

The Biology of Freedom
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The Philoctetes Center

Levy: Francis Levy
Nersessian: Edward Nersessian
Alberini: Christina Alberini
Ansermet: Francois Ansermet
Magistretti: Pierre Magistretti
Pfaff: Donald Pfaff
Schechter: Daniel Schechter
Audience: Speaker from audience

Levy: Good evening and welcome to *The Biology of Freedom*. I'm pleased to introduce Ed Nersessian. Ed Nersessian is Co-Director of the Philoctetes Center. He is Clinical Professor of Psychiatry at Weill-Cornell Medical College, and a training and supervising psychoanalyst at the New York Psychoanalytic Institute. Dr. Nersessian is Editor Emeritus of *Neuropsychanalysis* and Co-Editor of the *Textbook of Psychoanalysis*. Dr. Nersessian will moderate this evening's panel discussion and introduce the other panelists. I just wanted to say one other thing. I know that we have a large group of students from Marymount Manhattan College, from Dr. Roy Tietze's class, and I wanted to especially welcome them and encourage them to come to the Philoctetes Center. Thank you.

Nersessian: I will start by introducing the participants of tonight's roundtable, and I will start with Christina Alberini. Christina is Associate Professor of Neuroscience, Psychiatry, and Structural and Chemical Biology at the Mount Sinai School of Medicine. Her current research interest is in learning and memory.

Francois Ansermet is a psychoanalyst and a Professor and Head of the Department of Child and Adolescent Psychiatry at the School of Medicine at the University of Geneva. He is a member of the World Association of Psychoanalysis, and he is a Lacanian psychoanalyst.

Pierre Magistretti is a Professor of Neuroscience and Co-Director of the Brain Mind Institute at the Ecole Polytechnique Fédérale in Lausanne. He also serves as director of the Center for Psychiatric Neurosciences at the Centre Hospitalier Universitaire Vaudois and University of Lausanne. He holds the International Chair 2007-2008 at the prestigious Collège de France in Paris and has served as the president of the European Federation of Neuroscience Societies.

Donald Pfaff is Professor and Head of the Laboratory of Neurobiology and Behavior at Rockefeller University. He's a brain scientist who uses neuroanatomical, neurochemical and neurophysiological methods to study the cellular mechanism by which the brain controls behavior. He's a Fellow of the New York Academy of Sciences, member of the Advisory Board of the National Academy of Sciences, a Fellow at the American Academy of Arts and Sciences, and serves on the editorial boards of numerous scholarly journals.

Daniel Schechter is a psychoanalyst and Assistant Professor of Clinical Psychiatry in Pediatrics at Columbia University. He's a child psychiatrist specializing in early childhood and parenting issues and serves on the faculty of the Parent-Child Program of the Columbia Psychoanalytic. He is the recipient of numerous awards and grants, including an American Academy of Child and Adolescent Psychiatry Pilot Research Award, a Significant Contribution to Research Award from the International Psychoanalytic Association, and an NIMH Research Career Award, the focus of which is maternal post-traumatic stress disorder and its potential impact on caring for very young children.

Once upon a time, in the late nineteenth century, which is, to be precise, 112 years ago, Freud decided to write a monograph for neurologists, a psychology for neurologists, which means that he tried to use the neurology, or the neuroanatomy of the late nineteenth century, to explain how memory worked, how ideas worked, how perception worked. He spent around seven or eight months on this, and his mood during the period went up and down. Sometimes he felt very happy because he thought he was doing something and sometimes he felt very desperate and despondent, feeling that he was failing. At the end of this he sent some of the material off to his friend, and put some of it in the drawer and forgot about it. The work was not published until 1950, under the name *Project for a Scientific Psychology*. The aim was to see how you could explain mental phenomena through neurophysiology and neuroanatomy.

This effort continued on and off—usually off—from that period on, until the more recent past, the last 20-25 years, when it became much more possible, because of all the advances in neuroscience, to start again thinking in terms of finding a way to explain certain mental phenomena in neuroscientific terms. Of course the issue of consciousness remains a major stumbling block and, as you know, we've had previous meetings here that have dealt with consciousness. We had Jerry Edelman here talking about it. So that's what this meeting is about. We have psychoanalysts, we have neuroscientists, and they're experts on memory and all sorts of things that have to do with the mind and the brain, and we're going to see what they have to say.

Pfaff: In your beautifully written book, you talk about Damasio's Somatic Marker Hypothesis. Especially for our students from Marymount, could you discuss exactly what it is, and does the great Damasio have any evidence for it?

Magistretti: Yes, we can try, from what we read and actually I also discussed it with Damasio. I know him. I met him a few times. The idea actually goes back, at least in my reading, to William James. The idea of the biology of emotions. The basic fact is the following: let's take a very simple emotion like fear, for example. Let's say when you go out here later you go in a little street—I don't know if there are little streets in New York, but anyway—you go in a little back alley somewhere and you see a shadow coming toward you. You're going to be scared. And so you will have a perception. But accompanying that perception, you will have a number of manifestations, bodily manifestations. You will have your heart rate go faster, maybe you will be sweating. You will have feelings in your stomach or in your belly. So there's something somatic that accompanies your perceptions. Now, James and Lange—I think he was Danish—came up with this theory of emotions that in fact you are afraid *because* of the changes in the somatic state, which seems counterintuitive, at least. When I teach this to medical students, they say, "Well, no, it's not really true, actually. I'm afraid and that will trigger a somatic response."

James had this idea that, in fact, there is this sequence. The perception, per se, is relatively neutral in terms of emotion. If you had a computer that could recognize shapes—because a computer does not have a body, it will not be afraid, probably. You need a body to have emotions, and so the idea is that there must be of course systems that allow us to connect somehow perception with somatic state, and trigger a somatic response. But also you need a system that will read your somatic state and bring it to the brain, and now there is some evidence at least of some of the pathways. By bringing together the perception and the somatic state, you create the emotion.

