Pound -
And they will differ - if they do -
As Syllable from Sound

(by Emily Dickinson)

What about Sir Arthur Conan Doyle?

“It is a capital mistake to theorize before one has data. Insensibly one begins to twist facts to suit theories, instead of theories to suit facts.” – Sherlock Holmes/ Sir Arthur Conan Doyle

“It was easier to know it than to explain why I know it.” – Sherlock Holmes/ Sir Arthur Conan Doyle

"I have usually found that there was method in his madness. Some folk might say there was madness in his method.” - Sir Arthur Conan Doyle
What Neurobiology Is All About? Are All Psychotherapists & Psychoanalysts Also the Neuroscientists?

- “Neurobiology, like all science, is an ongoing process of trying to make sense of the world and one's relation to it by a recursive and unending process of making observations, summarizing the observations, and using the summaries to motivate new observations.

- Neurobiology is of interest and is accessible to everyone, and is an essential tool in the repertoire of anyone who is themselves trying to make sense of who they are and how they relate to the world around them.

- Neurobiology, like all science, is best assimilated by a process in which students themselves work through in their own minds and in relation to their own experiences and understandings relevant observations and the summaries of those observations suggested by others.

- Neurobiology, like all science, is a social process, one in which the observations and tentative summaries are shared among individuals, so that each can benefit from the ongoing inquiries of others.”

  – from the Syllabus for Neurobiology class of Prof. Grobstein, Bryn Mawr College.
Structural/Functional Prerequisites of the Mind: 
Brain Basics

Size:
- 3 pounds of tofu-like tissue
- 1.1 trillion brain cells
- 100 billion “gray matter” neurons

Activity:
- Always on 24/7/365 - Instant access to information on demand
- 20-25% of blood flow, oxygen, and glucose
- Typical neuron makes ~ 5000 connections with other neurons:
  - ~ 500 trillion synapses

Speed:
- Neurons firing around 5 to 50 times a second (or faster)
- Signals crossing your brain in a tenth of a second

Processes (on-going): neurogenesis; neuroplasticity, neurointegration

Structure:
- A) Two hemispheres (each divided into lobes: frontal, parietal, temporal, & occipital), middle brain, cerebellum; and brainstem. B) Many pathways. C) Neural networks. D) Grey matter = neuronal cells; White matter = connective pathways made up of tails of nerve cells (covered by myelin).
Structural/Functional Prerequisites of the Mind: The Neurons and the Synapses

- All cells have specialized functions. Brain cells have particular ways of processing information and communicating with each other.
- Nerve cells form complete circuits that carry and transform information.
- Electrical signaling represents the language of mind, the means whereby nerve cells, the building blocks of the brain, communicate with one another over great distances.
- Nerve cells generate electricity as a means of producing messages.
- All animals have some form of mental life that reflects the architecture of their nervous system. (Eric R. Kandel)

Brain as the electro-chemical machine!
Structural/Functional Prerequisites of the Mind: Neuronal Connections

Structural/ Functional Prerequisites of the Mind: Connectomes

Connectome = a map of dynamic functional-structural connections in human brain

From Bonhoeffer and Yuste (2002)

The human brain is a highly complex multilayered organ composed of many billions of neurons, organized into very complicated interconnecting neural networks. Typically, each neuron is connected to tens of thousands of other neurons through connections called synapses. Electrochemical signals that are passed between neurons through these synapses allow them to communicate. The connections between neurons are not static, but change over time.
JANUARY 18, 2014: ...In one of the largest studies looking at the “connectomes” of the sexes, Ragini Verma, PhD, an associate professor in the department of Radiology at the Perelman School of Medicine at the University of Pennsylvania, and colleagues found greater neural connectivity from front to back and within one hemisphere in males, suggesting their brains are structured to facilitate connectivity between perception and coordinated action. In contrast, in females, the wiring goes between the left and right hemispheres, suggesting that they facilitate communication between the analytical and intuition.

Male brains (top) show greater connectivity front-to-back, while female brains (bottom) are more connected across the hemispheres. Source: Science Daily
Structural/Functional Prerequisites of the Mind: Neural Networks

The more signals sent between two neurons, the stronger the connection grows, and so, with each new experience, the brain slightly rewires its physical and functional structure. Unique local physical and functional connections between neurons are called neural networks. Neural networks are typically characterized by preferred signaling pathways, and it is the interactions within and between these networks of neurons that enable us to perform various functions including cognitive functions, such as attention, working memory, pattern recognition and problem-solving.

