**Medical Physics 710 / BME 710 Due: Dec. 4th, 2018**

Journal Discussion 12, Quiz **Golman et al, 2006: Metabolic Imaging and Other Applications of**

**Hyperpolarized 13C1**

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**Due:** Dec 4th by the end of the day. Please turn in by hand, email, or submission to Canvas.

## Question 1. Briefly explain the differences between the DNP and PHIP methods of hyperpolarization with respect to the nuclei involved, time requirements, etc.. (3 points)

The DNP method is a general method and may be applied to all nuclei (H1, C13, N15, etc.) in virtually all molecules, while the PHIP method only can be used for polarization of C13 in a limited number of molecules. Basically, the PHIP method takes advantage of simpler equipment that the DNP method and can produce more than 20% polarization in a few seconds, while the DNP method requires 30-60 minutes to reach the same degree of polarization.

## Question 2: How does a paramagnetic contrast medium cause a change in signal? (2 points)

Paramagnetic contrast mediums (such as gadolinium) alter relaxation times of nuclei in surrounding tissues. More specifically, they cause a decrease in T1 times of tissues by indirectly facilitating relaxation in nearby hydrogen spins.

## Question 3: How is the contrast-to-noise ratio (signal over background) in C 13 different from proton imaging? (2 points)

When using hyperpolarized contrast mediums, the signal almost exclusively comes from the isotope you are interested in. This is because there is not a high abundance of fluorine, carbon, xenon inherently in the body. Thus there will be very limited background signal and the contrast-to-noise ratio will increase.

## Question 4: Briefly explain two clinical applications of C-13 imaging. (3 points)

C13 can be used to image vasculature and angiography. This is advantageous because of the relatively low background signal (used with projection imaging). In practice, this has been applied to the coronary arteries and renal arteries.

C13 has also been used to study perfusion. By injecting C13 into the coronary artery, one can obtain a qualitative map of perfusion. This can be used to show areas of low perfusion due to occlusion in vessels of the heart.