Now there is another theory—Cannon and Bard—who have the opposite one. I mean they had, in the earlier twentieth century. They said no, no, no. Actually, you are afraid. There is some construct there that tells you this is dangerous, and you have the somatic response. Actually, this is still taught in physiology textbooks: the Cannon and Bard vs. the James and Lange theory. So it's not really a completely resolved issue. It seems to me that the pendulum now—and Damasio, of course, was a promoter of this—is back to James and Lange.

Now I don't want to be too long, but just to bring it to Damasio—his idea is that we also have the capacity of anticipating the somatic state in which we will be if we make Decision A or Decision B. Let's say you have to announce bad news to someone. You can just imagine saying, "Okay, I'm going to go to this person and tell this person that this friend of yours is dead." It's going to be difficult, you feel very uncomfortable saying this, and then you have another possibility. You write it down on a piece of paper and put it in the mailbox, and make it go away. Maybe, depending on the kind of person you are, you prefer to do this. Now the idea of Damasio is that you can anticipate the somatic state in which you will be if you do A or B, and we tend to choose the situation that puts us in a less uncomfortable state. The idea is that decisions have a strong bodily component and we have the capacity to anticipate the somatic state in which we will be. I think these are interesting positions which deserve discussion. But clearly, this idea of an emotion being linked to a somatic state, and in fact being the trigger for the somatic state, being really the key factor in the emotion, goes back to William James.

Nersessian: So are you saying you have a different opinion from this, that's why you ask the question?

Pfaff: No, I was wondering whether you could consider the Damasio idea—and he's a very popular neurologist now—to be warmed-over William James? But you've explained it so beautifully that now I should ask the question behind the question: are you at all depressed that we're still talking about ideas that came from 120 years ago after all this research? Why should we not have advanced beyond that, as neurologists and as practicing psychological professionals?

Magistretti: Well, I wouldn't be depressed, because I think that there are—

Nersessian: There's Prozac and Zoloft. There's no reason to be depressed anymore.

Magistretti: No, even without these drugs. As a neuroscientist, for example, and as I say in the book, I have had a personal psychoanalytic experience of many years. I really think that the psychoanalytical framework posed by Freud, which doesn't have much—despite his efforts in

the project—of a strong biological underpinning, I still think it is a very rich and very fertile context in which to think today in neurobiological terms.

The fact that James has said something also not really based on biology—he says, well think of when you're upset, when you're really angry, and think that now you take away all the bodily manifestation of anger, so you're not red in your face. You don't have your heartbeat. He says—and maybe we can try—you cannot imagine anger if you remove all these bodily states you're anticipating. Maybe the fact that I don't see a problem that James said this without much biological evidence, and maybe the fact that today we may find some biological underpinnings for this, may be of interest. I don't think it's the whole story. But for example, for this to exist, for the fact that perception can trigger somatic response and that the somatic response can be detected by the brain, of course it would be important to know are there circuits that could mediate this in neurobiological terms. It may not be the whole story, but certainly one of the systems is the system that involves the amygdala, which receives basically all sensory modalities and then projects towards neuroendocrine and neuro- and autonomic nervous system nuclei, which will change the state of your body.

Work by Bud Craig in recent years has demonstrated the existence of what he called the inter-receptive system, which brings information from the viscera back to the thalamus, which is the sensory gateway, if you wish, and then to some parts of the sensory cortex, the insula in particular, and then further in the anterior cingulate. At least there seem to be circuits that could connect perception with body states, and the system that would inform the brain about a body state. Now if that's the whole story, I don't know, but at least there is some biological basis for what James said.

Nersessian: So, what's the psychoanalytic side of the story?

Ansermet: I will try to say something in my French-English, but I will return to 120 years ago with the Project Freudian. I think that the aim of Freud was creating a global theory of the mind, of the brain. It's a very difficult perspective to do that.

Magistretti: Even today.

Ansermet: Even today, and there are some people trying to do that, like Edelman and others—to put data together to give a new incidence for rating research also. I think for me, as a psychoanalyst, the question of the link, the relationship between representation and somatic state, is a very important question. This question is very *actual*. You can say—we are saying in our book—that the trace has a homeostatic function.

Nersessian: Do you want to say what the trace is?

Ansermet: The trace lives by the experience through the phenomenon of plasticity. Plasticity means that the experience leaves a trace in the neural network: a concrete trace, a structural and functional trace. The fact that the trace is linked to a somatic state is a very important question also in psychoanalysis for the theory of drive. The drive is the way of Freud for thinking about the relationship between the body and the mind. Perhaps you can say more than I, Dan Schechter, about the state of distress of the infant. Freud was speaking about *hilflosigkeit*—helplessness—

the state of distress in the child. The idea is that the child, in the beginning of his life, is unable to discharge by himself the inner excitement of his own body, that there are potentially destructive forces in living matter, and you have to discharge this destructive energy, this inner excitement. The concrete action of the Other is necessary to discharge the excitement, and leaves a trace. So the trace has a homeostatic function, a function of equilibration of the living matter with the inner excitement. For me it's a very central point in the theory of psychoanalysis. The trace is not only the inscription of the experience. The trace has a living function for the psychic life of the child. We can say about deprived children in situations with anonymous care that they are unable to organize themselves, not because they are destroyed by the environment, but because they are destroyed by their own excitement. So in the theory of Freud, we have in the first moment of the psychic life a link between the somatic state and the trace—the somatic state in terms of pleasure or displeasure. I can say more, but it was enough for beginning.

Nersessian: Do you want to say something about the trace? In other words, actually, there is such a thing as a trace, memory traces?

Alberini: Nobody has seen the trace yet. However, there are many data leading to the conclusion that there is a physical modification in the brain that corresponds to the experience, and this modification can be long-lasting, for example, in the long-term memories. However, it's not fixed, even though it's long-lasting. So in this process of becoming long term, the trace is not fixated. It's constantly changing.

We were discussing yesterday about continuity and discontinuity. This could be an interesting topic to go back to. In this dynamic process in which the trace is maintained resides the information—that is, memory. Although physically we don't have a way to identify the trace, we certainly are close to the point to be able to. We definitely try in neuroscience to identify markers that are linked, associated with this trace, and hopefully in the very near future we will be able to do so. There are many ways to do that—it can be electrophysiological, it can be molecular markers that are associated with this trace. Hopefully, that will help to address many questions about what's happening to the trace, and how is that linked to the emotional state, and how is that linked to the somatic state, and how is that changed?

