Chapter 20. Jacques Benveniste at Newton’s house

A particularly simple biological model

This new promising system was simple and it appeared to satisfactorily respond to the electromagnetic transmissions. It consisted in making coagulate blood plasma in a tube. As we all know, plasma is the liquid in which blood cells are suspended. After a simple centrifugation of blood to which an anticoagulant has been added, blood cells are removed and plasma can be then frozen for storage and later use. For these experiments sheep plasma was generally used.

When one wanted to perform an experiment, plasma was defrosted; calcium chloride was added to overcome the effect of the anticoagulant and to activate the coagulation process. The “biological activity” of heparin, an anticoagulant, was recorded and digitized by J. Benveniste and his co-workers to demonstrate the reality of digital biology in this biologic model.

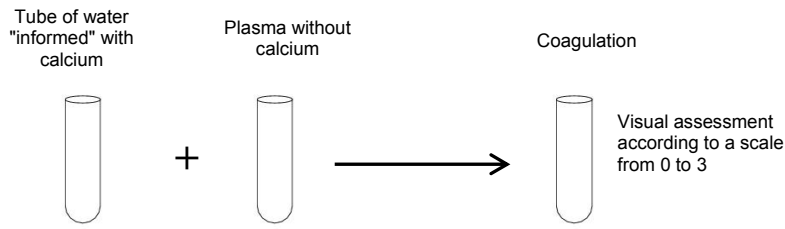

Figure 20.1. Principle of *in vitro* plasma coagulation. A solution of calcium (“informed” or not) was added to plasma. In the first experiments, coagulation was assessed with the naked eye (0: no coagulation; 1: starting coagulation, that is liquid plasma with a coagulation point; 2: moderate coagulation, that is viscous plasma; 3: complete coagulation).

The first experiments were performed in January 1999. As for the previous experiments of “digital biology”, “naive” water was “imprinted” on the coil wired at the sound card of the computer. The recordings which were “played” to water were anticoagulants (heparin or hirudin) or water as control. In the first version of the experiment, coagulation was evaluated with the naked eye (Figure 20.1).

Besides this new model, J. Benveniste made a new observation which was not related to "digital biology", but that could be an argument on the role of water in the "amplification of the biological signal". This experiment which was firstly performed on the isolated heart, was also reproduced with the coagulation model. The experiment consisted in diluting a biological solution – a solution of hirudine in this particular case – until a very low concentration (10^{-12} mol/L). At this concentration, there were still molecules, but their concentration was too low to have any biological effect. However, J. Benveniste noticed that if the dilutions were made by shaking, then the solution at 10^{-12} mol/L had nevertheless a biological effect! "Controls" that were not shaken had no effect. For J. Benveniste, it was an argument in favor of the role of water in the transmission and amplification of the biological signals. It was maybe less spectacular than the electromagnetic transmissions, but this result could be easily reproduced in other laboratories and moreover without any electronic and IT equipment.

Other previous results were confirmed by the team of J. Benveniste on the system of coagulation, in particular with high dilutions. Thus homeopathic pills "heparinum 30 CH" bought in a pharmacy and dissolved in water exhibited anticoagulant properties in this biological model. The link with the previous experiments with high dilutions was thus maintained.

To Cambridge

One remembers the words of G. Charpak considering the results of J. Benveniste – if they were true – as the "biggest discovery since Newton". On March 10th, 1999, J. Benveniste went to Cambridge – "at Newton's home" – to make a conference on his experiments entitled "*Electromagnetically activated water and the puzzle of the biological signal*". J. Benveniste was invited by Brian Josephson, a Nobel Prize laureate in physics from the Cavendish Laboratory of the Cambridge University whom he had met during the conference in Bermuda of April 1988 about which we spoke in the first part. Since this conference, both men kept in touch. The Cavendish Laboratory is in fact the department of physics of the Cambridge University. It is there that the structure of the molecule of DNA was elaborated by J. Watson and F. Crick, a founding episode of the history of molecular biology.

