Donatella Contini

“I began studying the vestibular system during my dissertation research at the Università di Pavia with Professors Ivo Prigioni and GianCarlo Russo. I had two postdoctoral fellowships, first at the University of Rochester with Professor Christopher Holt and then at the University of Illinois at Chicago with Professors Jonathan Art and Jay Goldberg.

My research focuses on characterizing the biophysics of synaptic transmission between hair cells and primary afferents in the vestibular system. For many years an outstanding question in vestibular physiology was how the transduction current in the type I hair cell was sufficient, in the face of large conductances on at rest, to depolarize it to potentials necessary for conventional synaptic transmission with its unique afferent calyx.

In collaboration with Dr. Art, I overcame the technical challenges of simultaneously recording from type I hair cells and their enveloping calyx afferent to investigate this question. I was able to show that with depolarization of either hair cell or afferent, potassium ions accumulating in the cleft depolarize the synaptic partner. Conclusions from these studies are that due to the extended apposition between type I hair cell and its afferent, there are three modes of communication across the synapse. The slowest mode of transmission reflects the dynamic changes in potassium ion concentration in the cleft which follow the integral of the ongoing hair cell transduction current. The intermediate mode of transmission is indirectly a result of this potassium elevation which serves as the mechanism by which the hair cell potential is depolarized to levels necessary for calcium influx and the vesicle fusion typical of glutamatergic quanta. This increase in potassium concentration also depolarizes the afferent to potentials that allow the quantal EPSPs to trigger action potentials. The third and most rapid mode of transmission like the slow mode of transmission is bidirectional, and a current flowing out of either hair cell or afferent into the synaptic cleft will divide between a fraction flowing out into the bath, and a fraction flowing across the cleft into its synaptic partner.

The technical achievement of the dual electrode approach has enabled us to identify new facets of vestibular end organ synaptic physiology that in turn raise new questions and challenges for our field. I look forward with great excitement to the next chapter in my scientific story.”