Schechter: I think it's very hard to consider the trace without considering the dimensions of development, as François alluded to, and the dimension of relationships, because the infant has the somatic state, but requires the Other, in the context of the attachment of the relationship, to make meaning of the somatic state. It's over development that that meaning can become more complex or can become somewhat rigidified or get the child stuck. We know that, for example, Bion said that the primary caregiver was the container of this destructive discharge, this potential excitement, the energy, the somatic states that arise with displeasure in the infant. If you're not able to contain those fragments, according to Bion, you have a disorganization, a de-linking, and a chronic state of distress or fragmentation. In fact, we know neurobiologically that excessive stress, when it's not modulated by the Other, as Hofer says, in the mutual regulation process that goes on with hidden regulators in early development, you can have damage to developing structures in the brain that lead to problems along the way that prevent the traces from becoming more complex, and from becoming more flexible or plastic. That, I think, is what Fisher refers to. That's psychopathology, essentially. So when we see people who are stuck, for example, with

early trauma, they need someone to help contain, to give meaning, and to allow the development to go forward.

Alberini: Probably to make new associations to that.

Schechter: Yes.

Magistretti: I think you bring up an important point, and I think it's a fundamental distinction, in that the two processes are somehow connected at some point, between development and the process of becoming. Development, if one puts this to the extreme of the spectrum, would be some sort of pre-programmed set of mechanisms, events that bring about the development of an organism. The process of becoming is something that is much more linked to contingency, to experience. Now there is of course an interplay because particularly in the early stages of life, development is still going on, so the pre-programmed—I mean synaptogenesis—goes on after birth and so on, so there are what one could call pre-programmed mechanisms, but at the same time there is the exposure to the Other, to the contingency, which is not determined, really. It's just contingency, and it's essential, I think, in the emergence of individuality. It's maybe a complex way to say nature and nurture, if you wish, but it's a little more subtle than nature and nurture. It's development versus the process of becoming, the emergence of individuality.

Ansermet: Yes, and we can say that the process of becoming is introduced to the question of the continuity or discontinuity in becoming in the development of the child. One part is you have all the reason of continuity, a lot of determinations, and that you will follow a line of development. On the other hand, through plasticity, and through other phenomena like reconsolidation, you have the opening to new traces—that traces will be associated with other traces, and we are working with Pierre about the paradox of plasticity. If you are thinking about plasticity, the fact that experience leaves a trace in the neural network, it is the idea of continuity or determinism. But in fact, afterwards, that trace may be associated with other traces, creating new traces which will be new stimuli for the becoming-brain, and for the becoming-child, and so you can say that the association between traces will separate from the early traces, creating a discontinuity.

That is a really interesting paradox, because you have in the same concept, in the same data of plasticity, two interpretations, one interpretation in terms of continuity. You have an event in your early life, and it will leave a trace forever in the neuronal network: plasticity. But also, plasticity is the fact that the trace may be associated with other traces, creating discontinuity. This introduces a paradox in the biological theory of memory at a neuronal level. You can say that memory is a continuity, but memory also is a discontinuity, and I think we are today in a movement of creating a new conception of memory, and also of mind-process or creativity. Perhaps creativity is the effect of discontinuity, and not of continuity.

Alberini: Perhaps if I can here I should give some information about what's going on in neuroscience now, and trying to understand the biological basis of the memory process in terms of memory establishment, which is called formation of memory, consolidation. When we learn something new, and if that memory is important, sufficiently important to be kept, then it's going to become long-term memory, and the underlying process that makes the new information into a long-term memory is called memory consolidation.

It was believed until very recently that once memories are consolidated, if they are very important, and they are very strong and long-lasting, they will be there forever, or at least for a long, long time, in that state. Once they are consolidated, they are there. They are sort of fixed. More recently, through rediscoveries of studies, actually of results that have been seen in the '60s, many years ago, but now in a more clear way, it has been shown that that's not true. When we have established memories, consolidated memories, and we recall them, those memories become fragile again, labile again, for a certain period of time. In that period of time, we can change those memories. We can disrupt them if we interfere in some way, pharmacologically or in other ways, or we can make new associations to those memories. If we make new associations, those memories will remain in a certain way. However, they will be now associated to something new. Actually, this is what goes on every time we recall a memory. That memory is now recalled in a new context, in a different time and experience. It's obviously going to change because it's going to be associated with something new, and it's going to be updated to whatever all of our experiences have been. This is what obviously is going on through development, but also through the therapeutic approaches. The process through which the recalled, retrieved memory is going to be maintained, is going to become stabilized again, is called reconsolidation.

Schechter: I was going to say that the therapeutic process I think of as the therapeutic relationship, so that in the telling of a memory to another person, or in the telling of the story, the story is then shared with that person, and we can say co-constructed. It now has a totally new context, new association, and it's also discharging, if you will, to the other person. The other person contains and receives and makes meaning, and that memory will never be the same.

Alberini: Absolutely.

Schechter: So you can never step in the same river twice.

Alberini: So many new associations, so many elaborations of the previous trace that now it's becoming a different trace, an opening to many others.

Ansermet: For me, reconsolidation and also the plasticity are really central biological data for discussing the question of psychoanalysis and the efficacy of psychoanalysis, because we are now at a very important point, I think, in the discussion that we have with Pierre and with Christina Alberini also. It's not a question of using neurosciences to prove psychoanalytic process, but it's a point of encounter between two different fields with a common question. It is our method. It's why I'm not a neuroscientist, really, not at all. I'm a psychoanalyst, a clinician. Pierre is a neuroscientist. Our book *Biology of Freedom* is a method of thinking in two fields without common measure—not the idea of superposition, of analogy, but to conserve two different perspectives with a common question. The common question of the trace left by experience, but also the question of the continuity and discontinuity in the becoming.