Contrary to the ultra-rationalist G. Charpak, B. Josephson is interested in subjects in the margins of the science. It is true that Newton himself who taught at Cambridge set an example by studying alchemy during a large part of his life. As for B. Josephson, haveing recieved a Nobel prize at the age of 33 for the work he realized at the age of 22, he tempted to reconcile parapsychology and

quantum physics. He was a director of the Mind-Matter Unification Project of the Theory of Condensed Matter Group at the Cavendish Laboratory. This project was "concerned primarily with the attempt to understand, from the viewpoint of the theoretical physicist, what may loosely be characterised as intelligent processes in nature, associated with brain function or with some other natural process".

B. Josephson explained why J. Benveniste was invited to present his work to this weekly seminary of the Cavendish Laboratory:

> "While the results claimed may seem surprising, the Cavendish Laboratory has been host to many surprising discoveries during the 125 years of its existence, and the controversial nature of the claims was not seen as good cause to follow the herd and veto his making a presentation. In regard to the Nature condemnation of 1988, my conclusion at that time was that its authors had made an insufficient case for its headline claim "High-dilution experiments a delusion", and nothing since has led me to see the frequent denunciations of the work as anything other than the hysteria that frequently accompanies claims that challenge the orthodox point of view." [1]

The presentation made by J. Benveniste was for him the occasion to present his vision of the biological world and more exactly to explain "how molecules communicate". His "doctrine" had evolved. One is far from the few lines of the article of *Nature* of 1988 which briefly suggested that "water could act as a 'template' for the molecule, for example by an infinite hydrogen-bonded network, or electric and magnetic fields". Nevertheless, the presentation in front of the public including eminent physicists in the Pippard Lecture Theater of the Cavendish Laboratory was rather a personal conception of the world of the biological molecules than a real theory supported by experimental facts. Among the listeners, besides B. Josephson, other illustrious physicists attended the conference, such as Sir Andrew Huxley, Nobel prize laureate in Medicine and Physiology (with John Eccles in 1963) and former president of the Royal Society. J. Benveniste gave a first overview of the possible applications of his "discoveries":

> "Benveniste suggested that the specific effects of biologically active molecules such as adrenalin, nicotine and caffeine, and the immunological signatures of viruses and bacteria, can be recorded and digitised using a computer sound-card. A keystroke later, and these signals can be winging their way across the globe, courtesy of the Internet. Biological systems far away from their activating

> molecules can then – he suggested – be triggered simply by playing back the recordings." [2]

Then, J. Benveniste explained why his researches had exceeded the "simple" frame of high dilutions because now the aim of his studies was nothing less than "deciphering the language" of biological molecules:

> "Benveniste started by asking some apparently childish questions. If molecules could talk, what would they sound like? More specifically, can we eavesdrop on their conversations, record them, and play them back? The answer to these last three questions is, according to Benveniste, a resounding "Oui!" He further suggested that these "recordings" can make molecules respond in the same way as they do when they react. Contradicting the way biologists think biochemical reactions occur, he claims molecules do not have to be in close proximity to affect each other. "It's like listening to Pavarotti or Elton John," Benveniste explained. "We hear the sound and experience emotions, whether they're live or on CD."

He continued by explaining why the current vision of the molecular mechanisms was insufficient to understand the biological phenomena:

> "For example, anger produces adrenalin. When adrenalin molecules bind to their receptor sites, they set off a string of biological events that, among other things, make blood vessels contract. Biologists say that adrenalin is acting as a molecular signalling device but, Benveniste asks, what is the real nature of the signal? And how come the adrenalin molecules specifically target their receptors and no others, at incredible speed? According to Benveniste, if the cause of such biochemical events were simply due to random collisions between adrenalin molecules and their receptors (the currently accepted theory of molecular signalling), then it should take longer than it does to get angry."

