



Review Paper

A historical perspective on the collaboration between psychoanalysis and neuroscience

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ABSTRACT

The aim of this article is to present and discuss the connections between psychoanalysis and neuroscience from a historical viewpoint. We start by examining how Sigmund Freud can be viewed as a pioneer in the interaction between these two fields. Freud was himself a neurologist and had maintained an interest in biology as he developed the key concepts of psychoanalysis. His ideas regarding psychosomatics are described. We will also explore how the concept of drive is essential to the connection between psychoanalysis and neuroscience. Then, we describe several key actors and historical events and characters at the interface of these two fields, namely Sándor Radó, Lawrence S. Kubie and Mc Culloch, the debates that took place during the Macy conferences, as well as the positions of Jacques Lacan, George L. Engel, and Eric Kandel. Finally, we present a synthesis of the main fields in which the connections between psychoanalysis and neuroscience are already fruitful, and those where they should be developed: the classification of mental diseases, the link between the scientific and psychic dimensions, therapeutics, the organization of the body, intersubjectivity, the subjective division and ambivalence, as well as transferential effects like such as the placebo and nocebo effects. In the conclusion, we advocate several strategic alliances and underscore the complementarity between rigorous scientific experimentation and the individualized psychoanalytic approach.

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1. Introduction

Psychoanalysis and neuroscience have traditionally been fraught with claims that each discipline tends to ignore the other, or, alternatively, refuses to take into consideration the state of the latest developments in the other discipline. We will try to show that beyond well-documented differences in methodology, attempts to foster a productive collaboration between these two fields have always existed and likely outnumber their formal differences. Documenting the extent of these attempts is beyond the scope of this paper; suffice it to say that it would be difficult to find a single psychoanalyst who would entirely reject the role of biological mechanisms on psychopathology.

Ansermet and Magistretti (2004) clearly laid out one of the most critical issues concerning the exchanges between psychoanalysis and neuroscience: will both sides be able to benefit from each other? Or whether will they play a lose–lose game?

In this article, we will discuss the following:

- Sigmund Freud's legacy and its ambiguities concerning the relationship between psychoanalysis and neuroscience.
- How Sando Radó and his contemporary European colleagues tackled the crucial issue of drives and their relationship to biology.
- The role of Lawrence Kubie and his attempt to articulate the connection between cybernetics and psychoanalysis, and explain how an alternative to his contribution has been proposed in France.
- The psychoanalytically-oriented interpretation of stress proposed by the Rochester school.
- Eric Kandel's presentation of the theme of neuroplasticity as a possible common ground for psychoanalysis and neuroscience.

Finally, we will offer suggestions for more fruitful collaborations between the two fields.

2. Sigmund Freud's legacy and its ambiguities

Sigmund Freud, a former student of Brücke's, is famous for his contributions to biological issues such as his descriptions of the effects of cocaine, the acoustic nerve pathway, the sexual organs of eels, and the differentiation of the aphasia. At least two of these areas of research were bound to have a direct effect on his approach to psychoanalysis. The unfortunate side-effects of cocaine probably encouraged him to abandon pharmacology and to focus on psychotherapy and his book, *Zur Auffassung der Aphasien*, contains at least two precise indications which will have direct applications in the psychoanalytic interpretation of psychoneurotic symptoms: the double aspect of representations (words- versus objects-representations), and the notion of hyperassociation (*Überassociation*).

Freud also wrote an unpublished draft, called "Psychology for Neurologists" in his correspondence with Wilhelm Fliess (Freud, 1986), of which several conflicting interpretations have been proposed. Some have considered this piece as a purely biological dissertation entirely disconnected from his psychoanalytic works, whereas others have concluded that its (allegedly negligible) neurological content was a rather thin cover for psychological considerations which would subsequently be expanded. Still others (such as Pribram and Gill, 1976) saw it as a precursor to the cognitive sciences and Jacques Lacan understood it as an early contribution to the ethics of psychoanalysis, as it included the first systematic description of helplessness – a theme that would be intensely discussed in psychoanalytic circles.

The *Studies on Hysteria* (Freud and Breuer, 1895) relied heavily on Breuer's thermodynamic model of "psychic energy" (Hirschmüller) from which Sigmund Freud would later derive the "dynamic" and the "economic" aspects of his metapsychology.