It is this simultaneous cooperative function of brain areas working together as large-scale networks which is at the root of the sophistication and computational power of the human brain.
Neural Synapses within Neural Networks
Structural/ Functional Prerequisites of the Mind: Left-Right Brain Coordination
Right-Left Connections – Corpus Callosum

LEFT side
- Language
- Symbols
- Sequential planning

Remember the sound of words

"Snake"

RIGHT side
- Pictures
- Music
- Spatial sense

Remember the visual image of objects

Corpus Collusum fibers

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www.hiddentalents.org
Structural/Functional Prerequisites of the Mind: Autonomic nervous system

Do we store the “body memories”? Remember, our brain/mind dyad’s partnership with the Sympathetic & Parasympathetic Nervous System
Structural/Functional Prerequisites of the Mind

Processes

• Neuroplasticity (NP)
• Neurointegration (NI)
• Neurogenesis
• Neural circuitry
• Electro-chemical process

Phenomena

• “Wire together - fire together” principle;
• Synaptic “pruning” phenomenon;
• “Don’t use it – lose it!” phenomenon.

Developmental NP – Synaptic pruning. (See Gopnik et al., 1999.) Example with telephone transmission. At birth – 2,500 synapses per neuron. At age 3 – 15,000; at adult age – half of that – via pruning and apoptosis.

NP of Learning and Memory – via a) change in the internal structure of neurons (especially synapses); b) increase in number of synapses. See Tortora & Grabowski, 1996; Durbach, 2000.

Injury-induced NP – based on taking on functions of the damaged cells.
What Is Neural Plasticity (NP)?

- Ability of the brain to **re-organize its neural pathways** (their structure, functions, connections) accordingly to the new experiences/ learning/ trauma (= accordingly to certain extrinsic and intrinsic stimuli).
- Multiple types of morphological/ chemical/ electrical processes are involved in NP.
- Multiple types of cells are involved in NP (neurons, glia, vasculature).
- Type of the **dominant** NP process is determined by age.
- Two primary conditions trigger NP process: a) normal human **development** and learning; b) **adaptation** (to changed environment) or **compensation** (for lost function).
- Role of **nature** (genes) and **nurture** (environmental factors and free will decisions of each particular individual).

Examples of NP: *Louis Pasteur & strokes; *V.S. Ramachandran & work w/ phantom pain/ chronic pain; *Improving performance through visualizations; *Recent experiments: Wearing blindfolds x 48hrs → visual cortex reorganize itself to process sound and touch. When blindfolds are off → the visual cortex will stop responding to tactile or auditory signals within 12-24 hrs.
Sea Slug – a Model for Neuroplasticity, Learning, and Memory

- Evolution is a tinkerer. In living organisms, new capabilities are achieved by modifying existing molecules slightly and adjusting their interaction with other existing molecules.

- Science has found surprisingly few proteins that are truly unique to the human brain and no signaling systems that are unique to it.

- All life, including the substrate of our thoughts and memories, is composed of the same building blocks.

Eric R. Kandel
Neuroplasticity: Changing our Belief about Change

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Neuroplasticity & Neurointegration in Action, 1

1) **Education** increases *neuronal branching* and brain volume and thickness. Learning → slows age-related mental decline.

2) **Physical exercise** promotes *neurogenesis*.

3) **Aging** brain optimizes itself to compensate for any weaknesses (shift of mental functions).

4) Specifically designed **brain exercises** → strengthen weak brain functions in people with **learning disabilities** (e.g., memorization helps the auditory memory; handwriting - strengthens motor capacities and adds speed and fluency to reading).

5) **Stroke** patients recover some lost abilities due to **brain reorganization**.

6) **Brain physically changes** its state while **thinking** (changes can be measured electronically). → completely paralyzed people move objects with their thoughts and interact with computers.

7) **Imagination and illusion** are used in people with **phantom limb pain** to restructure their brain maps and to overcome chronic pain.

8) People can improve performance through **visualization** : action and imagination often activate the same parts of the brain.
9) Wearing **blindfolds** for two days causes one’s visual cortex to reorganize itself to **process sound and touch**. Once the blindfolds are off, the visual cortex stops responding to tactile or auditory signals within twelve or twenty-four hours.

10) **Pupil adjustment** has been considered to be a fixed, innate reflex, but some people (e.g., the Sea Gypsies) can constrict them by 22%.

11) London **taxi drivers** have a **larger hippocampus** compared to bus drivers. Hippocampus is specialized in acquiring and using complex spatial information in order to navigate efficiently. Taxi drivers happen to use this region all the time, while the bus drivers follow the set routes.

12) “**Meditators**” found to have greater activation of intense **gamma waves** than in volunteers, which signaled **higher mental activity** (e.g., focus, memory, learning and consciousness) and heightened awareness.

13) **Gray matter volume** is professional **musicians**, is higher in motor regions, anterior superior parietal areas and inferior temporal areas.