In front of a public of physicists who were nothing but amazed about how molecules could emit electromagnetic waves of low frequency, J. Benveniste developed his argument of "beatings of frequency":

> "Benveniste's explanation starts innocuously enough with a musical analogy. Two vibrating strings close together in frequency will produce a "beat". The length of this beat increases as the two frequencies approach each other. Eventually, when they are the same, the beat disappears. This is the way musicians tune their

> instruments, and Benveniste uses the analogy to explain his water-memory theory. Thus, all molecules are made from atoms which are constantly vibrating and emitting infrared radiation in a highly complex manner. These infrared vibrations have been detected for years by scientists, and are a vital part of their armoury of methods for identifying molecules. However, precisely because of the complexity of their infrared vibrations, molecules also produce much lower "beat" frequencies. It turns out that these beats are within the human audible range (20 to 20,000 Hertz) and are specific for every different molecule. Thus, as well as radiating in the infrared region, molecules also broadcast frequencies in the same range as the human voice. This is the molecular signal that Benveniste detects and records."

If one were to summarize the reasoning, besides "high frequencies" there would also be "low frequencies" because of beatings and these low frequencies would be captured and recorded by the devices of J. Benveniste. But how to explain that one can then transmit the recording of a biologically active molecule to a biological system? Here again, J. Benveniste could exercise his innate sense of the metaphor:

> "If molecules can broadcast, then they should also be able to receive. The specific broadcast of one molecular species will be picked up by another, "tuned" by its molecular structure to receive it. Benveniste calls this matching of broadcast with reception "co-resonance", and says it works like a radio set. Thus, when you tune your radio to, say, Classic FM, both your set and the transmitting station are vibrating at the same frequency. Twitch the dial a little, and you're listening to Radio 1: different tuning, different sounds.
>
> This, Benveniste claims, is how millions of biological molecules manage to communicate at the speed of light with their own corresponding molecule and no other. It also explains why minute changes in the structure of a molecule can profoundly alter its biological effect. It is not that these tiny structural changes make it a bad fit with its biological receptor (the classical lock-and-key approach). The structural modifications "detune" the molecule to its receptor. What is more, and just like radio sets and receivers, the molecules do not have to be close together for communication to take place."

And at which moment water and its memory intervene?

> "Benveniste explains this by pointing out that all biological reactions occur in water. The water molecules completely surround every other molecule placed among them. A single protein molecule, for example, will have a fan club of at least 10,000 admiring water molecules. And they are not just hangers-on. Benveniste believes they are the agents that in fact relay and amplify the biological signal coming from the original molecule. It is like a CD which, by itself, cannot produce a sound but has the means to create it etched into its surface. In order for the sound to be heard, it needs to be played back through an electronic amplifier. And just as Pavarotti or Elton John is on the CD only as a "memory", so water can memorise and amplify the signals of molecules that have been dissolved and diluted out of existence. The molecules do not have to be there, only their "imprint" on the solution in which they are dissolved. Agitation makes the memory."

But some of the listeners asked: "So what do molecules sound like?":

> " "At the moment we don't quite know," says Didier Guillonnet, Benveniste's colleague at the Digital Research Laboratory. "When we record a molecule such as caffeine, for example, we should get a spectrum, but it seems more like noise. However, when we play the caffeine recording back to a biological system sensitive to it, the system reacts. We are only recording and replaying; at the moment we cannot recognise a pattern." "

J. Benveniste specified, abruptly caught up by his "transatlantic" dreams:

> "The biological systems do. We've sent the caffeine signal across the Atlantic by standard telecommunications and it's still produced an effect."

As for B. Josephson, although he was certainly not representative of the physicists who were present, the speech of J. Benveniste did not excessively shock him. He later made this remark about the hypotheses of J. Benveniste on "memory of water":

> "What science tells us about the possibility of the existence of "memory of water"? The scientists who are not erudite about water tend to have a naive vision of it: a liquid composed of H_20 molecules more or less isolated, in movement. In fact, water is more complex, with individual molecules temporarily agglutinating to form a network. It is not inconceivable that the interaction of

> these molecules could produce a mechanism that would allow memory of water. The scientists who are well informed about water take the proposal of memory much more seriously than those who are not informed." [3]

Demonstrations

J. Benveniste, D. Guillonnet and J. Aïssa came also to Cambridge to do demonstrations. A first experiment was performed on March 10th. It did not concern the electromagnetic transmissions strictly speaking, but rather the role of water as amplifier of the biological information. Indeed, as previously said, J. Benveniste noticed that biological solutions at low concentrations such as 10^{-12} mol/L which had no effect due to precisely this too low concentration could nevertheless have an effect if the solution was shaken. It was according to him the proof that water was capable of amplifying the "molecular signal".

