Breakout Discussion 6A:

Future Challenges and Barriers for NMR Science in the US

Discussion Leader: Jeff Hoch, UConn
Scribe: Mei Hong, MIT

Bottom Up
Challenges=Opportunities

- **Characterization of disordered proteins** in all their various manifestations: IDPs, IDRs, amyloid, liquid-liquid phase-separated states, and transient, low-population ("dark" or excited) states. (narrow (especially 1H) dispersion, low solubility). high B0, direct X-detection

- **Direct X-nucleus (13C, 15N) detection** for large and complex biomolecule studies. The sensitivity loss this necessarily entails requires the utmost sensitivity afforded by UHF. Optimal field strength appears to be 1.2 GHz. Low complexity sequences that are proline-rich. high B0, optimized coil configurations, cold preamps

- **Biomolecular Dynamics**. Higher magnetic fields enable relaxation studies to access new timescale regimes, additional sensitivity will enable characterization of lower-population transient states. (enzyme catalysis, coupled folding and binding, weak multivalent interactions, protein folding and unfolding, aggregation) high B0, high power-handling, low E-field cold probes

- **Complex carbohydrates, glycoproteins.** Plant and bacterial cell walls, heterogeneous systems. high B0

- **Your scientific driver here…** a multitude of other challenges high B0

Top Down
Overarching Challenges

- **Sensitivity/resolution**: limits for sensitivity and resolution intersect important problems from a range of fields – improvements in both expand the universe of applications

- **Focus arguments** on areas where NMR can make essential or unique contribution

- **Sustainable UHF-NMR** science:
  - ⋆ low or zero user fees
  - ⋆ travel support
  - ⋆ centralized application
  - ⋆ data handling/automation
  - ⋆ remote access
  - ⋆ hands-on support

- **Beyond the parameters of existing funding programs**
  - ⋆ New operating models for shared facilities
  - ⋆ Re-tooling large numbers of labs (x-nucleus direct detection; Agilent exit)

- **Translating prototype magnets into production magnets**
  - ⋆ Timelines for 1.2 GHz
  - ⋆ Beyond 1.2 GHz?