Throughout his work, Sigmund Freud frequently referred both to biology and neurology as practice and research, but he also referred to biology as theory and philosophy. Endocrinology, a flourishing science at the turn of the 20th century, was frequently referenced in his *Three Essays on the Theory of Sexuality* (Freud, 1905). Sulloway (1979) upheld the view that Freud mainly viewed himself as a biologist of the mind and, together with students such as Grubrich-Simitis, insisted that this actually meant that Freud was a Darwinian. Freud, however, considered himself as being more of a Lamarckian and a Haeckelian, an opinion he clearly expressed to his daughter Anna (Grubrich-Simitis, 1986). When he famously wrote, that "biology is a domain with [...] infinite possibilities," he had been discussing Weissmann's theories as possible incarnations of his own hypothesis of the death drive (Freud, 1920). The Lamarckian distinction between *autoplastie* and *alloplastie* (1809) – cases in which an organism tends to modify itself versus cases in which it tends to modify the environment – interested him intensely.

However, upon deciding to found a new psychology that would not be infeodated to the limits of neurology, Freud underscored the need to elaborate a causality interior to his newly gained field, and repeatedly condemned the attempts to merge psychoanalysis with other domains. The diffidence he showed towards Georg Groddeck in a letter to Felix Deutsch stating "One should refrain from the temptation of the autonomous nervous system and of the endocrine glands", clearly points in this direction. Whether Freud openly criticized Franz Alexander's theory of psychosomatic symptom-formation is not clearly documented, but it would be difficult not to see this indication as a critical allusion. One could also assume that this could be a way to put some limits to the enthusiasm provoked by W. Cannon's theory.

In a 1913 article written for an educated public, "*Das Interesse an der Psychoanalyse*", Freud attempted to show how psychoanalysis had contributed to eight domains. When it came to biology, Freud, instead of mentioning his past credentials in neurology, focused outright on his views on the significance of sexual conflicts. He claimed that his contribution to this field had been extremely unwelcomed and that scientists had "long refused to listen to him" (*lange Zeit nicht angehört*). When these attempts had finally proved insufficient, he was "submitted to very violent attacks" (*wurde...gegenstand heftigster Anfeindungen*) (Ges. Werke, VIII, p. 407).

The fact that nervous diseases can be the expression of sexual function disorders, Freud claimed, had been recognized by many poets and philosophers, but long refused by scientists. He went on by qualifying infantile sexuality as having a different logic than adult sexuality. In his view, the former was developed from erogenous zones (*erogene Zonen*) and constituted a structure different from the neurological body-schema; its second aspect was a relationship to feeding and elimination which, in previous texts, he connected to maternal love. Sexual function, he summarized, is "independent" and can be compared (*gegenüberstellen*) with all other bodily functions. He presented this divisive conflict between ego-drives and sexual-drives as the core of human subjectivity.

In fact, this paragraph from *Das Interesse an der Psychoanalyse* was a direct consequence of what Freud had already developed in his *Three Essays on the Theory of Sexuality* (1905). Freud often quoted the work of a Hungarian pediatrician, Samuel Lindner, who demonstrated in 1879 that thumb sucking is neither an abnormal phenomenon nor a sign of "degeneration," as was thought at the time. Furthermore, a healthy child will not necessarily refrain from sucking various objects in addition to his thumb,

although there were cases of utterly unrestrained sucking due to pathological reasons and cases of children who did not suck anything but did not look very healthy either. Freud described thumb-sucking as a pacifying practice employed by children in order to calm down and go to sleep. In this description, the child shuts down his body, temporarily cutting himself off from the world. From then on, the idea began to arise that sexual drives had a special importance for the constitution of a global body, i.e., both the biological body and the symbolic body lying beyond the “body image.”

Winnicott (1958), in turn, took these notions further with the notions of transitional objects and phenomena. A transitional object is a tangible sign of the existence of a transitional space. The subject changes from a state of unity with his mother to a relationship with her as an external and distant subject that is distinct from her (1951), thus allowing each of them to grow into something that is linked to their background but relatively autonomous at the same time. This idea was pursued further by Lacan when he described “object a” as something that allows the body of the child to become structured through a partial separation from the “big Other” (1956).

In *Inhibition, Symptoms and Anxiety*, Freud attempted to systematize his views concerning this sexual conflictual core, showing how the evolution could be traced from the completely unstructured fears (*Schrecken*) to anxiety, symptom construction through repression and character defenses.

What is especially conflictual in drives is their potential to create nightmares, beyond the pleasure they can produce. Freud regularly highlighted infant nightmares and described them as the result of a child's direct confrontation to drives, showing that the source of anxiety lay in the “helplessness” experienced when an adult could not offer guarantees against such pressing demands. The child has to somehow cope with his impulses, and therefore uses various more or less costly types of mechanisms of repression, sublimation and fantasy. The Freudian views on intersubjectivity were intensely colored by this predicament: the other subject, in this Freudian logic, can be experienced as a savior delivering the child from the demands of drives, but it can also be experienced as the traumatizing source of these unbearable demands, as a sibling submitted to such demands, or finally as an idealized figure ignoring or condemning them.

