

NEURONS ON THE COUCH

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SUMMARY

A hundred years after psychoanalysis was introduced, neuroscience has taken a giant step forward. It seems nowadays that effects of psychotherapy could be monitored and measured by state-of-the art brain imaging techniques.

Today, the psychotherapy is considered as a strategic and purposeful environmental influence intended to enhance learning. Since gene expression is regulated by environmental influences throughout life and these processes create brain architecture and influence the strength of synaptic connections, psychotherapy (as a kind of learning) should be explored in the context of aforementioned paradigm. In other words, when placing a client on the couch, therapist actually placed client's neuronal network; while listening and talking, expressing and analyzing, experiencing transference and counter transference, therapist tends to stabilize synaptic connections and influence dendritic growth by regulating gene-transcriptional activity.

Therefore, we strongly believe that, in the near future, an increasing knowledge on cellular and molecular interactions and mechanisms of action of different psycho- and pharmaco-therapeutic procedures will enable us to tailor a sophisticated therapeutic approach toward a person, by combining major therapeutic strategies in psychiatry on the basis of rational goals and evidence-based therapeutic expectations.

Key words: psychotherapy - neurobiology - brain imaging - neuropsychology - learning

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„As a result, when I speak to someone and he or she listens to me, we not only make eye contact and voice contact but the action of the neuronal machinery in my brain is having a direct and, I hope, long-lasting effect on the neuronal machinery in his or her brain, and vice versa. Indeed I would argue that it is only insofar as our words produce change in each other's brains that psychotherapeutic intervention produces change in patient's mind“

(Kandel 1979)

INTRODUCTION

Establishing an evidence base for psychodynamic therapy, the form of therapy that began with Sigmund Freud and was historically utilized more than any other psychotherapy treatment, has been a great challenge during the last century. The fact is that Freud himself has said: "Psychoanalysis is unjustly reproached, gentlemen, for leading to purely psychological theories of pathological problems. The emphasis which it lays on the pathogenic role of sexuality, which, after all, is certainly not an exclusively psychical factor, should alone protect it from this reproach. Psychoanalysts never forget that the mental is based on the organic, although their work can only carry them as far as this basis and not beyond it." (excerpt from a lecture delivered by Freud in 1910).

NEUROPSYCHOANALYSIS

A hundred years after psychoanalysis was introduced, neuroscience has taken a giant step forward. From the definition of WC Dendy (surgeon, 1794–1871), who said that "psychotherapeia" is "the helpful influence of the healer's mind upon that of a sufferer" (see Heinemann 1983) we come to much more sophisticated ideas in XXI century, which consider psychotherapy, for example, as a strategic and purposeful environmental influence intended to enhance learning

(Cappas et al. 2005). It is not surprising that on 2000 in London, therapists and scientist joined to establish The International Neuropsychology Society (Matthis 2000), which promotes interdisciplinary work between the fields of psychoanalysis and neuroscience. The new discipline named "Neuropsychology" claimed to offer a kind of unified theory: by correlating neurological insights into the structure and function of the brain with psychoanalysis's observation focused of subjectivity, neuro-psychoanalysis should be able to avoid, on the one hand, the mechanistic reduction of mental life sometimes associated with neuroscience, and, on the other hand, the mystical preference for theory over the scientific facts, sometimes typical for psychoanalysis.

Of course, there is an opposition to the efforts to integrate psychoanalysis and neuroscience. They highlight that the criticism does not imply that psychoanalysis is too vulnerable for interdisciplinary dialogue, but rather highlights the strength and special value of the field of psychoanalysis as a domain concerned with meanings, to which neuroscience cannot contribute significantly (Smith 1997, Blass & Carmelli 2007). In the paper entitled "Case against neuropsychology" (Blass & Carmelli 2007), authors used picturesque explanation: they explained that comparison of domains like neuroscience and psychoanalysis was "like considering chemistry and art as two irreducible perspectives on the paintings of Van Gogh. Indeed there

would be no painting without the chemical components of paint and canvas, but to suggest that these components provide an explanation of the painting that would be valuable for the artist is to deny the value of art and that which can be seen only through an artistic perspective". There is no doubt that such comparison is opening long and dynamic discussion, but to follow this direction is beyond the scope of our paper.

FROM PSYCHOTHERAPY TO BRAIN FUNCTION AND NEURAL CIRCUITS

Freud proposed that unwanted memories can be forgotten by pushing them into the unconscious, a process called repression. It was unknown, however, how repression occurs in the brain. However, contemporary research on memory and attention showed that humans have executive control processes (considered a key control function of the frontal lobes) to minimize perceptual distraction, overcome interference during short and long-term memory tasks and stop strong habitual responses to stimuli. In a 2001, Anderson and Green, who hypothesized that cognitive act has enduring consequences for the rejected memories, showed that the forgetting increased with three evident factors: (1) the number of times the memory is avoided, (2) resisted incentives for accurate recall, and was caused by (3) processes that suppressed the memory itself. The authors then concluded that executive control processes not uniquely tied to trauma might provide a viable model for repression. In addition, within the next few years the same group evaluated neuronal basis for aforementioned factors (Anderson et al. 2004) and found that controlling unwanted memories was associated with increased dorsolateral prefrontal activation, reduced hippocampal activation, and impaired retention of given memories (both prefrontal cortical and right hippocampal activations predicted the magnitude of forgetting). These results, according to Anderson and colleagues (2004), confirmed the existence of an active forgetting process and established a neurobiological model for guiding inquiry into motivated forgetting.