Nersessian: But it has to be that if certain neuroscientific findings don't at all go along with psychoanalytic findings, there will be a clash. Now you said something that seems to me would reinforce the psychoanalytic view, which is that memories get changed. The idea that memories become fragile again, and therefore are prone to be altered, is neuro-scientifically possible. The brain can do that and you can show how it can do that, which psychoanalysis has said since Freud, except psychoanalysis says something more. It says that change is usually for the purpose

of decreasing the unpleasurable emotions, and increasing the pleasurable, to create more pleasure, less displeasure, all-around pleasure. How would that fit into the neuroscientific view?

Magistretti: I think it's a very important question, in what determines the potential association of a trace that has become labile with other traces. One can think of a number of reasons—certainly the context: it's a reality. The other one, making more of an impasse here and I don't know how experimentally it could be proven, but I think it would be interesting to test what you are saying. An association that would bring about something more pleasurable, I mean it's basically to test neurobiologically the pleasure-displeasure principle as the drive for re-association. That would be I think an interesting question for a neurobiological experiment. Maybe Christina, you can think about it.

Alberini: Well I think what we know, mostly experimentally, and what we look at are these very long-lasting memories that are memories based on fear or displeasure.

Magistretti: The paradigms are—

Alberini: Exactly. Aversive memories, because they're very long-lasting. That can be, in a way, a representation of a problem that is in an individual that goes to therapy and wants to now create new associations, get rid of that problem through creating new associations. Now is that through necessarily *pleasurable* new associations—that I don't know. I think that can be discussed.

Nersessian: As you know, pleasure in Freud doesn't really mean pleasure in the sense that it's enjoyable to have a good glass of wine, and it's not enjoyable to have a bad glass of wine. Pleasure means, with the neuroscience available to him in the late nineteenth century, increase of tension is un-pleasure. Decrease of tension is pleasure. So as François was saying, if the child is hungry and he's crying, that's un-pleasure. The mother comes, gives the breast, that's pleasure, because the hunger disappears and the tension goes down. But in adult life, those similar issues are involved when you remember things differently for reasons that you may not actually be aware of, which can be discovered in analysis.

Alberini: The discontinuity, yes.

Nersessian: But you nevertheless change them, and the change is usually towards the less tension rather than the more tension.

Alberini: Well, I think that's a complex process. I'm not sure we are so aware of what we do through the new associations. I don't know how easy it is to outline an experiment like that, because I think what we know is that there are new associations forming, and it could be something we know because we see two associations, one with another, but it can also be a discontinuity. It can be that the problem is the many associations we have to go through, in order to get that.

Pfaff: What I started to say was I thought at this point in time, the pleasure principle would be, pardon the expression, a no-brainer. Every neuroscientist's lab has animals which are maximizing their pleasure and decreasing their displeasure, and the fact that we thought of more complicated ways of doing it isn't an issue at this point.

Nersessian: Do you want to tell us a bit more about this?

Pfaff: Well, no, actually I wanted to say something else.

Nersessian: Okay. Go ahead.

Pfaff: Even though you don't want to *be* a neuroscientist, I should think that you'd be very pleased with modern neuroscience in the sense that your trace, let's say fifty years ago, would have had the analogy of a glue making a synapse just a little bit stronger. But now we have nothing less than thirty proteins which determine the release of a neurotransmitter, nothing less than ten proteins which determine the reception of that neurotransmitter. We have signal-transduction pathways within the cell, nothing less than twenty. And then we have the cell nucleus, which has another opportunity for traces. So now we have more than a hundred ways in which you can have your traces, which will take us neuroscientists, us poor sluggards, another hundred and twenty years to figure out your theories about them. You have so many things to play with now.

Alberini: I think that's the beauty of the book. I think this is the first book that reinterprets psychoanalytic theories or discusses psychoanalytic theories with a neuroscience view.

Nersessian: Yes, I don't know of any other book that does it the way this book does it, in such a clear, thorough way.

Ansermet: We're not sure of the analogical model, and we use the new perspective of neuroscience and also new questions in psychoanalysis. For example, the question of becoming: how we can say that through plasticity, if the experience leaves a trace in the neural network, it's always changing. It's another paradox that we are discussing. We are in the paradox of permanent change. We never use twice the same brain.

Alberini: Right.

Ansermet: This is a very important question about determinism. I think we are not beyond the determinate-determinical point of view. It's difficult to discuss the question of determinism. But we are biologically determined not to be completely biologically determined. It is a determination of a lack of determination. That is also the question of the incidence of language, of history, or something else, also of creativity, of the act of the subject creating himself through plasticity. This is also a new question for psychoanalysis, because in psychoanalysis we have a tendency to be too much in the causality from the nineteenth century, and to have too much a linear causality. We give too much point of view with retrospective determinism. If we have a child with depression and the parents are divorced, we can by ourselves associate the depression of the child with the divorce of the parents, but perhaps it is another question. We are the experts of predicting the past. I think that all the questions of the opening, of the becoming, that is an actual question in neuroscience through plasticity, reconsolidation and so on, it's also a new question for psychoanalysis and for the kind of thinking that we have in our clinical practice.

Pfaff: Of course the neuroscientist goes to work every day with the faith that our behavior is completely determined by physical reactions and chemical reactions. Having said that, I can give two warnings to this fictitious neuroscientist: the first, that even though we proceed with the faith

that behavior is completely determined by physical reactions, it could be that certain top-down influences that you guys are expert in are so complex that, even though they are determined by micro-reactions among chemicals, they're not best described that way. I can give a scientific analogy between thermodynamics and statistical mechanics—late nineteenth century—statistical mechanics dealing with every little molecule, thermodynamics with the properties of the whole. Even though the force of science is reductionistic, and we know that statistical mechanics wins the day, nobody is going to disobey the three laws of thermodynamics, and it could be that we'll face an analogous situation in the next fifty years.

The second warning is one that I heard at MIT by a neuroscientist named Donald Mackay. He said even though your behavior is determined perfectly and completely, you don't have to believe that it is because I see you in a certain state—we're finite-state automata—I see you in a certain state, and as soon as I tell you that I've got you determined, you're in a different state, and I'm not sure what state you're in. So even if we are determined, we don't have to think about it.