3. Sándor Radó, 1890–1972: from first-rank theoretician to dissident

Sándor Radó was one of the most famous European analysts before leaving for the United States, having analyzed such famous practitioners as Heinz Hartmann, Wilhelm Reich and Otto Fenichel. Radó had studied law and medicine before he was convinced to embrace psychoanalysis upon his first meeting with Freud. Editor-in-chief of the *Internationale Zeitschrift für Psychoanalyse* in 1924 and of *Imago* in 1927, he was a leading figure of the Berlin Psychoanalytic Institute; in 1931, Brill invited him to organize the New York Psychoanalytic Institute. By then, he was often quoted for his work on melancholia (Radó, 1928) and addictions (Radó, 1926, 1933), which not only became classics in the New World, but also directly influenced such unexpected authors as Melanie Klein and Jacques Lacan. One of the most fascinating aspects of Radó's elaborations on that topic was probably that he managed to propose what appeared to be a rich heuristic analogy between pharmacology, psychopathology and a Freudian description of conflicts between ego and sexual drives that included the most recent characterization of death drives.

Although it has been suggested that further dissensions were largely due to his uncompromising character and the violent dia-

tribes he would launch against his colleagues, we would like to focus on the theoretical aspects that drove Radó to abandon the possibility of a confrontation between Freudian logic and biology. Quite unsurprisingly, the main reference he used to build his “adaptational psychodynamics” theory (Radó, 1955) was Cannon's concept of emergency function: “This theory is the new biological foundation upon which to rebuild the structure of psychodynamics, with the point of view of adaptation and survival as the cornerstone, and Cannon's concept of emergency function as one of the main pillars” (p. 169). Radó thus clearly preferred to instill the Cannonian paradigm of “emergency emotions” based on “fight or flight” situations into a developmental framework that gradually attempted to encompass all psychopathology, including the diverse varieties of neurosis understood as the result of “failures of emergency adjustment” (Radó, 1950, p. 228), rather than attempt to confront the Freudian framework of subjectivity (expounded in *Inhibition, Symptoms and Anxiety*) with experimental data.

One famous psychoanalyst who played a major role in Radó's eviction from the New York Psychoanalytic Institute and whose views clearly differed from the Cannonian theory was Lawrence Kubie.

4. Cybernetics and psychoanalysis: Lawrence Kubie and Warren McCulloch

Lawrence Kubie was one of the most impressive contributors to the interconnection between psychoanalysis and neuroscience. Equally qualified in neurology (he studied under Sherrington) and in psychoanalysis (he was analyzed by Edward Glover), his crucial contribution aimed at nothing less than replacing the Jacksonian dogma of the hierarchy of neurological functions (Kubie, 1930). “The phenomenon of spontaneous involuntary movements has never been satisfactorily explained”, he boldly wrote. The traditional explanation proposed by Hughlings Jackson, the release of a “lower” center from the regulative and inhibitory control of a “higher” center, has never been supported by physiological or anatomical evidence. Kubie proposed in his 1930 paper that “Out of the manifold possibilities with which the central nervous system is endowed, an attempt is made here to see if these obscure, ‘spontaneous’ neurological phenomena become any more understandable if one simply pictures the central nervous system as a place in which, under certain conditions and in certain areas, excitation waves move along pathways which ultimately return them to their starting points. This possibility is selected because such a circular wave would constitute a source of energy, which under certain conditions would give little or no outward signs of its existence, but which, with a slight change in conditions, might suddenly become manifest.” Kubie suggested that chains of neurons were involved in these “circular waves”, and even proposed that dendrites and axons could play a completely unexpected role given what was known about them at the time.

He then proceeded to apply his model to pathological phenomena:

“It is necessary to imagine only that the normal circuits through a silent area are altered by some pattern of lesions, or that the velocity of the wave or the duration of the refractory period is changed by some toxic or vascular or metabolic factor. As a result, normal pathways might be closed and unusual pathways opened which would lead the circling impulse out of its silent home into one of the active regions. What would happen then would depend upon the nature of the site which was invaded and the conditions met with there; but the passage of the wave through the active area would in each instance result in a discharge along some motor, sensory, or vegetative route. If the new circuit, once established, persisted unaltered – circling with a steady rhythm out of

the silent area to touch the active area at a constant and limited point before swinging back again – the phenomenon of rhythmical clonic spasm could be readily understood. But if the circuits through the silent area were inconstant and tortuous, and if the points of escape were more than one, or if the active areas were played upon at more than one locus, the grotesque and irregular phenomena of chorea or athetosis would also seem to be explicable. One may carry the speculation still further, and imagine that the escaping wave of excitation meets conditions in the active area which are so abnormal that instead of playing over the region merely for an instant it establishes here a temporary circus rhythm. If this occurs in the occipital cortex, is it difficult to imagine that the result would be the scintillating phenomena of migraine, whose wheeling lights may be taken as giving support to some of these speculations? Or if certain cell layers of the motor system were involved, might not epilepsy be the expression of the process?"

