Salinity regulation of paracellular transport in fish gill

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During the last decade, progress in bioinformatics and genomics has lead to recognition of a series of tight junction proteins of the claudin family not only in mammals but also in a series of fish species. These proteins are the main determinant of the paracellular permeability in all epithelia and their regulation in fishes appears to play key roles during development of e.g. the otolith, blood-brain barrier and oocyte. In osmoregulatory tissues, they are in many cases regulated in response to environmental salinity and this may explain changes in ionic permeabilities of these epithelia. The more than 50 claudin isoforms found in teleosts pose a challenge to the targeting of isoforms to study but significant advances have been made in recent years. These have especially been made using euryhaline fish species that are able to acclimate to a range of salinities and thus serve as important models for examining the molecular and cellular plasticity in epithelia. While both the capacity for specific transcellular ion-transport and the paracellular permeability contribute to the general transport characteristics found in osmoregulatory epithelia only the former has been examined extensively. Therefore, the ongoing research on tight junction proteins has a great potential to lead to major advances in our understanding of osmoregulation in general. In this presentation, the biology of tight junctions in the context of fish gill physiology is discussed and future directions of research on the paracellular path are proposed.