Magistretti: Yeah, but back to the sentence of François, which we like: “we never use the same brain twice.” You could actually see a sequence of events whereby an Event E happens when the brain is in a given Moment T, and that, per se, will somehow modify your brain. Your brain will be in a state S-prime after that. Now imagine that theoretically the exact same event will happen again—well, the brain is in a slightly different state, so the response will be potentially different, because the brain is in a different state. Again, I think that the sentence that we never use the same brain twice encapsulates this idea, without being idealistic or naïve. That's also what brought this title, which is maybe a bit catchy, *Biology of Freedom*, but it is really that these mechanisms of plasticity somehow provide a way to—escape maybe is a strong word, but a certain genetic determinism, and also the environmental determinism. It's really an intersection of these two determinisms that plasticity operates, and then something that cannot necessarily be predicted will come out.

Ansermet: It's very important, this question, and we have to think about it because it's not only a 120-year-old question. It's a question at least more than 2000 years before. For me, as a clinician, that question is very surprising because you have a question of repetition. It is impossible to change somebody, to change your own way of life. The question for neuroscience with this permanent change is more how is it possible to be the same, a little the same, when you are changing like that? After a dream, after a bad night, or a night of love—I don't know—you will be completely changed and in the morning you will not remember who you are. I think that for me, it's very dynamic, this position of two different ways. The question of clinical work is the permanence of identifications and the confusion of repetition. The question for neuroscience through plasticity and reconsolidation and so on, is more the diachronic identity, the conservation of—

Nersessian: What gives the sense of continuity if things are so changing?

Magistretti: I think the experiments which Christina was mentioning and has contributed, which is this idea that reactivation of traces actually makes this trace labile—and correct me, Christina; we had a long discussion about this—but what I understood is that really these traces have two things that can happen. One is to actually be consolidated. That ensures a certain continuity. But

also, the possibility of associating with others can introduce a discontinuity. In a way, this mechanism of reactivation of traces, with two processes of consolidation and re-association, provides at least potentially a framework to think about how to maintain a diachronic identity with the potential to change at the same time.

Nersessian: When you consolidate, let's say you have a Trace 1 that is now consolidated. Now you've developed, the trace becomes fragile and it's changed, but does T1 exist with T1 plus 2, or T1 is just altered now? What was originally consolidated is no longer in that particular way it was, or it continues to be, plus you have another version of it? Are there series of versions?

Alberini: Right. You have certainly to consider that there is forgetting, as well. So that's another change. Whether the trace is really identical to how it was initially, I would say probably not. I have no way of telling that yet because we can measure physically the trace. However, I would say that, over time, there is also the process of forgetting. Something is going to be lost, and that is already a change. But what we are talking about here is that when we recall, when we retrieve the memory, and that memory becomes labile again, whatever is reactivated is going to be maintained and therefore reconsolidated. That will stay.

In addition, that memory can and will make new associations, just by the fact that it's retrieved in a new context, in a new time. Those new associations are what we are talking about. That is enriching the trace that can take different directions. When we remember certain things and then we decide—we make decisions and take action—then the action is going to have multiple directions that we can choose from, because of new associations. So the answer is yes, it is maintained. Is it exactly the same as initially? Probably not. But there is a core that is maintained and, in addition, there are many new associations that are formed every time we recall a memory.

Nersessian: And that applies to whether Don was talking about things like procedural memory and autobiographic memory or there are differences?

Alberini: Procedural memories have not been studied yet very much in these terms. There are some studies in humans, actually, that have to do with motor learning, and they do undergo reconsolidation, but there is much less known. It is more about limbic-system-dependent memories in the animal and those would represent the so-called declarative memories in humans.

Schechter: I think it's difficult to lump all the different kinds of memories together because, to go back to Darwin, certain memories we need for survival. For example, a phobia of a snake or a very traumatic experience creates a somatic state through the amygdala and the limbic system. The problem we often have in psychoanalysis is that the psychoanalysis does not reconsolidate that memory necessarily at the limbic level, because whenever that person has something to reinforce that experience, it's triggering their traumatic, somatic states and they may not be able to exercise the frontal areas of their brain that would help calm them down and contextualize things, as well as parts of their limbic system, like their hippocampus. So in our research, when we have mothers who have post-traumatic stress of experienced violence and they watch their toddlers having a helpless or distressed state on the video or MRI scanner, they don't show the pre-frontal areas activated as women who don't have post-traumatic stress do. We need to understand how psychoanalysis works. My suspicion is that it's really contributing to the frontal, top-down control and meaning-making of some of these limbic and somatic memories and that

may not change so much because they're survival-related. I don't know what other people think about it.

Alberini: These are future experiments, very near-future experiments. There are components that probably have not been subject to the reconsolidation process, meaning they do not become labile. But they are there and they will stay. They are not becoming fragile that much. But what makes it fragile—the entire memory or the part that is reactivated—is more the emotional component. This is unknown yet. We are looking at that. And if that is true, it means that the emotional palette is attached to the memory.

Ansermet: It's a very difficult question about early traumatic experience and prenatal stress. I am working on that in the prenatal birth situation. You can say that all the discussion is about the nonsense of the experience of the living. You have to give meaning, as you said, meaning to the movement of the inner excitement, which is without meaning for the subject. I think the traumatic experience is more early traumatic experience through non-response of the other, more than from aggression from outside. It's possible to have aggression from outside for a little infant. It's clear in the situation of war and a lot of different situations, but it's important to realize that in the beginning of the life, there is aggression. It's too much to say aggression; it's the impact of inner excitement. All the mind may be seen as a defense against the reel of inner excitement, against drive. The drive is also a combination of representation and somatic states. But it's a new way to see also the question of the living in psychoanalysis and I think we have to rediscover the question of the living matter, of the living, in French *la vivante*. I don't know if it is the same in English to say "the living."

Nersessian: Life.

Ansermet: Yes. What is life? The perplexity of the infant in front of his own living movements. We can say that the trace has homeostatic function. With Pierre, we are discussing the paradoxical view of free will. We can say its un-achievements and nonsense of the living and discontinuity and unpredictability. All of these different faces of the human falling in the world, with the body and the outside world, which is in the beginning without sense, without meaning. The trace is the treatment of the nonsense of the living and it has a homeostatic function. We can say that the act of the subject—the creation of the subject—is something like a necessity to treat the inner excitement. You must be creative to go outside the nonsense of the living matter. Do you understand? I open a new way on creativity because we are talking about imagination.

