Chapter 10
Commentary: Neurobiology of Psychotherapy – State of the Art and Future Directions

Andrew J. Gerber

Keywords Neuroscience • Neuroimaging • Psychoanalysis • Psychodynamic Psychotherapy • Psychotherapy • Psychotherapeutic Change

The region of intersection between neurobiological research and psychoanalysis is fertile and growing. As every chapter in this section attests, both empirical methods and psychoanalytic theories have advanced toward a kind of interaction that would have delighted Sigmund Freud. While this area of research grows and finds its identity, perhaps the greatest challenge will be for it to define its goals. Therefore, with these chapters in mind, I propose the following unifying principles:

1. The best descriptions of psychopathology lie not in the use of sharply defined categories, but rather in a set of continuous trait and state variables describing the content and structure of an individual's mental life [1, 2].
2. The origins of most psychopathology are understood best as an interaction between inherited/genetic factors that lead to psychological traits, strengths, and vulnerabilities on the one hand and environmental factors, particularly experience, on the other [3, 4].
3. Psychological traits and processes are best understood not by being divided into the categories "cognitive," "affective," and "social," but rather as a combination of all three [5].
4. The mechanism(s) of action in psychotherapies of all kinds, including psychoanalysis and psychodynamic psychotherapy, overlap more than current clinical theories describe, thus beginning to explain the widespread finding that there are multiple effective ways to treat psychiatric illness with talk therapy [6, 7]; (Chaps. 11, 12, 13, 15, 16).

It is no coincidence that the psychoanalytic intellectual tradition has led us to the realization that former dichotomies are insufficient for describing our psychological lives. The psychoanalytic perspective is anchored in the notion that individuals create narratives that shape their thinking and behavior. By thinking *about* these strategies (what current researchers often refer to as "meta-cognition"), we gain the ability to make incremental modifications to these narratives, with significant impact on the way we organize old and new information. Just as we do this in successful individual treatments, we now have the opportunity to integrate multiple perspectives in our theory and research. These chapters are an important step in that direction.

A.J. Gerber (✉)
Division of Child and Adolescent Psychiatry, Columbia University, New York State Psychiatric Institute, New York, NY, USA
e-mail: gerbera@nyspi.columbia.edu

R.A. Levy et al. (eds.), *Psychodynamic Psychotherapy Research: Evidence-Based Practice and Practice-Based Evidence*, Current Clinical Psychiatry, DOI 10.1007/978-1-60761-792-1_10,

Unsurprisingly, there are many ways to embark on such an integration. These may be seen as lying on a continuum from detail-oriented investigation of individual empirical techniques and empirical findings related to psychopathology (what we can call the "trees") to broader theoretical and systems-neuroscience discussions of how our knowledge fits together (the "forest"). The chapters by Lehtonen et al. (Chap. 12) and Karlsson (Chap. 13) describe in detail two important techniques (positron emission tomography (PET) and single photon emission computed tomography (SPECT)) for measuring the state of the brain serotonin system, known to be central to a broad range of mental functions, and using this to quantify change in response to psychodynamic psychotherapy [9]. Buchheim and colleagues (Chap. 14) similarly describe how they use functional magnetic resonance imaging (fMRI) to analyze the psychological response of patients with borderline personality disorder (BPD) to attachment-related images. Ghaznavi et al. (Chap. 18) outline a promising study design, incorporating PET as well, for integrating neuroimaging in a psychodynamic psychotherapy treatment.

At the other end of the spectrum, Gabbard (Chap. 15), Riess (Chap. 17), and Viamontes (Chap. 19) take a bird's eye perspective on the role of neurobiology in understanding psychopathology and treatment from a psychodynamic perspective. By citing individual empirical findings in the realms of BPD (Gabbard) and the neurobiological systems that underlie a wide range of mental processes (Viamontes), these authors paint a new and exciting picture of the mind, in which language formerly thought of as purely "psychological" or "biological" is seamlessly integrated. Roffman et al. (Chap. 11) and Wong and Haywood (Chap. 16) stake out a middle ground, in which specific concepts, particularly in cognitive neuroscience, are used to bridge non-psychoanalytic and psychoanalytic ideas about the brain and mind.

