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Sommario/riassunto	<p>During the last decades, investigations on the olivo-cerebellar system have attained a high level of sophistication, which led to redefinitions of several structural and functional properties of neurons, synapses, connections and circuits. Research has expanded and deepened in so many directions and so many theories and models have been proposed that an ensemble review of the matter is now needed. Yet, hot topics remain open and scientific discussion is very lively at several fronts. One major question, here as well as in other major brain circuits, is how single neurons and synaptic properties emerge at the network level and contribute to behavioural regulation via neuronal plasticity. Other major aspects that this Research Topic covers and discusses include the development and circuit organization of the olivo-cerebellar network, the established and recent theories of learning and motor control, and the emerging role of the cerebellum in cognitive processing. By touching on such varied and encompassing subjects, this Frontiers Special Topic aims to highlight the state of the art and stimulate future research. We hope that this unique collection of high-quality articles from experts in the field will provide scientists with a powerful basis of knowledge and inspiration to enucleate the major issues deserving further attention.</p>