"The duration of such a circus movement in an active area might vary from a moment to hours or even days, depending upon the stability of the circus rhythm set up; which in turn – would depend upon the fundamental variables of wave velocity, circuit length and duration of the refractory phase. An unstable, temporary circus rhythm would correspond to the ordinary isolated epileptic seizure. A more stable system might explain status epilepticus. And it may be that a closer approach to the therapeutic solution of these difficult problems will depend upon the finding of drugs which will alter in the central nervous system, the relations of velocity to refractory phase, just as quinidine has been shown to act upon these factors in checking the probable circus movements of auricular fibrillation in heart muscle."

Warren McCulloch received a very comprehensive training in mathematics, philosophy and in neuroscience. He was intensely fascinated by the biological problem of loops, of which Kubie had foreseen the importance, and Lorente de Nó (1938) had validated the anatomical reality. Numerous debates took place between Kubie and McCulloch, as the latter viewed neuroscience through mathematical models and remained rather impervious to psychoanalytic models. Along with John von Neumann, who was in the process of developing the "theory of games" (Von Neumann and Morgenstern, 1944), McCulloch had a probabilistic view of the neural functioning (Arbib, 1989, 2000). In the early 1940s, conferences, taking place in the United States at the Macy Foundation under McCulloch's presidency, brought together at regular intervals an interdisciplinary group composed of mathematicians, logicians, anthropologists, psychologists and economists with the objective of developing a "general science of the functioning of the mind" (McCulloch, 1953). These conferences initiated the cybernetic movement as well as the field of cognitive and information sciences. The participants envisaged the future, considering what would happen after the war as well as wondering what type of scientific theory would prevail in the years to come, and which fields of research should be supported first and foremost. The group was really in search of a common paradigm (Heims, 1991). It was at that time that Norbert Wiener coined the term "cybernetics," drawn from the Greek word meaning "government." This field related electronics-related systems, computers, armament system and everything else that was known to depend on the circulation of information from one neuron to another and on the organization of the body. The idea was to find common points and enable their convergence, thus establishing useful exchanges between the disciplines.

Several debates between McCulloch and Kubie took place during these conferences (Essig, 2006). On one side, there was McCulloch, a physician who had persuaded himself that the study of loops could help cure a variety of neurological ailments. His approach focused on expressing neural problems purely as mathe-

matical formulas. McCulloch was indeed a reductionist, interested in neither psychic determinants of human conflicts, nor individualization. Kubie, on the contrary, insisted on the importance of the issue of the subjective effects of "reverberating circuits" which was increasingly misunderstood and rejected by other participants.

In his first paper read at the Macy conference, which would be published only a few years later, Kubie characteristically claimed that the neurotic process should be the focus of study in both physiology and psychoanalysis (Kubie, 1958). He deplored what he saw as an unfortunate hostility between researchers of the two disciplines and claimed what he termed the "neurotic potential" inherent in the "symbolic process" to be capable of generating both "the highest achievements of creativity" and ... neurotic misery.

In his presentation, Kubie claimed that the "automatic repetitiveness" is an interaction between organic and psychological variables. On the psychological side, he stated: "It can detach an affective state from its initial stimulus, so that the affective state continues ceaselessly to attach itself to other situations and objects. Or it can distort the relation between a symbol and what it originally represented, so that although we are conscious of the symbol, the meaning has become inaccessible to our own introspection. Whenever this happens, the pattern of thought, feeling, purpose or action becomes insatiable and repetitive." He claimed that this suggests a lack of integration of the three "symbolic functions" of unconscious, preconscious and conscious mechanisms. Whenever the preconscious and conscious mechanisms predominate, creativity prevails; whenever the unconscious mechanisms predominate, "the resultant patterns of behavior are rigid, insatiable, unalterable by external experience and rigidly repetitive."

These mechanisms also have biological correlates "not only in the triggering of epileptic fits through the excitation of the cortex, but also in the reverberating circuits phenomenon [he has personally demonstrated], which vary from an individual to the other; pharmacologic agents have facilitating or inhibiting effects on these repetitive mechanisms."