Mechanisms of Action

A unifying and centrally motivating pursuit in the field of psychodynamic research is to identify the mechanisms of action for change in psychodynamic psychotherapy and psychoanalysis [7]. Perhaps, no other question is as central to the daily thinking of clinicians, researchers, and even patients themselves [9]. The work of empirical psychodynamic researchers, such as those represented in this section, suggests first that we know more about this now through neurobiological research than was known before, and second, that at least some of our difficulties lie in the use of different and sometimes ambiguous terminology [10]. To that end, I will suggest three principle mechanisms of action, anchored in what we know about both psychotherapeutic change and neural mechanisms of learning.

Exploration of Affect: Exposure and Response Prevention

One of the most basic mechanisms of change, often referred to as simple learning and known from decades of animal research to be mediated by the hippocampus and amygdala, involves desensitization to a stimulus through repeated exposure, without concurrent negative consequences (i.e., response prevention) [11]. This mechanism is discussed most consistently by non-dynamic clinicians and theorists (and forms a core component of behavior therapy) and may *sound* less psychodynamic if one adheres to the entrenched false dichotomy between "cold cognitive" (i.e., exposure learning) and "social/emotional" learning. However, as described both through clinical accounts and through psychodynamic process research, a significant amount of most dynamic sessions is spent in helping patients attend to thoughts and affects that have been linked in the past to negative experiences, demonstrating that such attention is not only tolerable but will ultimately help to avoid future problems [12, 13]. In fact, one might see a significant part of the analysis of defense as allowing greater "exposure" to painful thoughts and feelings both in and outside of sessions. Dynamic and

non-dynamic clinicians would still disagree, in many cases, on whether the beneficial effect of exposure comes from the mere presence of the thoughts and feelings themselves (a more traditionally non-dynamic view) or some kind of "working through" of the thoughts and feelings. However, one might see this distinction as another kind of false dichotomy and accept that all exposures have both components (probably impossible to distinguish from one another in most circumstances). As we read the findings of important experiments such as those by Lehtonen et al. and Karlsson, we must consider to what extent exposure is the most parsimonious account for the changes they observe.

Understanding and Practicing New Relationship Patterns: Working in the Transference

It has been an accepted premise of cognitive science for some time that a considerable portion of what we "know" is stored as a set of behaviors or procedures, not as declarative or language-based ideas [14, 15]. These procedures may or may not then be accessible to our conscious awareness, but even under those circumstances, our awareness comes after the establishment of the memory and is not an intrinsic or necessary part of it. For example, a golf pro who can describe the mechanism of his swing and even notice when his swing has changed in some way nonetheless encodes the behavior of his swing separately from this description. The issue of how such procedural knowledge is changed, however, is more complicated and is, as of yet, poorly understood. It would stand to reason that devoting conscious attention to a procedure, as in the case of the golf swing, might help *practice* a different, and hopefully better, way of executing the behavior, even if in the moment of consciously applying the knowledge the behavior is more awkward and may even be less successful (imagine the self-conscious execution of a set of behaviors, in contrast with the natural fluidity of when it has become automatic).

This understanding suggests that social behaviors, which require a great deal of automaticity and fluidity, are executed the vast majority of the time without any self-consciousness and fall into the category of procedural memory [14]. Therefore, a major mechanism of action in psychotherapy may be establishing the structures for *practicing* such behaviors. This may, at least in part and in some clinical situations, consist of actual practice during sessions (what has long been termed the "corrective emotional experience") but also includes the use of some conscious framework – psychodynamic or otherwise – to remind the patient how to practice behaving more successfully in relationship contexts. The nature of the framework may matter less than its success in getting the patient to practice more adaptive behavior. Transference interpretations can be used to establish one kind of such framework, and though immediate and powerful in their nature when applied properly, are not necessarily the only effective ones.

