



## 2015 Science Writers Symposium Lab Tour: Nuclear Magnetic Resonance (NMR) Labs

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*Caption:  
Image of NMR  
spectrometer and  
magnets*

The word *spin* might make you think of someone trying to influence your opinion. But in physics, spin is an intrinsic property of some subatomic particles that make some nuclei act like small magnets. *That* kind of spin is key to a powerful technique—called nuclear magnetic resonance (NMR)—scientists use to study complex, biological products at the molecular level.

NMR uses a strong magnetic field and radio waves to trigger the release of electromagnetic energy from atoms with nuclei that have spin. Computers convert these data into contour plots that resemble topographic maps. We use these data to determine the locations of atoms in relation to each other in molecules. This enables us to create 3D models we can study using images we can rotate on a computer screen.

We are using NMR to study poly- and oligosaccharides (long and shorter chains of sugar molecules),<sup>1</sup> used as bacterial vaccines. Microbes need these molecules to cause disease; so we are studying how specific parts of these molecules trigger the production of the antibodies that attack them. Thus, we are figuring out the rules by which manufacturers must design polysaccharide vaccines to ensure they are safe and effective. The work will also help us evaluate these vaccines by using NMR to determine if the vaccines were developed according to these rules.

Using NMR, we found that polysialic acid (PSA) has the same structure whether free or as part of the pathogen,<sup>2</sup> but only the bound PSA triggers antibody production. Understanding why this is might help researchers develop vaccines. The new NMR facility at the White Oak campus can help us solve that puzzle.

The NMR spectrometers are stronger than previously used at FDA. Stronger magnets provide more precise data generated by NMR and thus more precise models.

CDER shares the new NMR spectrometer with the Center for Drug Evaluation and Research (CDER), which will use it for extremely sensitive assessments of the purity of heparin<sup>3</sup> and evaluation of protein therapeutics.<sup>4</sup>

This powerful magnetic molecular “microscope” is one way that FDA incorporates new technology into its regulatory science work to protect and promote the nation’s health.

**Questions?** Contact FDA’s Office of Media Affairs at 301-796-4540 or [fdaoma@fda.hhs.gov](mailto:fdaoma@fda.hhs.gov).

1. Battistel et al., *J. Am. Chem. Soc.* 2012, *134*, 10717-10720.
2. Azurmendi et al., *Proc. Natl. Acad. Sci.*, 2007, *104*(28), 11557-11561.
3. <http://www.fda.gov/drugs/guidancecomplianceregulatoryinformation/importsandexportscompliance/ucm255671.htm>
4. Kozłowski et al., *N. Engl. J. Med.*, 365, 385-388.