The inner magnetosphere of the Earth is home to a bewildering variety of natural plasma waves that can transport energy between different populations of particles, different species, and different regions of space. An important outcome of these waves is the creation of the high-energy Van Allen radiation belts, whose dynamic behaviour has been surprisingly difficult to explain and predict. In this talk I will review the state of the art in our understanding of wave-particle interactions in the inner magnetosphere, in its various manifestations. Topics covered include wave-particle interactions in the context of (i) wave excitation for some of the leading waves involved in radiation-belt dynamics (chorus, EMIC, and magnetosonic waves), (ii) wave propagation and redistribution of energy from its source region throughout the inner magnetosphere, (iii) wave-particle interactions between waves and high-energy particles, including some recent progress in modelling linear, non-linear, and non-resonant effects, and (iv) wave-particle interactions in the context of global modelling efforts. I will conclude with an overview of some of the missions slated for launch beginning in 2012, their focus, capabilities, and some of the fundamental physical issues that they will resolve in the coming decade of radiation belt research.