Kubie asked: "Is the tendency to repetitive phenomena something which is influenced by endocrine, metabolic or enzymatic differences, or by differences in the relationship between conduction-times, refractory periods and synaptic delays?" He advocated for a threefold research analysis, using psychological tests, quantitative and qualitative assessments of psychoanalytic sessions as well as "every possible neurophysiological and neurobiological technique."

He then depicted three more crucial issues for research:

- The "central emotional position" was inspired by R. Spitz's research on separation and hospitalism, where "the clinical fact which is already evident is that once a central emotional position is established early in life, it becomes the affective position to which that individual will tend to return automatically for the rest of his days. This in turn may constitute either the major safeguard or the major vulnerability of his life."
- The problem of trigger-mechanisms "concerns the many subtle and usually overlooked trigger mechanisms, which precipitate human beings out of one psychological state into another. These trigger mechanisms are among the most ubiquitous, the most unique and certainly the most neglected aspects of the human neurotic process. Psychiatrists have confined their attention to the one easily recognized example of trigger mechanisms, i.e., the phobia. Yet many other affective phenomena are triggered off in every-day life: such as laughter tears, rage and anger."
- The role of the preconscious system in the neurotic process – an issue that had led Kubie to ask for the cooperation of the hypnotherapist Milton Erikson.

The role of the preconscious system in symptom-formation, he claimed, had been gravely underestimated. “It is my suspicion that as a consequence of this, we have failed to recognize that by far the largest share of human perceiving, recording, thinking, recalling, problem-solving, planning and desiring, plus all of their affective concomitants and controlling influences, occur continuously and incessantly without the participation of conscious awareness. Yet they are not unconscious, in the technical sense. They are not behind an iron curtain of repressive forces. Of this incessant turbulent stream of preconscious mental activity our conscious symbolic thinking represents only a small sample. A basic gap exists both in analytic theory and in all experimental physiological investigations of thought processes from the failure of both disciplines to recognize the central role of preconscious functions in all human perceptual and conceptual processes, in identifications, in creative processes and in the very psychotherapeutic process. Moreover it is the vulnerability of preconscious processes to distortion by unconscious processes which is the essence of the neurotic process: yet preconscious mentation has been almost totally neglected by analysts and neurophysiologists alike” (Kubie, 1941).

5. Jacques Lacan, Lawrence Kubie's influence, and cybernetics

Let us now address what Jacques Lacan attempted to do in the early 1950s. Lacan did not take attend the Macy conferences, but he had collaborated with several mathematicians in the 1940s, in particular those who were interested in the theories of probability. There are two reasons why these theories drew Lacan's attention:

- He considered the psychic functioning of the individual similar to that of a gambler. A gambler places many types of bets, some of which are susceptible to jeopardize his position – in a clear analogy with the object of desire that may represent a pleasant, but also a nightmarish figure in the unconscious.
- Patients may obviously say a number of things about a variety of subjects, but they do not say everything. Many crucial points have to be guessed, assumed and rebuilt by the analyst. There is always the danger of making mistakes. For this reason, Lacan attempted to make the case that psychoanalysis was a “conjunctural science” based on probabilities; Von Neumann's *Theory of Games* was thus extremely appealing to him.

Lacan was very interested in assessing to what extent the key elements dominating a case can be found and what we can rely on when we try to look for these elements. Lacan asks the following question: what chance do I have of finding features that can be useful in understanding the case and in the therapeutic strategy?

Basically, there are three things that bring Lacan closer to Lawrence Kubie: the refusal of the Jacksonian hierarchical model, an interest in the various forms of repetition, and the adhesion to the Freudian thesis on the traumatic sexual core of human subjectivity. Lacan also viewed drives as a type of repetition that could be accounted by computerized models. He had studied medicine and written a doctoral thesis on paranoia, based on both German phenomenological psychiatry and on French psychiatry. In his thesis (1932), he claimed that psychiatric research should focus on “psychogenesis” and wrote: “A symptom – physical or mental – is psychogenic if its causes express themselves on the basis of complex personality phenomena; the manifestation of these causes reflects this personality and the treatment may depend on it.” By that time he elaborated his mirror-stage theory as a moment or structuration of the subject, an “*imago*” through which the subject attempts to triumph over “prematurity” through aggressive relationships to the mirror-image. Thus, subjective structuration was described as having a dramatic quality. Lacan's views on pathological repeti-

tion, tended to identify it with a failure in the dynamic construction of the *imago*. The dominant affect in this construction was the omnipresence of anxiety: anxiety over prematurity, anxiety over the double in the mirror.