The neural basis of procedural memory, cognitive schemas, and relationship-specific schemas is currently under investigation. Unlike declarative memory, which is subserved by the hippocampus [16], procedural memory has been shown to be based in the basal ganglia [17]. Social cognition, even that outside of conscious awareness, has been traced to regions of the temporal lobe, including the anterior temporal pole as well as the more posterior fusiform face area [18]. Investigation is currently underway to determine how circuits in these areas bring about relationship schemas.

Building a Narrative: Cognitive Restructuring

Exposure and response prevention (process 1) is the description of a narrow range of information (the stimulus) over time. Relationship patterns (process 2) describe a broader range of information (i.e., how a set of independent agents interact) but at a single point in time. Therefore, it stands to reason that the third mechanism looks at the way a broad range of independent agents interact over time, in

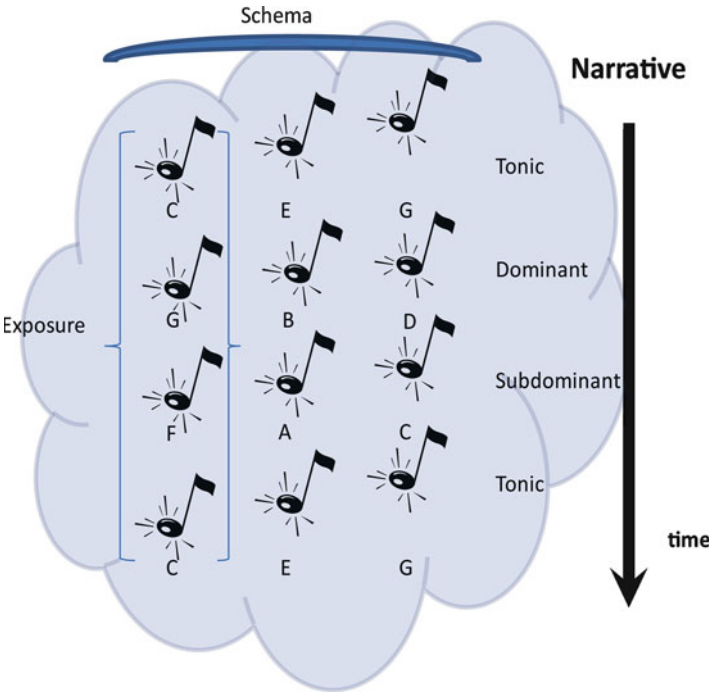

Fig. 10.1 Schematic of mechanisms of action in psychotherapy

other words the creation and modification of personal narratives. We can draw the analogy between a single percept as a musical note (Fig. 10.1). Thus, a relationship schema is represented by a chord and the progression of a single note is akin to a series of exposures. In this model, a narrative is analogous to a series of chord progressions, or musical composition. We accept that some aspects of how we listen to and experience music are based on a set of innate principles (e.g., the expectation that a melody progresses from tonic to dominant/subdominant and back to tonic chords) while others emerge from prior experience [19]. Similarly, we accept the unchangeability of some narratives (e.g., development, drives, conflict) yet work to build our experience and expectations within a set of narratives that are most useful to us. As with schemas, there may be many such narratives that function well, and it is the task of psychotherapy to help the patient find a set of narratives that are most useful for him or her. In psychodynamic thinking, this is often described as "co-construction," whereas in cognitive therapy, it may be thought of as "cognitive restructuring."

How we represent narratives neurobiologically is not yet known. Most neuroscientists would suggest that given the relatively abstract and evolutionarily late nature of this ability, it is most likely to lie in the prefrontal cortex (see Chap. 19 by Viamontes for a more detailed description). Those investigating the "embodied mind" or ideas about "mirror neurons" would likely trace the origins of narrative to the premotor cortex [20]. Research in this area is needed.