Two blind experiments were performed at Cambridge: one was blinded by B. Josephson himself and the other one by D. Guillonnet. Each of the experiments included one shaken tube of hirudin 10^{-12} mol/L (= active tube), a tube of hirudin 10^{-12} mol/L that was not shaken (= inactive tube), a shaken tube of water (= inactive tube), a tube of water that was not shaken (= inactive tube). It was actually a success because the unique active tube was correctly designated in both experiments because it was the only one who delayed coagulation (Figure 20.2).

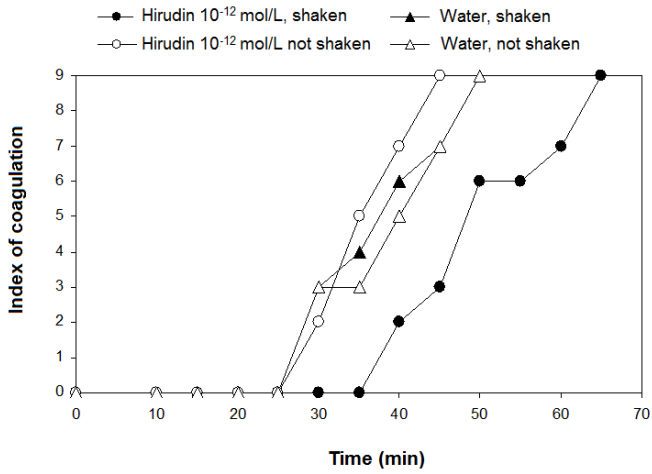

Figure 20.2. Experiment performed in Cambridge in the laboratory of B. Josephson on March 10th, 1999 and blinded by the latter. The purpose of this experiment performed with "low concentrations" of an anticoagulant (hirudin) was to illustrate the role of water as "amplifier" of weak biological signals: concentrations of hirudin at 10^{-12} M prepared with "shaking" had an effect and had no effect if not "shaken".
Each of the experimental points was performed in triplicate and coagulation was assessed from 0 (no coagulation) to 3 (maximal coagulation). The sum of 3 scores is shown at each time on the figure. Consequently the index of coagulation (sum of the scores of 3 tubes) cannot exceed 9 (maximal coagulation in 3 tubes). [4]

It was also planned to perform transmission experiments with "digitized hirudin", but the calibration of the experiment (determination of the optimal concentration of calcium) took time and a single open-label experiment was performed the next day. The experimental conditions were not ideal because coagulation was a little too fast; it was the tube with transmitted hirudine which had the shortest coagulation time, contrary to what was expected…

But, "fortunately", time was short and the team could hardly linger. Upon returning from this excursion, when J. Benveniste told the stay in the Cavendish laboratory to his collaborators stayed in Clamart, he confided with a half-smile and with the wrongly contrite look of a child who was caught with his fingers in the jam pot: "Maybe there was an "inversion" with the last experiment, but "he" did not realize it". As for B. Josephson, he told afterward the coming of J. Benveniste to Cavendish and he summarized the experiments he attended in these terms:

> "Benveniste had brought the experimental equipment and he reproduced his most recent experiments in front of us. These have proved as convincing as possible, considering the limited time which we had." [5]

And here is J. Randi again …

B. Josephson appeared to have been convinced by these experiments because a short time after, he was embroiled in a debate with the "skeptic" Robert Park. Advocating for J. Benveniste and his work, B. Josephson went perhaps a bit too far by proposing a public demonstration of the new results of J. Benveniste. *Time Magazine* echoed these exchanges:

