

CONCLUDING REMARKS

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I must begin these concluding remarks by paying tribute to Robert Naquet who passed away last December. He had accepted to open and conclude this meeting. He was a good clinician and a good scientist. Among his personal qualities, his sense of humour was widely appreciated. He was a very old friend of mine. I will remember.

I wish to express my most sincere appreciation to Jacques Durand who has organized this meeting with the support of the scientific and organizing committees. I am deeply honoured and grateful. Jacques was my student many years ago. The most important for him was the fun he had in doing experiments. He was not a careerist but a generous friend with his colleagues. When Jacques asked me whether I was ready to participate to this special meeting, I put only one condition: the invitations must be based first upon friendship and not on a specific topic in neurobiology. Thus our selection of contributors was guided somewhat by the desire for meeting friends again and hearing about their progress on all fronts. A tentative program was set-up and twenty contributors were invited, twenty accepted and provided us with the best neuroscience today. I want express my gratitude to each of you for your contributions to this conference. I must say that I am really impressed by the quality of your presentations and your professionalism.

Thank to Cesira Batini, the formal presentations will be published in the renowned journal "Archives italiennes de Biologie". I must express my thanks to Dr. O. Pompeiano who is the Editor of the Journal and who has accepted to publish this conference.

I am not competent to discuss your contributions in details in fifteen minutes. Have you realized that we go from insect to fish, lobster, mouse, rat, cat to human brain... from *in vivo* to *in vitro* experiments, from synaptic boutons, single neurons to networks and assemblies of networks, often combining a variety of experimental approaches with models? I cannot conclude because you have opened more doors for the future than closing a chapter.

Let me just tell you some over-all impressions and make a few comments.

FIRST ABOUT THE SPEAKERS !

Because of our biased selection of the speakers, there is no unity in your presentations. However, I can characterize all of you by the way you make your research. I met some of you a long time ago, some other more recently. You all have in common qualities which make the good scientists:

You were ready to listen us speculate beyond available facts;

You were ready to discuss and reconsider traditional viewpoints;
 You were ready to hear us propose new hypothesis;
 You were generous in helping us in learning new techniques, in implementing new set-ups, in training our students;
 You had open-minds;
 You were rigorous, exigent and simply honest.
 For all these qualities which are not anymore so common in our scientific community, I respect you.

MY SECOND COMMENT CONCERNS THE NEED FOR NEW CONCEPTS

When we discussed with Cesira to prepare a short history of these last fifty years, I red again old symposiums about “Brain Mechanisms and Consciousness” (1954), “Reticular Formation of the Brain” (1957), “Brain Mechanisms and Learning” (1961)”. I had forgotten their tremendous intellectual powers. I was extremely surprised by the length of the papers and the vivid discussions that followed had the same length than the papers. They were often violent with scientific arguments but never aggressive. Hypothesis were suggested, ideas were debated and took a large place as investigative tools and results were lacking. These great scientists, Magoun, Moruzzi, Jasper, Eccles, Grey-Walter, Penfield and many other were passionate, provocative and, which is more, took their time to have fun. They were humble and conscious of our ignorance as stated by Adrian in 1954: “at present we are in a lamentable state of ignorance about where these potentials are being produced” (speaking of EEG).

Nowadays, the way to do Science has changed. “L’air du temps” is not humility but a triumphantly mood. Neurosciences are even imperialist with a dominating idea that it will explain the universe. I went to read recent articles and books about these new fashionable fields of neuroscience such as “neurophilosophy” or “neuroeconomy”. I was hoping to find out new concepts about consciousness and the human brain which will change my rather dated views. I am sorry to say that I did not find new conceptual advances but only messages that can be summarized by one sentence: “any human behaviour such as consciousness, social activities, and even economy and finance needs a working brain”! This is the basic new but short message. This is all hot air as far as I am concerned.

Fortunately these new fields invented by well-known neuroscientists are a minority and the wide range of your contributions with a variety of new approaches demonstrates successful achievements. If I had to find a common feature to your work, I will stress your methodical attitude. What I mean is that whatever the object of your research and whatever the level of organization you are working on, you all dissect the problems. From the molecule to the whole brain, you all must accept to reduce the complexity. Often during these two days, many of you have raised the question as to decide which degree of complexity is relevant for our understanding of brain mechanisms. As nobody has the answer, the good attitude is not to reject any option. May be we can have a wish: one day a visionary man like Ramòn y Cajal will tell how to put all these complexities together and make a sense of our brain.

SOME COMMENTS ABOUT THE FUNCTION OF THE DENDRITES

I remember vividly my first meeting with Hsiang-tung Chang in Cuba in 1965. He explained with great patience to the young student that I was his concept of the dendritic function. He explained that the soma of pyramidal cells was a link for reflex activities while the apical dendrites were the site of complex processing, integrations, memory and even intelligence. I never have forgotten his provocative views. Since, tremendous progress with new tools have destroyed the dogma that dendritic distances were too long and tenuous for distally located synapses to have any effect on the soma. Dendrites are active devices but however much remains to be known about their function.

During the last decades the amount of investigative work in this area produced an enormous body of data in terms of characterization of channels, receptors, synapses. It has been a time for data accumulation and we are now a little like the astronomers were 15 years ago when the Hubble telescope delivered unprecedented images to the earth. They were submerged by huge quantity of data and realized that a dedicated collaboration between scientists, engineers, contractors, and institutions from all over the world was mandatory. Neurobiologists face the same problem with the development of sharing all sorts of databases. Grey-Walter in the fifties expressed already the wish that "some day we shall feel the need for a world brain reference library".

I wonder whether we have not exhausted the methodologies available with the micro-electrodes of the electrophysiologists. New hypothesis and new concepts will come with new tools. I strongly believe in the combination of different biophysical, molecular, chemical, computing tools which will impose new hypothesis and new concepts.

You can imagine my pleasure in reading a paper published in *Journal of Neuroscience* in February 2006 imaging single neurons in culture with voltage-sensitive dyes. It confirms that our recent imaging approach published in 1995 and 2001 will be followed by others laboratories and will bring hopefully new unexpected questions about the neuronal signal and its processing.

Now I wish to let you go with one question! Let's imagine that we are in the fifties and the microelectrode is not and will not be invented. Meanwhile some chemist implements new molecules that are good sensors which react to variations in voltages. Add a biologist who has the idea to stain neurons with these sensors and a physicist who develops a camera to look at the stained neuronal membrane in live neurons. Fifty years later, what is our current concept of an operating neuron? I am waiting for your answer by e-mail!