MR connectomics is an emerging framework in neuroscience coming from the successful combination of diffusion MRI and whole brain tractography on one side and complex network analysis on the other side. In the present work we review the current methods enabling structural connectivity mapping with MRI and show how such data can be used to infer new information of both brain structure and function. We also list the technical challenges that should be addressed in the future to achieve high resolution maps of structural connectivity. From the resulting tremendous amount of data that is going to be accumulated soon, we discuss what new challenges must be tackled in terms of methods for advanced network analysis and visualization, as well data organization and distribution. This new framework is well suited to investigate key questions on brain complexity and we try to foresee what fields will most benefit from these approaches.