In the 1950s, Lacan learned from his mathematician friends about the Macy conferences and computer programs. He asked them to help him develop models with loop phenomena. There is little doubt that Lacan was informed of Kubie's ideas, although he does not seem to have ever quoted him. Lacan tried to re-write the Freudian psychic apparatus in terms of vectors and graphs. The first descriptions of this can be found in Edgar Allan Poe's short story, “The Purloined Letter.” Edgar Allan Poe was an American poet and writer who was highly interested in the theory of probabilities and had read Laplace, a physicist who lived at the time of Napoleon I and published a probabilistic theory of cosmogenesis. In his short story, Poe offered a probabilistic theory of the detective's work. Of course, Lacan became highly interested in this theory and made a description of the psychic apparatus in the shape of a graph. Whereas Kubie tried to describe an unlimited number of nervous phenomena structuring the organization of all parts of the body, Lacan tried to describe a more limited aspect that was clearly inspired by the second Freudian topography: the impact of the sadistic superego on symptom-formation. In doing so, he was most probably inspired by Franz Alexander's theory of the “automatic superego”, and more generally by the European theories that assumed that a specific pathology of the superego determined several degrees of “self-punishment” that determined neuroses and psychoses.

There was another difference between Kubie's and Lacan's elaborations, although their basic hypotheses were Freudian. Lacan gave his graphs a linguistic quality which was not so present in Kubie's approach. Lacan had studied linguistics at the Sorbonne under Henri Delacroix, and was also familiar with Edouard Pichon, a child psychiatrist who had become the president of the *Société Psychanalytique de Paris* and wrote a famous grammar in which he tried to account for unconscious mechanisms (Damourette and Pichon, 1911–1940). The “signifying chain”, as Lacan (1966) described it, is a loop and is very similar to what was described earlier by Kubie. The main difference between them is that, for Kubie, the loop is a purely neurological phenomenon, whereas for Lacan, it should be considered as a symbolic phenomenon that can be experienced either as “structuring” or brutally automatic. To further demonstrate his view, Lacan compared two scenarios: a signifier with a relatively supervised functioning, and something much more disquieting that he called “signifier in the real.” He was referring to the French psychiatric tradition, in which verbal hallucinations were understood as an abnormal experience of inner speech (“Seglas' phenomenon”).

Another difference was that Lacan tried to replace the Freudian model of the mental apparatus by the interconnection of several vectors. One of them was the “unconscious chain of signifiers” or “unconscious message” that epitomized the subject's destiny in a secret formula; the second was the “effect of signification” that highlighted the subject in traumatic moments when the tragic nature of the “unconscious chain of signifiers” could not be ignored anymore; the third vector represented the narcissistic protection that allowed the subject to ignore the content of the “unconscious message.”

6. George Engel: from reductionist to Freudian psychosomatician

Another interesting case is that of George L. Engel, who started as a pure neurologist and eventually made a name for himself by developing the “bio-psycho-social model.” Engel was initially only

interested in electroencephalography (EEG), a field that was highly promising at the time; it was thought that EEG findings would point out specific characteristics of symptoms. During his studies, he had to collaborate with the psychoanalyst John Romano. The beginning of this collaboration was peculiar: Engel was really very critical at first, until he realized that Romano was able to predict some of his patient's reactions, and was even able to curb the phenomenon. He then became interested in psychoanalysis. Newly appointed at the University of Rochester Medical Center, Engel suggested a series of investigations focused on the study of stress, and more specifically psychosomatic disorders. They developed a theory of psychosomatic symptoms, clearly connected to the theory of trauma, in a crucial opposition to the so-called theories of "psychosomatic personality" (as in the case of Marty and M'uzan's "pensée opératoire" or Sifneos' "alexithymia"). In Engel's theory, converging stressful events foster psychosomatic phenomena, depending on a global situation that imposed both helplessness and hopelessness on the subject. Traditionally, stress is normally conceived above all in terms of aggression. The "fight or flight" model describes that when the subject is in a situation of danger due to external aggression, he must either fight or flee. However, one classical difficulty in this model is that some subjects seem more immune to stress than others. Engel underlined that there was another absolutely critical condition in this model: external help. All subjects need support, and if they do not receive any, stress can result due to the absence of support. By saying this, Engel opposes the classical views of Cannon or Selye, claiming that stress – and finally distress – is determined by hyperarousal: according to Engel, hypoarousal could also be a powerful source of distress. This theory, which draws heavily on psychoanalytic research, was demonstrated by an extensive experimental study on helplessness (Engel et al., 1956). Although the term helplessness has been adapted to cognitive theories, it is clear that the initial research derives from psychoanalytic investigations.

