

Statement of Interest for a Network of Excellence

NMR in Structural Genomics and Structural Proteomics

NMR has established itself as an invaluable tool in the investigation of the structure and dynamics of biomolecules. In the post-genomic era, the contributions of NMR to the fields of Structural Genomics and Structural Proteomics will only continue to increase as weak biomolecular interactions are increasingly recognized as central to the biochemical processes of Life, as these weak interactions are best captured with NMR. Decades of work by talented individuals and collaborative teams have allowed Europe to boast both human and infrastructure capitals in NMR that are second to none.

Although NMR has contributed extensively to Structural Biology, it was felt that interactions between top-level laboratories with complementary expertise was limited. For this reason, the EC FP6 funded Coordination Action NMR-Life was created to promote the networking and coordination of NMR research in Structural Genomics. The activities of NMR-Life were developed to achieve five main goals: a) to foster cross-fertilization among the four scientific areas on which the project focuses (i.e. protein-protein interactions, protein-DNA/RNA interactions, protein-ligand interactions, and membrane and immobilized proteins), b) contribute to the development and dissemination of common good practices and methodological approaches, c) foster the transfer of knowledge among different research teams, thereby enhancing the spread of innovative methods and tools, d) implement a common reference point for the European NMR community by maintaining a common virtual on-line laboratory, and e) jointly identify bottlenecks and possible breakthroughs in biological NMR. The efforts to provide a platform for exchange among European researchers spearheaded by the CA have been successful. Given the development of Structural Proteomics towards Systems Biology, it is evident that new experimental approaches such as in-cell NMR, solid-state NMR on native-like membrane samples, dynamic nuclear polarization, and paramagnetic highlighting of transient interactions, among others, will open new avenues for obtaining biological information, in particular of samples or systems that are not yet accessible by other techniques. We believe that a Network of Excellence for NMR in Structural Proteomics is the appropriate next step to further strengthen European NMR research on the international stage.

The funding of an NOE would provide support for the advancement of both technology and methodology through collaborative efforts. NMR is becoming more and more successful in structure determination and in dynamic characterization of biomolecules, but the NMR community, and those working in the field of Fundamental Genomics in general, have stimulating challenges to address in the near future. Namely, the unraveling of biological processes in a complex network of weak transient interactions that must be characterized at an atomic level but within a systems biology approach. Specifically, our efforts should be focused on the investigation of:

- a) protein-protein complexes to understand biochemical processes,
- b) protein-ligand interactions for drug discovery,
- c) protein-DNA/RNA interactions for expression and translation,
- d) metabolomics for the investigation of the metabolism in biological fluids,
- e) in cell/*in vivo* NMR to monitor *in vivo* processes,
- f) solid state NMR for the world of membrane proteins, and
- g) molecular imaging.

We want to pursue these objectives through an NOE by i) advancing knowledge in systems biology and investigational methodologies, ii) the exchange of personnel, iii) the exchange of good practices, and iv) the organization of dedicated meetings. The funding of an NOE would therefore

not only provide a venue for the transfer of knowledge and ideas, as undertaken by the CA, but would also provide support for the advancement of both technology and methodology through collaborative efforts. The coordination and joint advancement of research, along with enhanced training activities and the encouragement of academic-industrial collaboration are all important roles a Network of Excellence could play, helping Europe to maintain its position as the world leader in NMR.

Our successful experience with NMR-Life leads us to believe that the European Bio-NMR community can successfully take advantage of the opportunities an NOE would provide. We envision an NOE of approximately 12 partners, allowing for some growth in involvement from the current ten NMR-Life partners, while avoiding allowing ourselves to be hindered by an overly large membership. We are hopeful that a call for proposal for an NOE in Structural Genomics or Structural Proteomics will soon be available, and request that the European Commission consider the possibility of such an opportunity.