If we begin with a series of hypothetical mechanisms such as these, the path forward seems reasonably well laid out. The essence of good science is to begin with specific and testable ideas and then design experiments that tell us which parts of these ideas are supported by the evidence and which are not. There are, however, a number of pitfalls to be avoided along the way:

1. Avoid putting too much hope in single trendy ideas that are viewed as being the final "answer" to a complex and long-standing problem. While there have been many innovative ideas in neuroscience and its application to psychotherapy over the past decade (e.g., mirror neurons [21]), default mode functioning [22], right versus left brain functioning [23], quantum mechanics as a basis for free will [24], it is much more likely that the truth lies not in one new concept but in an integration

of good elements of psychodynamic theory (e.g., a motivated, complex unconscious, interaction of endowment and experience, character structure, relationship models, importance of narrative) with a range of existing models and techniques for studying neurobiology.

2. Avoid using pictures of the brain to convince others of the merits of a new theory or psychological argument. It is well known how susceptible we all are – both in and outside of the neuroscience community – to the aura of authority and certainty that surrounds a study which purports to measure a fundamental property of the brain [25]. However, it is important to keep in mind that many measures of neurobiology – functional MRI in particular – can be as unreliable and susceptible to selective interpretation as any questionnaire or behavioral measure. Undoubtedly, neurobiological measures have much to offer, but they need to be treated with the same caution and skepticism as any other indirect measure of psychological functioning.
3. Beware of arguments that use neurobiological terms to make old arguments with new authority and without clearly spelling out alternative interpretations of the data, or what one would have expected from other theories. This is particularly problematic when neurobiologic terms, such as "prefrontal cortex" or "amygdala" are used as almost word-for-word substitutes for older concepts such as "ego" and "affect." The neurobiologic terms may themselves be well anatomically defined, but the function of these regions is far more complex than is often described in reviews, and it would be a coincidence of remarkable proportion if they overlapped with such precision with our older ideas.
4. Science is by its very nature preoccupied with small details. Thus, we must beware of any arguments that focus only on the grand arc of research – for example, those that exclusively cite general books, reviews, or other "synthesizers" of research – as opposed to the details of the individual experiments. A common fantasy of science is that it gives final answers to problems about which we had only been able to speculate beforehand. In practice, science takes two clearly articulated opposing perspectives and tries to generate data that make one seem more likely than the other.
5. Science (or neurobiology) will be neither the "savior" or the "death" of psychoanalysis or psychodynamic psychotherapy [26, 27]. Science is a tool that helps protect well-meaning people from only seeing what is consistent with their previous cherished ideas. We all have cherished ideas, and if someone – scientist notwithstanding – is intent enough on proving what they have previously believed, science is no protection. However, if we are humble enough to recognize just how little we know and how biased we can be if we are not careful, science can be a powerful way to work together as a community and not stray too far from a reasonable representation of reality. Or, in other words, truth is that which, when you ignore it, does not go away. Science is a way of systematically trying to ignore something (blinding, randomization, systematic measurements) and then looking to see if it is still present.

References

1. NIMH Research Domain Criteria (RDoC). May 2010. Retrieved Sept 2010, from http://www.nimh.nih.gov/research-funding/nimh-research-domain-criteria-rdoc.shtml#6.
2. Vickers AJ, Basch E, Kattan MW. Against diagnosis. Ann Intern Med. 2008;149:200–3.
3. Caspi A, McClay J, Moffitt TE, Mill J, Martin J, Craig IW, et al. Role of genotype in the cycle of violence in maltreated children. Science. 2002;297:851–4.
4. Caspi A, Sugden K, Moffitt TE, Taylor A, Craig IW, Harrington H, et al. Influence of life stress on depression: moderation by a polymorphism in the 5-HTT gene. Science. 2003;301:386–9.
5. Lieberman MD. Social cognitive neuroscience: a review of core processes. Annu Rev Psychol. 2007;58:259–89.
6. Ablon JS, Jones EE. Psychotherapy process in the national institute of mental health treatment of depression collaborative research program. J Consult Clin Psychol. 1999;67:64–75.
7. Jones EE. Therapeutic action: a guide to psychoanalytic therapy. Northvale, NJ: Jason Aronson; 2000.