14) Learning to **juggle** for 7 days → increase in **temporo-occipital cortex**.

15) Extensive **learning of abstract information** → **parietal cortex and the posterior hippocampus** are thickening ( - brain regions involved in memory retrieval and learning).
- Human = Neo (new) – mammalian; deals with cognitive/ logical/ verbal/ symbolism/ mentalization.
- Paleo (old)-mammalian = Limbic system level; deals with emotions.
- Reptilian = Medulla system level; deals with autonomic, involuntary functions such as breathing and heart rate.

P. MacLean, 1990, The Triune Brain
Figure A represents available (so-called hard-wired) brain pathways responding to stimuli, including the traumatic ones.

(Adopted from LeDoux, 1996)
Figure B represents the response (fear reaction) due to acute traumatic stimulus, when higher brain areas do not get involved in modulation of this response.

Figure C represents the response due to chronic/ repetitive traumatic stimulus, when amygdala nuclei are primed to get a more robust response (fear/ fight-and-flight), while higher brain areas and hippocampus look atrophied (from non-use).
The story of Phineas Gage, or famous story of the Traumatic Brain Injury: Phineas Gage’s skull and frontal lobe were pierced by a metal rod, changing his personality forever.
Modeling the path of the tamping iron through the Gage skull and its effects on white matter structure

http://www.plosone.org/article/info:doi/10.1371/journal.pone.0037454
Mean connectivity affected by the presence of the tamping iron combined across subjects

http://www.plosone.org/article/info:doi/10.1371/journal.pone.0037454

Modeling the path of the tamping iron through the Gage skull and its effects on white matter structure

http://www.plosone.org/article/info:doi/10.1371/journal.pone.0037454
Does Brain Anatomy Matter in Mind Matters?

Fear, Anxiety and Anguish
The Pleasure Circuits

Limbic system - a “seat” for emotions?

A- Corpus callosum
B- Olfactory tract
C- Mammillary bodies
D- Fornix
E- Anterior thalamic nuclei
F- Amygdala
G- Hippocampus
H- Parahippocampal gyrus
I- Cingulate gyrus
J- Hypothalamic nuclei

I've learned that people will forget what you said, people will forget what you did, but people will never forget how you made them feel. (Maya Angelou)
The cingulate cortex (yellow) and its anterior portion (orange) in a sagittal section of the brain.

1) orbitofrontal cortex
2) lateral prefrontal cortex
3) ventromedial cortex
4) limbic system
5) anterior cingulate cortex
Key Brain Areas for Consciousness

(adapted from) M. T. Alkire et al., Science 322, 876-880 (2008)
Neuropsychiatric findings in depression correlated with principles of Freudian metapsychology

Hypofrontality

Hyperactivity and electrical stimulation of Cg25

Single photon emission computed tomography (SPECT) images from a depressed patient showing characteristic hypofrontality relative to a healthy control subject.


Positron emission tomography (PET) images of cerebral blood flow changes during transient induced sadness in healthy controls (left); pre deep brain stimulation (DBS) in depressed patients (centre); and 3-month post DBS in treatment responsive patients (right).

Hyperactivity in Cg25 and hypoactivity in the dorsolateral prefrontal cortex (DLPFC) is evident during low mood and depression. This situation is reversed during remission of symptoms. ACC, anterior cingulate cortex; ins = insular; PF, prefrontal cortex.

Do Genes Matter in Mind Matters?

Genes May Dictate Response to Stress

First human brain-imaging study on this topic (Turhan Canli, Stony Brook University). The amygdala region was overactivated in people with the "short" version of the gene and with high levels of life stress. Less stress associated activation in the amygdala in the group of people with a different genetic background. Current direction: to see if one's genotype influences decisions about seeking out a more or less stressful life.

Gene mutations: Pinky and the Brain Experiment

Simple gene mutations can have drastic consequences (e.g., changing one protein can change encephalization of a mouse) - Chenn & Walsh, 2002, Science
Does Nurture Matter in Mind Matters?

