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PROJECT SUMMARY/ABSTRACT
Rheumatoid arthritis (RA) is a chronic, progressive, systemic, inflammatory disease that primarily attacks peripheral joints and surrounding tendons and ligaments. This often very painful and debilitating disease affects approximately 1.3 million Americans, of which about 70% are women. 10% of affected subjects suffer total disability. Over the last decade there have been considerable advances in the treatment of rheumatoid arthritis (RA). The use of biologic agents that antagonize tumor necrosis factor (TNF) has resulted in decreased morbidity as well as clinically meaningful improvement in quality of life. Nevertheless, a considerable proportion of RA patients, ranging from 20% to 50% in clinical trials, failed to mount a robust clinical response to these agents. Given the very high cost and potential serious toxicities associated with TNF antagonists, identification of predictors of the response to TNF antagonist therapy would help to optimize the clinical management of RA patients.

Novel optical tomographic imaging (OTI) methods have been developed in recent years and are currently tested for various clinical application ranging from breast cancer imaging to imaging of brain activities. This novel technology promises to offer new insights into the various disease processes without the use of ionizing radiation at a relatively low cost. The group of Dr. Hielscher has recently shown that OTI is particularly sensitive to small changes in finger joints affected by RA. These changes manifest themselves in differences in the optical absorption and scattering coefficients inside these joints, which come about by changes in the optical properties of the synovial fluid as well as the vasculature surrounding the joints.

We hypothesize that optical tomographic imaging (OTI) methods will be able to detect changes occurring in arthritic joints that are treated with TNF antagonist within the first few months or even weeks of treatment initiation. Therefore, the specific aim of this revision application is to perform a longitudinal observational pilot study with 20 RA patients to identify optical imaging biomarkers that can be used to predict treatment outcome. In particular we expect that patients who respond to the treatment will show an increase in the variation of the scattering and absorption coefficient across the joint. In addition, both absorption and scattering coefficients will decrease. In patients for whom treatment response is not observed, no changes will be observed over the course of the treatment. A successful study would provide preliminary data for a more extensive grant application by a newly formed interdisciplinary team of NIAMS researchers.