8. Peterson BS, Bansal R, Chung YA, Dong Z, Duan Y, Gerber AJ, Hao X, Kangarlu A, Liu F, Marsh R, Plessen KJ, Royal J, Wang Z. Lewis's child and adolescent psychiatry. In: Marti A, Volkmar FR, editors. New York: Lippincott; 2007.
9. Sandler J, Dreher AU. What do psychoanalysts want? The problem of aims in psychoanalytic therapy. London: Routledge; 1996.
10. Gabbard GO, Westen D. Rethinking therapeutic action. Int J Psychoanal. 2003;84:823–41.
11. LeDoux JE. Emotion circuits in the brain. Annu Rev Neurosci. 2000;23:155–84.
12. Goisman RM. The psychodynamics of prescribing in behavior therapy. Am J Psychiatry. 1985;142:675–9.
13. Bram A, Björgvinsson T. A psychodynamic clinician's foray into cognitive-behavioral therapy utilizing exposure-response prevention for obsessive-compulsive disorder. Am J Psychother. 2004;58:304–20.
14. Westen D, Gabbard GO. Developments in cognitive neuroscience: i. conflict, compromise, and connectionism. J Am Psychoanal Assoc. 2002;50:53–98.
15. Westen D, Gabbard GO. Developments in cognitive neuroscience: ii. implications for theories of transference. J Am Psychoanal Assoc. 2002;50:99–134.
16. Squire LR, Knowlton BJ. The medial temporal lobe, the hippocampus, and the memory systems of the brain. In: Squire LR, Kandel ER, editors. Memory. New york: W H Freeman & Co; 2000.
17. Packard MG, Knowlton BJ. Learning and memory functions of the Basal Ganglia. Annu Rev Neurosci. 2002;25:563–93.
18. Pelphrey KA, Carter EJ. Brain mechanisms for social perception: lessons from autism and typical development. Ann N Y Acad Sci. 2008;1145:283–99.
19. Jeans J. Science and music. New york: Dover; 1937.
20. Gallese V, Lakoff G. The brain's concepts: the role of the sensory-motor system in conceptual knowledge. Cogn Neuropsychol. 2005;22:455–79.
21. Gallese V, Fadiga L, Fogassi L, Rizzolatti G. Action recognition in the premotor cortex. Brain. 1996; 119(2):593–609.
22. Raichle ME, MacLeod AM, Snyder AZ, Powers WJ, Gusnard DA, Shulman GL, et al. A default mode of brain function. Proc Natl Acad Sci USA. 2001;98:676–82.
23. Schor AN. Affect regulation and the origin of the self. Hillsdale, NJ: Lawrence Earlbaum; 1994.
24. Schwartz JM, Stapp HP, Beauregard M. Quantum physics in neuroscience and psychology: a neurophysical model of mind-brain interaction. Philos Trans R Soc Lond B Biol Sci. 2005;360:1309–27.
25. McCabe DP, Castel AD. Seeing is believing: the effect of brain images on judgments of scientific reasoning. Cognition. 2008;107:343–52.
26. Blass RB, Carmeli Z. The case against neuropsychoanalysis. On fallacies underlying psychoanalysis' latest scientific trend and its negative impact on psychoanalytic discourse. Int J Psychoanal. 2007;88:19–40.
27. Hoffman IZ. Doublethinking our way to "scientific" legitimacy: the desiccation of human experience. J Am Psychoanal Assoc. 2009;57:1043–69.