Biology is not always destiny in Alzheimer's – twins’ data

- Genetics studies demonstrate significant impact of environment
- 20–40 % likelihood of both twins affected by Alzheimer's
- Low level of education is a risk factor for Alzheimer's disease
- Knowing genetic risk may not increase anxiety
• Hearing Sounds, Understanding Actions: Action Representation in Mirror Neurons
  Evelyne Kohler, Christian Keysers, Alessandra Umiltà, Leonardo Fogassi, Vittorio Gallese, Giacomo Rizzolatti

• Neural mechanisms of empathy in humans: A relay from neural systems for imitation to limbic areas
  Laurie Carr, Marco Iacoboni, Marie-Charlotte Dubeau, John C. Mazziotta, and Gian Luigi Lenzi

Applied Neuroscience: Empathy & Mirror Neurons Research

Single Neuron Recording and the Birth of Relational Neurobiology
Applied Neuroscience: Empathy & Mirror Neurons Research

- Explains the role that mirror neurons may play in how we understand and connect with each other.
- Reports on experiments indicating that the neurons that "fire" when a monkey does an activity also "fire" when the monkey observes the activity, suggesting that neurologically, doing and watching are the same.
- Suggests that humans use a similar "mirroring" response to translate what we see, so that we can relate to each other and the world.
- Demonstrates an experiment involving pictures of different facial expressions that may show how mirror neurons tie us to each other's feelings as well as actions.
- Suggests that mirror neurons may have enhanced humans' evolutionary process and survival success.
Neuroimaging

Why *functional* imaging?

Source: modified from Posner & Raichle, Images of Mind
MRI vs. fMRI

The Brain Before fMRI (1957)
Polyak, in Savoy, 2001, Acta Psychologica
MRI vs. fMRI

**MRI**
- high resolution
- one image

**fMRI**
- low resolution (~3 mm but can be better)
- many images (e.g., every 2 sec for 5 mins)

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**fMRI**

Blood Oxygenation Level Dependent (BOLD) signal - indirect measure of neural activity

⇒ neural activity  ⇒  ↑ blood oxygen  ⇒  ↑ fMRI signal

Source: Jody Culham’s [fMRI for Dummies](https://www.fmrifordummies.com) web site
FIGURE 2. Visual Focus of an Autistic Man and a Normal Comparison Subject Shown a Film Clip of a Conversation
FIGURE 4. Visual Focus of an Autistic Man and a Normal Comparison Subject Shown a Film Clip Portraying an Embarrassed Nonspeaker in a Social Situation.
Christian Nuns, Recalling a Profound Spiritual Experience

Beauregard, et al., Neuroscience Letters, 9/25/06

Tibetan Monk, Boundless Compassion

Meditation Increases One’s Ability to Concentrate and Make Decisions
When researchers looked at brain scans of Buddhist monks meditating, they found that the parts of the brain that help people concentrate and make decisions became more active. The burst of activity was very strong in young monks learning to meditate. But it was smaller in monks who had meditated more. This could mean the older monks' brains had learned to focus more easily.
The deficiencies in our description would probably vanish if we were already in a position to replace psychological terms by physiological or chemical ones. Biology is truly a land of unlimited possibilities. We may expect it to give us the most surprising information and we cannot guess what answers it will return in a few dozen years to the questions we have put to it. (S. Freud)

Almost 100 years have passed since Freud wrote those words, and many of his questions remain unanswered. Steady progress, however, has been made in the development of a neurobiological understanding of what happens in the brain when the mind is engaged in psychotherapy. Advances in cognitive neuroscience and neuroimaging have facilitated a greater appreciation of the neuroanatomy and neurophysiology of the CNS. The technology to study the real-time functioning of the brain through measurement of blood flow or glucose uptake, for example, has been widely used for a quarter of a century. Numerous challenges endure, such as subtle individual variations of neural circuitry, uncertainty as to the proper area to study, and the possibility that differing forms of therapy affect the brain differently. Within the boundaries created by these limitations, however, there is an emerging understanding of the neurobiological correlates of some common psychotherapy elements. ..

http://www.psychiatrictimes.com/neuropsychiatry/neurobiology-psychotherapy
The Neurobiology of Psychotherapy:
Main brain system involved in mediating attachment

<table>
<thead>
<tr>
<th>Common therapy element</th>
<th>Neurobiological correlate</th>
<th>Effects</th>
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<tbody>
<tr>
<td>Attachment</td>
<td>Oxytocin</td>
<td>• Mating behavior</td>
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<td></td>
<td>• Aggression</td>
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<tr>
<td></td>
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<td>• Maternal bonding</td>
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<td>• Anxiety in social settings</td>
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<td>Arginine vasopressin</td>
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<td>• Displays of aggression</td>
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<td>• Affiliation</td>
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<td>Mu-opioid receptor</td>
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<td>• Protection</td>
</tr>
<tr>
<td></td>
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<td>• Separation anxiety</td>
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The Neurobiology of Psychotherapy:
Main brain system involved in mediating empathy

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<th>Neurobiological correlate</th>
<th>Effects</th>
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<tr>
<td>Empathy</td>
<td>Anterior cingulate cortex, insula</td>
<td>Mirroring of physical pain, emotional distress, and social discomfort</td>
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<tr>
<td></td>
<td>Superior temporal sulcus</td>
<td>Predicting future behavior of others</td>
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<td></td>
<td>Oxytocin receptor gene</td>
<td>Emotional aspects of empathy</td>
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<td></td>
<td>Arginine vasopressin 1a receptor gene</td>
<td>Cognitive aspects of empathy</td>
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Main brain system involved in mediating learning