7. Psychoanalysis, neurosciences and the future of psychiatry: Eric Kandel's hesitations

We would like to end this paper by recalling the work of Eric Kandel (born in 1929), because it makes highly interesting connections between psychoanalysis and neuroscience. Kandel received the Nobel in Physiology and Medicine in 2000 and wrote a biographical essay entitled *In Search of Memory* (Kandel, 2006), claiming that the primary stimulus of his lifelong research had been a question on the nature of memory. Kandel clearly relates to his own traumatic personal story: he came from a family of Austrian shopkeepers; his father had owned a very humble shop in Vienna, but during the war, the family had to emigrate suddenly because they were Jewish. Kandel presents these traumatic events as the point of departure of his vocation. He believes that "once we are able to account for the cases where the trauma is simply forgotten and those where it comes back and cannot be stopped, we will have made progress in the field of psychic studies."

From the outset, Kandel's interest in psychoanalysis was twofold. He had first studied psychiatry after meeting several psychiatrists in New York. Because psychoanalysis was a Viennese phenomenon, Kandel felt relatively at ease with the field and therefore started hospital training in psychiatry. After following several other encounters, however, he hesitated between choosing a career as a biology researcher or as a psychiatrist. He started several psychotherapies, of which he does not say much; at any rate, his book does not convey an unreserved passion for this field. According to Kandel, he had a strong motivation to account for what happened to his patients, from both the physical and psychic viewpoints. His perspective is rather fascinating, and it could be

said the Kandel is highly representative of the nature of possible connections between psychoanalysis and neuroscience. In his book, he pays tribute to a number of colleagues. In particular, he mentioned his friendship with Judith Rappaport, who is now a leading biological researcher in childhood mental disorders in the United States. Judith Rappaport was extremely critical of psychoanalysis as a whole. Her position was very hostile and adamant, which was not the case for Kandel. Very interestingly, Kandel retained the idea that psychoanalysis is really the field that offers the best descriptions of mental functioning, the most faithful ones, the ones where nothing is left out, even contradictory aspects.

Kandel has greatly contributed to the understanding of the mechanisms underlying various forms of memory, and it is not within our scope to describe them in details. Psychoanalysts were particularly interested in his research on brain plasticity. In the 1950s, the idea that synaptic connections could change began to emerge. Kandel developed this idea considerably by demonstrating that anatomical changes were equally possible, and that genetic mechanisms also come into play and can be triggered or shut off by environmental phenomena.

Kandel certainly had psychoanalytic patterns in mind, although he always insists that his viewpoint is fully reductionist. Kandel's position can be considered as positively ambivalent toward psychoanalysis, i.e., although he agreed with psychoanalysts on a number of points, he blamed them for not making sufficient efforts to demonstrate the efficiency of their technique. When Kandel said that psychoanalytic concepts should absolutely be reformed according to new scientific data, he was being somewhat overly demanding as clear biological data are actually still lacking in psychiatry. Indeed, no specific biochemical marker for mental disease diagnosis has been discovered. Moreover, recent data have shown that psychoanalytic treatment is at least as efficient as alternative techniques.

The unconscious is, of course, a key concept in the field of psychoanalysis, but it is also a notion that has greatly influenced cognitive theorists. In passing, Kandel mentions all cognitive theories actually stem from psychoanalytical theories. Indeed, until the late 1980s, cognitive and psychoanalytic theories were considered similar and opposed to behavioral theories.

One interesting point is the subtlety with which Kandel discusses the issue of the type of memory implied in unconscious forgetting and recollection. Drawing from personal experience, he considered that the unconscious cannot be explained only by implicit memory. This position was opposed to that of many of his American colleagues, and also differed from that of attachment theorists such as Peter Fonagy, for whom repression phenomena could be reduced to mnesic traces. Kandel had a much broader view of memory symptoms, which is one of the main fields of study of psychoanalysis. What we find most interesting about Kandel is that he stated his conclusions from personal experience and refused to reduce psychic phenomena to a precise neural mechanism.

8. A few propositions to enhance collaborations between psychoanalysis and neuroscience

After examining a few historical connections between psychoanalysis and neuroscience, we thought it would be relevant to propose a few recommendations in order to enhance the already fruitful existing exchanges between these two fields. There is a basis specific to psychoanalysis, namely the conflictual field of psychosexuality and the resulting complexity of the psyche. Kandel has insisted on the need for psychoanalysts to keep informed of the latest neuroscientific discoveries as well as the interest, for neuroscience, of taking into account the mental complexities un-

veiled by psychoanalysis. On the other hand, Freud insisted that the specific features of each field should be respected. In the same way as Karl Jaspers criticized what he called “*cerebral mythology*,” the tendency to promote unwarranted biological explanations, it is justified to ask that each domain admits its own limitations. Similarly, *psychophobia* – the fear of complex psychological explanations, a popular term among Swedish clinical psychologists critical of reductionism – should be avoided, as it tends to erase the very nature of psychopathology. In a previous paper, we have advocated for the criterion of *adequacy* in the evaluation of psychopathology research: investigations taking into account the recognized characteristics of a given phenomenon, including its complexity, should be preferred. In the same way as the search for a “single gene” of schizophrenia or autism have been unfruitful, alliances between psychoanalytic observation and specific neuroscientific research programs should be more effective. Several fields of connection are discussed below.