Schechter: But doesn't that require the Other? You need something outside the self.

Ansermet: Yes, you need the Other.

Nersessian: Are you ready to take questions from the audience?

Ansermet: I am not ready.

Levy: It strikes me that this whole emphasis on the limbic system and on the somatization of emotion, looking at it as a physical body—didn't Freud say the ego was a "body ego"? Wasn't that a quote of Freud's?

Nersessian: Damasio likes that quote.

Levy: Yes. Isn't there a kind of animal model here in a certain sense? Could we be having this discussion about avian or other mammals? Obviously, monkeys have been used. LeDoux uses monkeys and so forth. But increasingly, this whole discussion that's been going on about the body—it strikes me that now we are taking the movement away, that consciousness becomes less the real—even you talk about “top-down.” So I ask you, could we be having this whole discussion removing the actual human consciousness from the equation?

Magistretti: I'm not sure that I can really answer your question, but bringing up the issue of animal strikes to a point which I think has been the object of a certain confusion, at least it seemed to me, which is instinct versus drive. Sometimes they are just used interchangeably. This I just offer for discussion, but instinct would be something that is like a pre-programmed behavior, if you wish, and would be more on the animal side, in which there is less freedom. Probably human beings also have a certain degree of that, but much less than animals.

Drive, in terms of the engine for behavior, is maybe similar. But the origin of drive is different from the origin of instinct. The instinct being more genetic, let's say, in origin versus drive, which is the production of plasticity, of the intersection between experience and a little bit, of course, of the genetic background. But it's not something pre-programmed. We say sometimes that animals have instructions for use. They know a number of things that they have to do. For example, Francois was telling me about this pheasant in Tuscany. He has a nice house in Tuscany and he was looking at a pheasant courting the female pheasant and they do something very well-structured and very repetitive. Now a man courting a woman—fortunately, each one has his own technique. This is a bit of a joke. It depends on the culture. It's just to illustrate this notion, which again I think needs to be put clearly on the table to avoid the potential confusion between instinct and drive. One being really genetically determined, the other one being the product of plasticity.

Ansermet: I think also we have lost the instructions for use for sexual life, for love, also. The object of love, the sexual object of the fantasies are very different and they are not corresponding and that's why between men and women it's so complicated, so difficult. The other question about your discussion is the question of pleasure and displeasure. Why, when you propose the door for pleasure and the other door for displeasure, most people are choosing displeasure. I don't know if animals have the same problem.

Alberini: They do, they do.

Ansermet: They do?

Alberini: Yes.

Magistretti: You think so?

Alberini: Well, it's not known whether the mechanism is the same, but they do.

Nersessian: Masochistic rats. What do you think of that?

Pfaff: What's the evidence that animals usually choose displeasure?

Magistretti: No, humans.

Ansermet: Not me, but humans are self-destructive.

Pfaff: It depends on how restricted an idea you have of the range of human motivations. In other words, if you were to talk about the mastery motive or the achievement motive, then you would say that an intelligent individual, who has his food and his water and a spouse and so forth, might choose displeasure in the sense of a challenge because that serves a different kind of motivation.

Alberini: Exactly.

Pfaff: I would repair to this man, Abraham Maslow, who talks about different hierarchies and motivation, with self-actualization being at the top. But I personally have never felt self-actualization to be unpleasurable.

Schechter: But sometimes predictability or control, even if it's subversive, is better than neglect or unpredictability. There are gradations of what is pleasure.

Pfaff: Boredom is stressful.

Schechter: We have someone in the audience who works with the prefrontal cortex in rodents, and from what I understand, there are aspects of the prefrontal cortex that will promote limbic—you know, the fight/flight fear—by saying, “Well, gee, out there, you better be scared,” and so it revs up the amygdala and other parts, and mice or rats will say, “No, no, no. That shock won't happen if you step on that part of the grid.” They learn to extinguish that fear response. So in response to your question, I think there are beginnings in animal research to look at this, but obviously we're kind of biased towards considering human consciousness very precious and we don't understand animals so well.

A: I have a a puzzling question for Christina that you might have answered for me. I wanted to know if I'm on the right track. My sister and I, who are eleven months apart, grew up like twins. But we've had different lifestyles and different lives altogether. I've traveled and she's had children and a mother at home. Last year she came to spend a month with me and we relived a lot of childhood memories. A lot of them differed as to what I remembered and I was puzzled. A few of them were traumatic. I remember them so differently and I'm puzzled at how we lived in the same place and had the same experiences and we had different memories of it. Is it because we've had different lifestyles that we have both changed those memories? I was just so shocked.

Alberini: Right. Absolutely, the two different lives that you've had, the two different histories—therefore there are so many different associations that you make when you recall your memories throughout your life. They become different. Actually, often times, what we remember through associations are even so-called “false memories.” Those are memories that are not true but they are associated to some other memory and so we believe that that thing happened. However, it's just an association that came up. So there you go, the two of you are talking about your childhood memories and who knows what happened.

A: Mine were real to me.

Alberini: This is not to say that it's an invention of what the childhood was. But it's a different interpretation because of the different association and re-elaboration of the memory throughout your history.

Nersessian: You also have different characters and different personalities. An analyst listening to the memories would be able to tell the differences because of the differences of character.

A: Well, I thought it was because we perceived the experiences differently. But what you're saying is that, because of our different lifestyles and experiences—

Nersessian: Both.

Alberini: And the perception, the different perceptions you have of your histories. What you went through and the different perception that you have.

Nersessian: Well, you would say both, though. In other words, they originally perceived it differently and the consolidation or reconsolidation was different.

Magistretti: You would think that the perception would be different.

Alberini: In each one the perception can be different, sure.

Nersessian: Based on what you said, it's inevitable. The brain keeps changing so it has to be different.

Schechter: But it's not only the biology that's different. I think it's sad that in the translation of the title of your book something was lost because the original French title is *À Chacun son Cerveau*, each one to his own brain.

Alberini: Right.

