Clinical epigenetics: seizing opportunities for translation

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Management of chemical exchange across cellular membranes is critical to ensure access to nutrients, riddance of waste and safeguarding integrity and identity of the concerned biological (sub-)system (organelle, cell, organ, organism). Dedicated proteins are involved in the import of most chemical matter and expressed only when/where required, for energetic reasons, chemical safety and cellular homeostasis. Expression of particular membrane transporters repertoires should thus reflect demand-and-offer rules, integrating the metabolic aspiration of the systems with environmental availability. Regulation of the expression and function of solute carriers proteins (SLCs), the largest group of transporters in the human genome, should control cell metabolism and any process depending on it. If we were to know the transport specificity and function of most SLCs, their dynamic expression pattern could act as proxy for the metabolic state of the associated cell/tissue. We have started to systematically chart SLC function by genetics, proteomics and chemical biology. We find that SLCs modulate a large variety of cellular processes: such as metabolism, signalling, chromatin states, specific immune cell functions. We have systematically mapped the SLC genetic interaction map as well as a large survey of SLC-drug dependencies. We have also developed chemical tools allowing for the efficient regulation of individual SLCs. Altogether, these studies herald an age in which the interface between chemistry and biology can be studied, understood and modulated with unprecedented precision.