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<td>Learning</td>
<td>Repeated stimulation in single session</td>
<td>Neurotransmitter release</td>
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<tr>
<td></td>
<td>Repeated stimulations across multiple sessions</td>
<td>Synaptic connections</td>
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Adapted from http://www.psychiatrictimes.com/neuropsychiatry/neurobiology-psychotherapy
## The Neurobiology of Psychotherapy:
Main brain system involved in mediating emotion regulation

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<td>Emotion regulation</td>
<td>Prefrontal cortex, posterior parietal cortex, amygdala</td>
<td>Cognitive reappraisal</td>
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<td></td>
<td>Ventral-lateral prefrontal cortex</td>
<td>Suppression</td>
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Adapted from http://www.psychiatrictimes.com/neuropsychiatry/neurobiology-psychotherapy
Main brain system involved in mediating fear extinction

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<td>Fear extinction</td>
<td>Amygdala, ventral-medial prefrontal cortex, rostral anterior cingulate cortex</td>
<td>Fear extinction</td>
</tr>
<tr>
<td></td>
<td>NMDA activation</td>
<td>Enhances fear extinction</td>
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<tr>
<td></td>
<td>Hippocampus</td>
<td>Provides context for fear extinction</td>
</tr>
</tbody>
</table>

Adapted from http://www.psychiatritetimes.com/neuropsychiatry/neurobiology-psychotherapy
The Brain Reacts to Psychotherapy
http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0109037

Objective
Neurobiological models of depression posit limbic hyperactivity that should normalize after successful treatment. For psychotherapy, though, brain changes in patients with depression show substantial variability. Two critical issues in relevant studies concern the use of unspecific stimulation experiments and relatively short treatment protocols. Therefore changes in brain reactions to individualized stimuli were studied in patients with depression after eight months of psychodynamic psychotherapy.

Results
At T1 patients showed enhanced activation compared to controls in several limbic and subcortical regions, including amygdala and basal ganglia, when confronted with OPD sentences. At T2 the differences in brain activity between patients and controls were no longer apparent. Concurrently, patients had improved significantly in depression scores.

Conclusions
Using ecologically valid stimuli, this study supports the model of limbic hyperactivity in depression that normalizes after treatment. Without a control group of untreated patients measured twice, though, changes in patients' brain activity could also be attributed to other factors than psychodynamic therapy.
Frontolimbic neural circuit changes in emotional processing and inhibitory control associated with clinical improvement following transference-focused psychotherapy in borderline personality disorder.


Aims: Borderline personality disorder (BPD) is characterized by self-regulation deficits, including impulsivity and affective lability. Transference-focused psychotherapy (TFP) is an evidence-based treatment proven to reduce symptoms across multiple cognitive–emotional domains in BPD. This pilot study aimed to investigate neural activation associated with, and predictive of, clinical improvement in emotional and behavioral regulation in BPD following TFP.

Results: Analyses demonstrated significant treatment related effects with relative increased dorsal prefrontal (dorsal anterior cingulate, dorsolateral prefrontal, and frontopolar cortices) activation, and relative decreased ventrolateral prefrontal cortex and hippocampal activation following treatment. Clinical improvement in constraint correlated positively with relative increased left dorsal anterior cingulate cortex activation. Clinical improvement in affective lability correlated positively with left posterior-medial orbitofrontal cortex/ventral striatum activation, and negatively with right amygdala/parahippocampal activation. Post-treatment improvements in constraint were predicted by pre-treatment right dorsal anterior cingulate cortex hypoactivation, and pre-treatment left posterior-medial orbitofrontal cortex/ventral striatum hypoactivation predicted improvements in affective lability.

Conclusions: These preliminary findings demonstrate potential TFP-associated alterations in frontolimbic circuitry and begin to identify neural mechanisms associated with a psychodynamically oriented psychotherapy.
“The One-Sided Focus on CBT is Damaging Swedish Mental Health”

In 2012, Sweden did massive investment (two billion Swedish Crowns) in cognitive behavioral therapy (CBT). The idea was simple: address rising rates of disability due to mental illness by training clinicians in CBT. Now, several years and nearly 7 billion Crowns later, the National Audit Office (NAO) audited the program. Briefly, it found:

• The widespread adoption of the method had no effect whatsoever on the outcome of people disabled by depression and anxiety;
• A significant number of people who were not disabled at the time they were treated with CBT became disabled thereby increasing the amount of time they spent on disability; and
• Nearly a quarter of people treated with CBT dropped out.