Schechter: So you have your brain and your sister has hers, and your experiences and your biology interact differently, of your own trajectories, your own traces, your own network of associations. Yet you share something at the same time.

A: So it could be the combination of we both perceive the experiences differently as well as we've had different things happen to us over the 35 or 40 years we've been living.

Alberini: Yes, exactly.

Ansermet: Perhaps you were the same but in your becoming you will be different. The act of the subject is always transforming the subject. We can say that one part is perception—experience and perception. The other part is inter-receptive pathways and somatic states reading. This act of the subject is the result of the tension between perception for one part and reading a somatic state for the other part. After that is the perception of the act of the subject and the subject is a creation, a creative process.

A: Would you say that all of you are really very closely related in terms of either the pleasure principle or the pain principle and also in terms of consolidation or in terms of veering away from the consolidation, the running away from pain? In a sense what I see is that you all are one team.

Nersessian: We are getting there.

A: There's so much to know, especially since you don't know what some of these pathways are yet. Also what I see is that sometimes you go on a different path, which really is changed significantly from the object that the infant started with, which is absolutely amazing. Not all people can do it, but it can happen. I was also reminded of this where I've heard a lot of people say, well, my mother or my father really weren't bad. They did the best they could. So even though the infant was reaching out at some point and the subject was very angry for a long time, they realized they did the best they could. Yet at the time, they were looking to get rid of that—what did you call it? Not intensity, but something like—

Nersessian: Destructive—

A: Yes, whatever. But anyway, it's a team.

A: I was watching this interesting lecture on electroshock therapy on TED.com, which everyone should go and visit. It was about this surgeon who had a successful surgery practice, but he had a genetic disposition for depression and his colleagues saw that he was depressed. His referrals went down, his practice started to fail, he got a divorce and became severely depressed, so much so that he was institutionalized. His former colleagues basically said, all that's left for us to do is prefrontal cortex lobotomy. Luckily, there was a 27-year-old resident who said, "No, let's just try electroshock therapy."

Nersessian: When was this?

A: I don't know, this was actually pretty recent I would say. So there were no results except after the tenth treatment of the electroshock therapy he started to feel a result. He went through 20 treatments and he was incredibly cured. He still retained all his long-term memories of his experiences, the same collection of past experiences—there's your continuity right there. Yet at the end of 20 treatments, there was a dramatic effect on his basal emotional state. Francois was saying that experience leaves a trace in the neural network, so experience was still there: his past memories of what he went through in his life up to his practice. But my question is—kind of like the lady in the houndstooth jacket was saying with her sister—within the same person what determines a happy spin on the consolidation of new memories, or what determines a happy spin on the retroactive remembrances of experiences versus a pessimistic spin on the formation of the same new memory or the pessimistic spin on the same remembrance of the same memory within the same person after the electroshock therapy? I guess my question to all of you, mostly the scientists, is what is a neurophysical/biological basis, which determines a happy disposition or a resilience, versus a depressive melancholic or someone who's emotionally fragile?

Pfaff: I can say that since I was an undergraduate electroconvulsive shock has been an effective treatment for depression and it remains an effective treatment for people who are resistant to the

various antidepressants. But secondly, to answer your main question, certainly our genetic heritage has something to do with it. Dopamine, which is a very important transmitter for your mood and your sense of reward, has nothing less than five different genes coding for dopamine receptors. Small changes, even single nucleotide bases in the promoters of one of those genes, can make a difference as to how happy a person you're going to be.

A: I guess my main question is, then, what is a neurobiological basis that will explain the effectiveness of electroshock therapy—because this guy had a genetic predisposition for depression. This thing, is it like a restart? Does it re-start your neural pathways and increase your fluidity—

Pfaff: That's a good question and there's no solid answer. But I can point you to the work of Helen Mayberg, a professor of neurology at Emory University, who is refining it to the point where she's not giving electro-convulsive shock, but she's specifically stimulating one area of the brain called Brodmann area 25, which is in the frontal cortex and which seems to be effective. It now goes under the name DBS, Deep Brain Stimulation, for treatment-resistant depression. You'll hear a lot about it in the future.

A: Dr. Alberini, you mentioned that the memories that have an emotional component tend to be the more labile memories.

Alberini: Or the more long-term, the strongest memories.

A: So they don't tend to be more labile with the emotional component?

Alberini: No, I think that what we are trying now to see, and we don't know yet, is whether after the reactivation, when they are in a labile state, whether the possibility to disrupt them actually targets the emotional component. Not the cognitive part of the memory, but more the emotional component, which is what makes them strong in the first place.

A: Is that why the memories that have an emotional component tend to be the ones we hold onto longest?

Alberini: Right. We need to be exposed only one time to very shocking experiences. We don't need to see them twice. September 11th we will remember for our entire lives; we don't need to see that twice. Those are the strongest, longest-lasting memories, even though we had one single trial exposure to it. And those are obviously emotionally very charged.

A: Yet the emotional part of it is more susceptible to being changed—

Alberini: This is what we hope. There is some suggestion for that, but we don't know for sure yet. It's an experiment in progress.

A: Isn't that an interesting kind of dynamic, that it's the thing that makes us hold onto it and yet maybe is malleable in some way.

Alberini: Exactly.

Magistretti: I just wanted to comment about Helen Mayberg because her work, one that preceded the Deep Brain Stimulation, also was a nice example of plasticity. There is a very nice study where they had depressed patients, and some were subjected to mostly cognitive-behavioral therapy, while others received pharmacotherapy. They did a brain scan, a PET scan, which measured glucose-utilization—so the activity of different areas—but monitored under the form of brain works, so an area of the brain that is more active will consume more glucose and you can see that in the scan. They looked at the basal pattern of glucose utilization before the treatment. Then after the treatment, either pharmacotherapy or psychotherapy, they did scans again in those patients who responded. Interestingly enough, the pattern was different in the patients that responded. Even more interesting, it was different between those that responded to pharmacotherapy and to psychotherapy, showing that even just psychotherapy changed the pattern of brain activity monitored by utilization of glucose, indicating potentially a plasticity response. Now the interesting thing is that there was an area—at least one, maybe more—which were different, as I said, but there were some common areas in the two groups of patients that responded, and one was this Brodmann area 25, which then became the object of this Deep Brain Stimulation, which seems to be quite an interesting approach. The only point I wanted to make was that this work, which is very promising for DBS, actually originated also from a study that I thought was an illustration of plasticity.