8.1. The problem of classification of mental diseases

To put it simply, what is meant by the term “diagnosis”? It has been clearly demonstrated that the automated, “statistic” use of tools such as the Diagnostic and Statistical Manual (DSM) (APA, 2000) or the International Classification of Diseases (ICD) (WHO, 1992) as “diagnostic handbooks” is insufficient, as they tend to generate purely “behavioral” diagnoses. As the authors of the Psychodynamic Diagnostic Manual (PDM) rightly claim, the sole consideration of observable disorders does not suffice to provide a sound diagnosis (Greenspan et al., 2006). What we have previously referred to as “core subjective conflicts” practically precludes the possibility that patients with the same underlying conflict constantly present the same clinical picture. Moreover, similar behavioral disorders in several patients can be the result of very different underlying conflicts. In other words, much biological research would greatly benefit from the aid of psychoanalysts to provide more reliable diagnoses on the basis of detailed observations.

8.2. The therapeutic field

A crucial aspect of therapeutics is how to adjust individualized strategies or tactics to specific patients. Psychoanalysis is very helpful here (Sauvagnat et al., 2004). In the therapeutic field, it is very tempting to consider all phenomena and all psychic symptoms in the same way. However, what we know on the basis of long-term evaluation is that the most stereotyped treatments tend to have very little effect in the long run, while the more inventive and flexible psychoanalytic therapies tend to have lasting effects even after discontinuation (Shedler, 2010).

8.3. The body image and body structure

In our opinion, only psychoanalysis can sufficiently and extensively account for this. The recent works on the body image (Sauvagnat, 2005), and on movement (Berthoz, 1997), are fascinating but do not sufficiently account for what the body represents if they are not complemented by a psychoanalytical viewpoint.

8.4. The intersubjectivity

Intersubjectivity is an issue that neuroscientific research should take in consideration when it tries to account for mental phenomena. There are about 10 different psychoanalytic theories on intersubjectivity, and we believe this variety is necessary to understand the phenomena. The attempts to reduce this issue to the mere “theory of mind” cannot account for the whole range of phenomena at play.

8.5. The subjective division and ambivalence

When it comes to understanding the subjective division and the individual's forms of ambivalence, a psychoanalytic approach is necessary. This dimension has always been present in psychoanalytic research (Sauvagnat, 2001), and historical attempts to ban it have only resulted in erratic clinical phenomena such as the 2nd epidemic of multiple personalities in North America (1950–1994). To best tackle these phenomena of ambivalence and subjective divisions, it is important to assume that the patient has a somewhat complex functioning with a multi-layered psyche.

8.6. The transference effects

Neuroscience alone cannot explain the effect of therapeutics, even in the case of a medication. To complicate matters, in addition to the well-accepted placebo effect, there also exists the nocebo effect. These effects, (i.e., the part of the therapeutic efficacy unexplained by pharmacology), is difficult to assess but can range from 20% to 60% depending on the case. Understanding such phenomena implies psychoanalytic elaborations on the expectations as well as the conscious and unconscious assumptions of the patient.

9. Conclusion

This brief description of a few historical landmarks in the collaboration between psychoanalysis and neuroscience has shown, not only that a variety of positions have been taken both by neuroscientists and psychoanalysts, but also that some authors' opinions have significantly shifted. What is particularly striking is the fact that both fields are in what George Devereux called a relation of complementarity, each being at a certain point incompatible with the other, although a total disjunction tends to considerably limit their scope and results of research. When one wishes to experiment, as Sylvie Tordjman did with studying stress in autism (1997), it is essential to be able to think that behind an apparent coldness shown by the patient, there may be panic, some type of conflicting disorganization or even a total disinvestment. These are clearly not the same thing.

In a way, psychoanalysis can also be considered as a sort of reaction of medicine toward pure science. Whereas experimental science has entered medicine in the 19th century, the versatility and creativity needed by medical practice are still recognized as indisputable qualities. This same versatility and creativity are precisely what psychoanalysis claims to be the very nature of human subjectivity, including in psychopathology. Proposing that experimental protocols be complemented by psychoanalytic collaboration should remain an open possibility.

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