The Swedish NAO concludes, “Steering towards specific treatment methods has been ineffective in achieving the objective.”

How, you might reasonably ask, could anyone think that restricting choice would improve outcomes? It was 1966, when psychologist Abraham Maslow famously observed, “I suppose it is tempting, if the only tool you have is a hammer, to treat everything as if it were a nail” (p. 15, The Psychology of Science). Still, many countries and professional organizations are charting a similar path today.
References


Socrates and Descartes are probably the two most important philosophers who ever lived, because they are the two who made the most difference to all philosophy after them. At least seven features unite these two philosophers and distinguish them from all others.

1. Each was an initiator, a revolutionary, virtually without predecessors. No other philosophers depended so little on previous philosophers, and no other philosophers made subsequent thinkers depend so much on them.

2. Each began by doubting and questioning everything, or nearly everything, even the commonplaces everyone else took for granted.

3. Each made the quest for the knowledge of the self the central philosophical quest, though they meant somewhat different things by it. What Socrates meant by "know thyself" was "know Man's essence, know universal human nature." What Descartes meant was "know your own existence as an individual."

4. Each identified the 'self' with the soul rather than the body. Each was a "dualist": they believed that reality is dual (twofold): matter (including our bodies) and spirit (including our souls).

5. Each focused on the epistemological question, or "the critical problem" of How do you know?


7. Each believed he was divinely commissioned to philosophize by a supernatural sign.

Is This True?

Biblical Psychiatry’s view of man

The Ontological Dichotomy of Man
1 Thess 5:23; Heb 4:12; Lk 16:19-31

Body
Biological Machine
Robot to the spirit

Spirit
Seat of personality
memory, choice,
mood, emotion

Brain
Interface between
body and spirit that
exchanges information
like a USB cable between
a CPU and printer
-contains no memory storage
-not responsible for choice
-does not generate emotion

www.bible.ca
Using PET scans, scientists are in the first stages of relating different emotional states—pleasure, sorrow—to different patterns of brain activity.

**Functional magnetic resonance imaging**, or MRI, is another new technology that can detect the living brain at work. This is a computer-enhanced fMRI scan of a person who has been asked to look at faces. The image shows increased blood flow in the part of the visual cortex that recognizes faces.
NB: ***Corpus callosum plays the important role of connecting the left and right cerebral hemispheres.

***Anterior commissure is part of the path for pain.

***Medulla deals with autonomic, involuntary functions such as breathing and heart rate.
A: Projections to and from amygdala nuclei to other regions of the brain. Abbreviations: Cx: cortex, DM: dorsal medial.

B: Association of amygdala with brain regions that are actively involved in emotional processing (red) and brain regions that are typically involved in emotion inhibition and regulation (blue), as well as other regions involved in emotional responses (purple). Abnormal morphometry and activity of these brain regions are frequently reported in stress-related psychiatric conditions. Abbreviations: ACC: anterior cingulate cortex, VMPFC: ventral medial prefrontal cortex, IFG: inferior frontal cortex, OFC: orbital frontal cortex, R_Ant_Insula: right anterior insula, DMPFC: dorsal medial prefrontal cortex, DLPFC: dorsal lateral prefrontal cortex, PCC: posterior cingulate cortex. (Yan, 2012)
The Psychosomatic Medicine Theory

Thoughts Ideas

Emotions Sensations Feelings

Stress

Mind-Brain

Brain-Body

Cell-Genetic-Molecular

Autonomic Nervous System

Endocrine system

Peptic ulcer

Gastrointestinal etc

Adrenals

Cybernetic Feedback to Limbic-Hypothalamic-Pituitary

Thymus, Spleen, Lymph, etc
Paralyzed Man’s Arm Wired to Receive Brain Signals
After doctors bridge his spinal injury with electronics, a paralyzed man can control his arm with his thoughts. By Antonio Regalado on October 20, 2015

The project, described today at the meeting of the Society for Neuroscience in Chicago, is a step toward a wireless system able to transmit brain signals through the air to electronics sewn into the limbs of paralyzed people, thereby restoring the ability to carry out simple daily tasks.
A Shocking Way to Fix the Brain
Neurosurgeons hope to treat some of the most intractable mental disorders by putting advanced arrays of electrodes into patients’ brains.

“...Dr. Eskandar’s OCD patients take three-hour showers. They spend eight hours cleaning their surroundings with bleach. They get stuck at the bathroom sink in their hotel room on appointment days, unable to stop washing their hands until someone comes to get them. OCD affects an estimated 2.5 million adult Americans. But only those who have exhausted all other treatment options—Luvox, Anafranil, Prozac, cognitive behavioral therapy—end up on Eskandar’s operating table at Massachusetts General Hospital.

