

# **Systems Medicine Disease Maps: the roadmap for integrated representation of disease mechanisms**

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Despite the availability of various network-based approaches, tools for disease-specific functional analysis require farther developments to allow systematic data interpretation and hypothesis generation. The Systems Medicine Disease Maps Project is a large-scale community effort to comprehensively and systematically represent a range of disease mechanisms (<http://disease-maps.org>). It is a network of scientific and clinical groups that exchanges best practices, shares information, develops systems biomedicine tools. The aim is to provide to biomedical community highly curated and user-friendly platform for disease-related molecular network maps and for data interpretation towards clinical decision support systems (CDSS). Primary focus of disease maps is generation of interconnected signalling, metabolic and gene regulatory network maps represented in standard formats. The involvement of domain experts ensures that the biocuration process is comprehensive, the key disease hallmarks are covered and relevant knowledge is adequately represented. Number of milestones for Disease Maps Project and the current solutions are discussed, that includes creating and maintaining disease maps in common standards; sharing sub-parts of the disease maps implemented into many human disease mechanisms using exchangeable modules approach; providing technical solutions for maps complexity management; and web-tools for map exploration. In translational medicine projects, disease maps are used for advanced omics data interpretation and hypothesis generation, or for predictive analysis as the basis for mathematical models. We describe our experience on developing disease maps and provide examples for Parkinson's disease, asthma and Atlas of Cancer signalling network (ACSN), and demonstrate how these resources can be used for modelling, data visualisation and interpretation. The strategy of Disease Maps Project will facilitate systems medicine for understanding disease mechanisms, cross-disease comparison, finding disease comorbidities, suggesting drug repositioning, generating new hypotheses.