A: The first thing I wanted to say is to thank you for organizing this fascinating panel and thank you for being so welcoming to my students. Rather than an individual question, I just think that the work and the connections between those two important fields are mind-boggling. I guess some of this may be my connections to my students or for my students, but it is just fascinating to me the whole idea that a hundred billion neuron central nervous system doesn't need more than one in four to deal with the outside world. The other three are dealing with exchange of information.

We share with our siblings 50% of genes. What we are driven to do, I think, is to make that discontinuity and create our own identity, our own personality, that both is plastic enough to deal with flexibility and change and also constant to give us a sense of who we are that continues through all of our experiences. I can't say enough about how stimulating your discussion has been. Thank you so much.

A: I have a question about how we as humans are capable or not capable of rewiring our responses. Not necessarily stress responses to memories, but stress responses to the environment, like the flight or fight response. I'm an actor and part of the work in acting is trying to transcend or channel some of the stress response that comes out of being in front of a large group of people and performing. When a performance transcends that stress response, I think a lot of people, including the performers, describe that as being a "free" performance or "in the zone," in that there's none of that stress or tension that comes from the stress response. Sometimes it's not free. There are certain factors that come together and a performer isn't able to get out of that stress response. So a lot of technique and craft is increasing the chances that the performance will be free of that stress response. I'm just wondering what you think about our capacity to train ourselves to use thought and suggestion and ourselves to transcend the stress response and to make it more of something that we can manage ourselves.

Pfaff: Nobody's saying anything, so I'll just admit that your question is beyond the realm of current neuroscience. I've heard an awful lot about behavior modification techniques, which work, but they're not necessarily understandable from the point of view of the third nerve cell from the left.

Schechter: I would question what roles or situations the actor is placed in that make it difficult to be freer or in the zone in the same way that I would ask a mother who comes to see me what makes it easy with one child and not another, what internal associations or traces are activated by being asked to perform a certain role in a certain situation with a particular audience in a certain theater in a certain place at a certain time of day when something's going on in your life. I think it's so complex that it's fascinating to figure that out. Maybe you'll help us understand.

A: Part of the reason I asked is because it does seem a lot of times to be very circumstantial or random. There are some moments where it clicks and some where it doesn't. It can be just this very ephemeral thing that doesn't have to do with what we ate or the breathing exercises that we did.

Schechter: That's what Freud would have called in the past the unconscious, so we can ask these guys, "Where is the unconscious?" That's what I wanted to know. It's not declarative, it's not procedural, it's not implicit, it's not explicit. What is it?

A: The actors are playing off each other, too. You know, what the energy is that's going on there.

Ansermet: Perhaps I can try to say something about your question because I have experiments with some people like actors. The reason of the stress of the actor is very different in different situations. You can have the interpretation that they are afraid of the situation of creating, of doing their act as actor, but also there is the question of enjoyment, the excess of enjoyment. In French we say *jouissance*. I had a patient who was afraid by the question of the gaze. She had a problem with the gaze of the people looking at her and in fact, she was really in too much satisfaction and it was the guilt process, a difficult story with her own life. We have to look not only in terms of aversive behavior and treatment and so on. When somebody is afraid and has too much stress, we have to look beyond the stress to the question of enjoyment. This is very important for the work of an actor, for me, in my experience with actors. They are more traumatized by the pleasure than by the fright of the situation of being an actor.

A: I was wondering if you could talk a little bit about automatic process and free will, or the lack of it, that neuroscience is showing.

Magistretti: Well, let's say we admit that through the processes that we discussed, of plasticity, there is an inner reality that is built with time, and that on one side, there is this link between certain somatic states, traces that build our inner reality, which are associated with certain states which may be much more subtle than fear or anger or something like that. One can consider the possibility that a given state is a slight deviation from a homeostatic state. As living organisms, the basic principle of physiology since Claude Bernard is that everything is regulated such that we maintain our internal milieu or homeostatic situation. You may imagine that somehow a given event, a given experience, will actually activate a certain set of traces which are associated with a certain somatic state. And that this somatic state is a deviation from a homeostatic state.

If we go back to physiology and forget about what I said, but just consider homeostasis—say, for example, if we have high glucose levels there are processes that release insulin from the pancreas and get glucose to enter into the tissues to reestablish the homeostatic value of glucose. If you're diabetic it doesn't work like that, but let's say that we are in a physiological situation. Now, we go back to this idea of a representation of a set of traces associated with a certain somatic state which is a deviation from a physiological or homeostatic situation to reestablish the physiological state. It's more complex than just releasing insulin, for example, because this somatic state is associated with a representation. So there will be a drive. What we discuss in the book is the idea that drive is a highly physiological process to maintain homeostasis.

But now, because the somatic state is associated with a given representation, it will have to go through the representation with a specific act with a specific object. That will be very determining in the action of the person. We have of course free will, particularly free referring to drive versus instinct, but this free will is determined by the way we have constructed and put together with experience all these traces with the associated somatic state. There is a sort of free will, but it's not random. It's not anything. It's really determined by the tight link between representation and somatic states, which are expressed in the drive. It's a long explanation and maybe a bit confusing.

Ansermet: To be short, it is a biological necessity to be free. We need to be free to create actions, acts. To be creative, we need to find always new inventions, new solutions, to recreate this equilibrium. It's something very paradoxical. It is a necessity to be free. For me, it's that biology of freedom. It's a necessity to be creative. It's the movement of human life to find solutions. I'm discussing psychoanalytic processing often, that we are always in the logic of the cause of the determination, but we have to discuss also the logic of the response of the subject. The response, the specificity of invention of the subject, to find a solution. The subjects are finding solutions like symptoms. They are a solution and a gap, *un piège*—

Schechter: A trap.

Ansermet: A trap, a solution and a trap. There are often these two dimensions, but I think it's movement toward the creation of a solution.