... Most psychiatrists agree that new treatments for mental illness are desperately needed. Existing drugs for brain disorders are often ineffective and frequently produce troublesome side effects. One reason is that drugs alter the chemistry of the entire brain, not just the area of interest, modulating the behavior of otherwise healthy neurons.
Talk Therapy Found to Ease Schizophrenia
http://www.nytimes.com/2015/10/20/health/talk-therapy-found-to-ease-schizophrenia.html
By Benedict Carey
OCT. 20, 2015
Dr. Moshe Szyf, McGill University
"Epigenetic processes mediating between early life environments and mental health; diagnostic and therapeutic implications."

International Society for Research in Child and Adolescent Psychopathology
Early life adversity is known to have long-lasting impact on the phenotype of the offspring; particularly important are the associations between early life adversity and development of psychiatric disorders later in life. What are the mechanisms that mediate between exposure to stress during gestation and long-term effects on mental health? DNA methylation is a mechanism that marks genes during development and provides identical DNA sequences with different identities. Experiments in rodents demonstrated that low maternal care resulted in changes in DNA methylation in the glucocorticoid receptor gene in the hippocampus, which remained throughout life and altered the life long behavior of the offspring increasing anxiety and responsivity to stress. Similarly in humans we noted differences in DNA methylation in the glucocorticoid gene in hippocampi of adults who were abused as children. Our recent studies show that these changes in DNA methylation in response to early adversity affect broad regions of the genome and that they are not limited to the brain and occur in the immune system as well. Data from nonhuman primates and humans shows overlapping genes that are altered in response to both prenatal and postnatal stress in multiple tissues; placenta, the immune system and the prefrontal cortex. A fraction of these alterations in the methylome remain in a gender specific way into adulthood. We have evidence from a study of a natural disaster in humans that objective stress is associated with changes in DNA methylation that are detectable in T cells and remain into adolescence. The DNA methylation changes in T cells in the 5HTT transporter are associated with serotoninergic activity in the brain. We propose that the changes in DNA methylation in response to early life adversity are “adaptive genomic” mechanisms that adapt life-long genome programming to the anticipated life-long environment based on signals received during gestation and early life. These data have both diagnostic and therapeutic implications that will be discussed.
Imaging studies of the newborn and infant brain provides many novel opportunities for better understanding both early biomarkers of risk for mental disorders, and potentially for early identification of future disorder. Major findings from the UNC Early Brain Development Study, a longitudinal imaging study of typical children, twins, and children at risk for schizophrenia will be presented. At birth, the basic structure of cortical gray matter and white matter tracts is already established. In the first years of postnatal life, there is rapid growth of cortical thickness and surface area, myelination of existing white matter connections, as well as development of resting state functional networks. Genes of risk for schizophrenia predict differences in neonatal brain structure, and children at risk exhibit abnormal functional connectivity shortly after birth. The study of genetic and environmental influences on neonatal brain structure and early developmental trajectories will be critical for understanding the causes of developmental and psychiatric disorders, identifying early biomarkers of risk, and for defining periods of postnatal brain development that are more or less plastic and responsive to early interventions.
A man who fears suffering is already suffering from what he fears.  
Michel de Montaigne

It is the mind that maketh good or ill, That maketh wretch or happy, rich or poor.  
Michel de Montaigne
Neurotransmitters Different parts of your brain share information and organize plans for action through a code system that involves both chemistry and electricity. Chemicals called neurotransmitters" are emptied from tiny sacs into the space between nerve cells. These chemicals cross that space and bind to receptors on other nerve cells. The binding process triggers an electrical stimulus in the receiving cells, that starts the whole process of chemical release all over again.
aim of reconciling psychoanalytic and neuroscientific perspectives on the mind. This goal is based on the assumption that these two historically divided disciplines are ultimately pursuing the same task, namely, 'attempt[ing] to make the complications of mental functioning intelligible by dissecting the function and assigning its different constituents to different component parts of the [mental] apparatus' (Freud, 1900a, p. 536).

