# Diffusion Tensor Imaging (DTI)

- DTI: Type of MRI exam, which highlights brain white matter (WM) i.e. axons / fibers.

- Known changes in gray matter (GM) from previous GW studies. Likely WM changes too, either because of or causing the GM changes.

- Study design: scan all subjects to gather DTI images (56 per scan). Then compute DTI parameters from these. Then compare these parameters between two groups of Seabees: A and B for statistical significance, i.e. differences not due to chance or errors in data gathering.


Perpendicular   Parallel
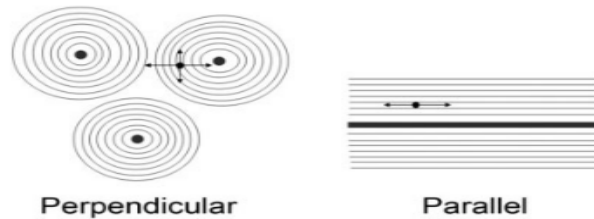
- We expect under conditions as shown above (model of normal WM) that diffusion is mostly parallel to WM fibers and not perpendicular to them due to myelin barriers (which repel water).

- We can obtain the mean, largest & smallest deviation (from mean) of the 3-D diffusion components (computed from the original images) and compare A vs B.

- Then we tabulate which, if any, are larger in A vs B or smaller in A vs B throughout the brain.

Group Comparison (p=0.05)

DTI Derived Type	WM Volume A<B (%)	WM Volume A>B (%)
Mean Diffusion	0.0	41.0
Parallel Diffusion	0.0	0.0
Perpendicular Diffusion	0.0	43.4
Diffusion Deviation	31.2	0.0

Explanation: A vs B

- Principal findings: In Group A, mean and perpendicular diffusion are increased, and diffusion deviation is decreased, in comparison to Group B, without changes to parallel diffusion.

- From the literature (primarily animal studies) these differences imply diffuse, subtle WM disease in group A consistent with demyelination rather than outright axonal destruction.

- Conclude that group A is originally identified Syndrome 2 and group B is normal control group.

Perpendicular   Parallel
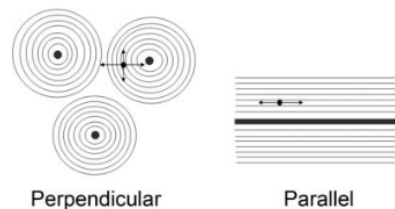
Importance

- De-myelination can be followed by re-myelination: probably not so for axon destruction.

- Important to continue to identify which process is predominant in ill veterans.

- May provide insight into the underlying damaging process, e.g., toxic agent, known symptoms of exposure, known WM damage profiles from established records.