On the other hand, neuroimaging studies of the brain and behavior, from Baxter et al. (in the 1990s) till now, have shown that psychotherapy and pharmacotherapy almost equally resulted in the normalization of previously raised or reduced activity in a certain brain regions of interest. For example, in treating patients with compulsive disorders, studies showed that both therapies (psychotherapy based on cognitive-behavioral therapy i.e. CBT principles in comparison to pharmacotherapy with SSRI antidepressants) equally resulted in the normalization of previously raised metabolism rates in the right caudate nucleus (for a review, see Linden 2006).

Additionally, it seems that state-of-the art functional imaging can even predict which patient will respond to psycho- or pharmaco-therapy and which will not. Interesting data acquired from measuring glucose meta-

bolism in subjects with major depression, published by Helen Mayberg's group (Konarsky et al. 2009) have shown that hyperactivity of certain regions within cingulate cortex - CC (interface of pregenual and subgenual CC) was a predictor of non response to both psychotherapy (CBT) or pharmacotherapy (venlafaxine), and suggested that in the resistant cases, only the deep brain stimulation of subcallosal cingulate gyrus, including Brodmann area 25, should be considered as a therapy of choice (see Schlaepfer et al. 2009 for guidelines).

In the recent years, further functional neuro-imaging studies were published on pharmacotherapeutic as well as psychotherapeutic treatments in patients with a range of mental disorders, particularly focusing on effects of CBT. But, the most recent fMRI findings from Mainz (Germany), that included subjects with panic disorder, showed that there was some similarity in the effects of psychotherapy regardless the type of psychotherapeutic intervention. Namely, in persons with panic disorder, very high limbic (hippocampus and amygdala) activation was accompanied with low prefrontal activation in relation to negative words (inhibition-related activation patterns were noticed), but after a short-term psychodynamic treatments that lead to visualized changes in fronto-lymbic circuitry, inhibition-related activation patterns disappeared and such results were similar to one registered after CBT, under the similar research conditions (Beutel et al. 2010). Thus, either with CBT or by psychodynamic-therapy interventions, changes in neuronal circuits were noticed in the same manner in patients with panic disorder whose suffering decreased.

"Seen in a larger context, one may consequently state that all psychiatric interventions are, at the end of the day, of a biopsychosocial nature" (Brenner et al. 2006).

PSYCHOTHERAPY AS A PURPOSEFUL ENVIRONMENTAL INFLUENCE THAT ENHANCE LEARNING

Since the pioneering studies on the neurobiological foundations of learning by Donald Hebb (1904-1985) in the middle of the last century (Brown & Milner 2003), many scientists and clinicians showed that interplay between several factors: genetic, biological, developmental (psychological) and environment-related factors, influence the onset and course of mental disorders (Marić et al. 2009 – ref 15,16).

In a fundamental article entitled "A New Intellectual Framework for Psychiatry," Nobel Prize winner Eric Kandel (1998) proposed several principles for informing psychological thinking with the advances made by the neurosciences over the last century. Most notably, he proposed that "all mental processes, even the most complex psychological processes, derive from operations of the brain". Discussing on this brain-behavior connection, he further suggested that "altered genes do not, by themselves, explain all of the variance

of a given major mental illness”, leaving the possibility that experience and environment influence development and function of the brain. The fact is that genome sequence remains constant, but its transcription (its ability to control the formation of specific proteins) does not! For instance, once genes have been activated by cellular developmental processes early in life, the type and the extent of gene expression is being regulated by environmental influences throughout life. These processes create the brain architecture and influence the strength of synaptic connections. In particular, the discovery of the synaptic plasticity of the brain provides a foundation for understanding how neuronal networks are formed by activity and stimulation (Brenner et al. 2006). According to Kandel (1998): “Insofar as psychotherapy or counseling is effective and produces long-term changes in behavior, it presumably does so through learning, by producing changes in gene expression that alter the strength of synaptic connections and structural changes that alter the anatomical pattern of interconnections between nerve cells of the brain. As the resolution of brain imaging increases, it should eventually permit quantitative evaluation of the outcome of psychotherapy.”

Psychotherapy, if considered as a strategic and purposeful environmental influence intended to enhance learning (Cappas et al. 2005) may be particularly effective in shaping the expression of genes.

“Considerable evidence has been accumulated that, in addition to neurobiological interventions, psychotherapy presents an effective form of influencing and changing metabolic activity and the microstructure of the brain. If psychotherapy is understood to be a form of learning, then the unfolding learning process can also effect changes in gene expression and thus influence the strength of synaptic connections” – Brenner et al. (2006).

With (unrestricted) freedom to imagine (Maric et al. 2009 - ref 16), one can expect that when placing a clients on the couch, we actually place their neuronal networks; while listening and talking, expressing and analyzing, experiencing transference and contra-transference, we normalize the synaptic connections and influence the dendritic growth by regulating gene-transcriptional activity.

CONCLUSION

Mental illness is the product of a circular causality between nature and nurture, constantly interacting with each other. Correspondingly, successful therapy interventions that start at various stages of illness development and treat a certain spectrum of dysfunctions have a bidirectional effect each time. We hope that increasing knowledge on cellular and molecular interactions and mechanisms of action of different therapeutic procedures in psychiatry today will enable us not only to specifically address different psychopathological syndromes with either pharmacotherapy or psycho-

therapy, but to use individually tailored therapeutic schemas by combining all available treatment strategies on the basis of well defined goals and evidence-based expectations from any given therapeutic approach.

Kandel’s statement (1979) that: “A genuine dialogue between biology and psychoanalysis is necessary if we want to achieve a coherent understanding of mind” should become a contemporary research algorithm.

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