Notwithstanding the fact that psychoanalysis and neuroscience have approached this important scientific task from radically different perspectives, the underlying unity of purpose has become increasingly evident in recent years as neuroscientists have begun to investigate those 'complications of mental functioning' that were traditionally the preserve of psychoanalysts. This has produced an explosion of new insights into problems of vital interest to psychoanalysis, but these insights have not been reconciled with existing psychoanalytic theories and models. Likewise, neuroscientists tackling these complex problems of human subjectivity for the first time have much to learn from a century of psychoanalytic inquiry.
The neural bases of key competencies of emotional intelligence

Frank Krueger, a,b Aron K. Barbey, b,c Kevin McCabe, d Maren Strenziok, b Giovanna Zamboni, e Jeffrey Solomon, f Vanessa Raymont, g and Jordan Grafman b,1

http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2799712/
Andre Haynal:
Historically, in hypnosis, associations were unidirectional and were not tied to actual, hidden affects. Through its evolution beyond hypnosis, analysis was redirected little by little towards mutuality.
The building blocks of analysis are an exploration of the unconscious aspects of personality through the associations of the analyzand and analyst as well as their affective exchange. Interpretation is, therefore, in no way an application of metapsychology to individual cases, but very much a free exchange between protagonists in a specific situation. The affective exchange develops, reinforces, and authenticates the framework of the encounter.
Whatever the case for the analyst’s anonymity, and thereby his or her “neutrality,” is not analysis an undeniably personal encounter in every way?

In summary: If we consider that the analytic task unfolds within its framework, thanks, in part, to the analyst’s (and the analyzand’s) intervening, which we call interpretation, this article pleads for a perspective of interpretation as one of the elements of the exchange. It is, on the one side, verbally communicated insight, and on the other side, affective contents. As such, interpretation is, in fact, a carrier of affects in an intense exchange, sometimes unintentional, in which the musical component (rhythm, melody, intensity, tonality) finds all of its significance.
Two of the most compelling features of the last twenty years have been dramatic achievements in the laboratory and striking advances in biomedical technology. Together, they have literally extended the frontiers of the mind by embodying emotions in the biology of the brain more successfully than ever before and by creating the possibility of identifying the intricate interconnections between brain-based emotions and the functioning of the neuroendocrine and immune systems. Spectacular developments in laboratory science and visualization technology have been essential components of the explosive development of neuroscience, a field which has quickly become one of the most respected, exciting and actively pursued in medicine. Within the neurosciences an area variously called "psychoneuroimmunology" and "neuroimmunomodulation" has recently emerged which seems on the verge of tracing the pathways between emotions and disease whose connections had long been glimpsed in clinical contexts by physicians ranging from Galen to Freud and from Maimonides to Alexander.

The modern grounding of emotional expression in the biology of the brain began with the work of the American neuroanatomist James Papez. In 1937, Papez argued from anatomical and clinical evidence that an "ensemble of structures" in the lower, subcortical areas of the brain constituted the "anatomic basis" and "harmonious mechanism" for the elaboration and expression of emotions. Rejecting the possibility that emotion is "a magic product," Papez insisted that it is "a physiologic process which depends on an anatomic mechanism."
Papez’s ideas were effectively promoted by Paul MacLean, a physician and neurophysiologist. In 1949, MacLean proposed a hypothesized "visceral brain" as an anatomical and functional system intermediate between the "intellectual" cortex and the "discharging" hypothalamus. This system was "largely concerned with visceral and emotional functions." In the 1950s, MacLean generalized his ideas into a theory of the "limbic system," an integrated set of subcortical structures in the brain including the hippocampus and amygdala whose precise role in emotional expression and modulation he explored through the electrical and chemical stimulation of specific anatomical regions and structures. Other investigators added human clinical evidence and the results of surgery on the brains of laboratory animals, which also pointed to the role of the limbic system in the expression of emotions.

The organs of the immune system (thymus, spleen, and lymph nodes) and the organs of the neuro-immune system (adrenal gland, hypothalamus, and the cortical and subcortical brain).
Interest in the limbic system remained strong through recent times, although in the last several years neuroscientists have raised questions about the looseness of some of the earlier theoretical assumptions and anatomical constructs. They are still interested in the neural substrates of emotion within the brain but have shifted their attention to the hemispheres of the cerebral cortex and to the interactions between cortical and subcortical regions. In the 1970s, neuroscientists began to concentrate on the right cortical hemisphere as the most interesting locus of emotional control. Roger Sperry’s award of the Nobel Prize in 1981 for his work on "cerebral laterality" (the differences between the "left" and the "right" brain and their behavioral significance) reinforced this trend, but respected neuroscientist R.W. Doty indicated in a 1989 review article that "any idea of emotion in an intact mammal being played out purely via subcortical circuitry is an unsustainable abstraction. On the other hand, the evidence is unequivocal that subcortical structures are essential for the expression of the more "primitive" emotions, and can support such expression in the absence of the neocortex." Current work is verifying the integrative functioning of cortical and subcortical areas (especially the amygdala) in the organism’s response to primitive emotional experiences such as fear.
Structural/Functional Prerequisites of the Mind: Autonomic nervous system

Lane R D et al. (2009). Psychosomatic Medicine, 71, 117-134