> "Nobel laureate Brian Josephson was incensed. He had just read a column by physicist Robert Park poking fun at the work of a French biologist who maintains that the benefits of homeopathic medicine can be transmitted electronically. Josephson, who since winning the 1973 Nobel Prize for Physics has developed an interest in fringe sciences, fired off an e-mail challenge to Park, who promptly responded. Their exchange could lead to the first rigorous test of one of the world's most widely practiced alternative therapies." [6]

What would be this test?:

> "In his challenge, Josephson suggested a randomized double-blind test. Park, a longtime critic of homeopathy, was delighted to accept and is now close to agreeing with Josephson on a protocol. In one proposal, samples of water, some of which have been given the Benveniste treatment, would be examined by the biologist himself, who would then attempt to identify which, if any, had been rendered homeopathic (*sic*)."

J. Benveniste and D. Guillonnet confirmed these exchanges in one of Digibio's newsletters of 1999:

> "Further to an abundant correspondence between Brian Josephson, the physicist Robert Park and ourselves, the American Society of Physics (APS) expressed its interest to participate in the demonstration of a specific biological effect of a recorded signal."

But J. Benveniste was hardly favorable to this confrontation which was decided by others, even if one of them is a faithful support, furthermore a Nobel prize laureate:

> "Yet Benveniste seems hesitant. Some "variables," as he puts it, including financing, remain to be discussed. Until now, neither the effectiveness nor the putative mechanism of homeopathy has ever been subjected to what nonbelievers would call a scientifically valid test. Indeed, the U.S. National Center for Complementary and Alternative Medicine, which has $ 50 million to spend this year for just this kind of trial, has yet to sponsor even preliminary tests. Now it may be upstaged by a laureate and a skeptic." [7]

Another "skeptic" was J. Randi who suggested putting his million dollar prize at stake, which was still available to those who would demonstrate a "paranormal" effect… or related to homeopathy (what did not seem very different to him). The first reason which made J. Benveniste seemed reluctant was that he was well placed to know the danger to experiment on a stage. Indeed, as B. Josephson wrote to J. Randi:

> "I can only urge both you and Dr. Park to be patient. Dr. Benveniste considers he is in a kind of situation wished upon him by the scientific community where 'extraordinary claims demand extraordinary evidence', and he is taking steps to provide that 'extraordinary evidence'. This, however, takes time and, as I say, one must be patient.
>
> I must also make it clear that the idea of some official test such as one under the auspices of the APS was always my idea and not his, and he has always made his preference for going instead along the conventional scientific path involving submitting the evidence to a referred scientific journal clear. Given the way a past editor of Nature exploited his editorial privilege to publish a seriously flawed (on scientific grounds) denunciation of his experimental work, this rather negative attitude to 'investigations' can perhaps be understood." [8]

Another reason of these hesitations during this period when Randi continued to propose putting his pot of money at stake, was that J. Benveniste was in front of a new "miracle". After the "contaminated serum", "wild transfers" and "inversions", this was now a new challenge which was as unexpected and disturbing that J. Benveniste was once again confronted to: the "eraser effect".

Notes of end of chapter

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[1] B. Josephson. Molecular memory. *The Independent*, March 22nd, 1999.

[2] L. Milgrom. The memory of molecules. *The Independent*, March 19th, 1999.

[3] B. Josephson. Forword to "Ma vérité sur la mémoire de l'eau" of J. Benveniste, p. 8.

[4] Plasma coagulation is very sensitive to calcium concentration. Therefore, each experiment was preceded by a pre-experiment intended to determine the optimal calcium concentration. In the present case, the experiment had been performed with two concentrations of calcium chloride: 5.5 and 6 mmol/L. In order to simplify, we have shown only the experiments made with 6 mmol/L; the experiments with 5.5 mmol/L led to the same conclusions.

[5] B. Josephson. *Ibid.*

[6] L. Jaroff. Homeopathic E-Mail; Can the "memory" of molecules be transmitted via the Internet? *Time magazine*, US edition, May 17th, 1999 p. 77.

[7] L. Jaroff. *Ibid.*

[8] E-mail of B. Josephson to J. Randi of August 11th, 2000.