Heart disease is the number one cause of death in the United States, a total of 300,000 persons die annually. The disease costs the United States an estimated $35 billion dollars annually. Scientists studying atherosclerosis evaluate the quantity, distribution, composition, and morphology of plaques within the aortic arch to assess the efficacy of potential treatments. Researchers currently rely on viewing plaques in 2D, using techniques that are unable to fully quantify important volumetric characteristics of the plaque, such as thickness and percent occlusion.

**OSTEOARTHRITIS**

Rheumatoid arthritis (RA) is a chronic inflammatory disorder that most typically affects the small joints in the hands and feet. Unlike the wear-and-tear damage of osteoarthritis, rheumatoid arthritis affects the lining of your joints, causing a painful swelling that can eventually result in bone erosion and joint deformity. An autoimmune disorder, rheumatoid arthritis occurs when the immune system mistakenly attacks the body’s tissues. In addition to causing joint problems, rheumatoid arthritis can also affect the whole body with fevers and fatigue. RA is two to three times more common in women than in men and generally occurs between the ages of 40 and 60. RA currently affects 3 million Americans. Currently, the cause of RA is unknown and there is no known cure for this debilitating disease.

The number of deaths annually caused by cancer is over 500,000 or roughly one in four of all deaths. The total cost to the United States is $228 billion dollars each year. A major focus of both academic research groups and pharmaceutical companies deals with biochemically targeted treatment. Current methods provide some measure of qualitative assessment, but researchers need hard numbers to verify that treatments work as designed. Numira has developed tools to quantify the disease state of the bone, or roughness. This measurement has been adopted by numerous researchers in academia and the pharmaceutical industry.

**QUALITATIVE AND QUANTITATIVE VESSEL ANALYSIS**

The ability to quantify various vessel characteristics, including volume, surface area, diameter distributions, branching factors, and tortuosity, is a value to a large variety of researchers. The areas of research include kidney disease, lung fibrosis, and brain disease, but perhaps the greatest area of emphasis is in cancer research.

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**Numira Biosciences’ Commercial Applications of CIBC Software Tools**

Numira Biosciences is a Salt Lake City based Contract Research Organization (CRO) specializing in microCT small animal imaging. A typical Numira project includes the following stages: specimen preparation and staining, microCT scanning, and quantitative imaging data analysis. Numira makes extensive use of the CIBC software tools for processing and analyzing imaging data. Below we present results from several of Numira’s core applications and detail the central role played by CIBC’s Seg3D, SciRun, and Teem software packages in their production.

**RHEUMATOID ARTHRITIS – BONE SURFACE ROUGHNESS**

Rheumatoid arthritis (RA) is a chronic inflammatory disorder that most typically affects the small joints in the hands and feet. Unlike the wear-and-tear damage of osteoarthritis, rheumatoid arthritis affects the lining of your joints, causing a painful swelling that can eventually result in bone erosion and joint deformity. An autoimmune disorder, rheumatoid arthritis occurs when the immune system mistakenly attacks the body’s tissues. In addition to causing joint problems, rheumatoid arthritis can also affect the whole body with fevers and fatigue. RA is two to three times more common in women than in men and generally occurs between the ages of 40 and 60. RA currently affects 3 million Americans. Currently, the cause of RA is unknown and there is no known cure. One major result of RA in predilection models is the change in bone characteristics. Current methods provide some measure of qualitative assessment, but researchers need hard numbers to verify that treatments work as designed. Numira has developed tools to quantify the disease state of the bone, or roughness. This measurement has been adopted by numerous researchers in academia and the pharmaceutical industry.

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The number of deaths annually caused by cancer is over 500,000 or roughly one in four of all deaths. The total cost to the United States is $228 billion dollars each year. A major focus of both academic research groups and pharmaceutical companies deals with biochemically terminating the growth of new vasculature, or angiogenesis, within the tumor. Areas of research which are exploring anti-angiogenesis includes all major types of cancer including Breast cancer, Esophageal cancer, Kidney cancer, Leukemia, Liver cancer, Lymphoma, Melanoma, Non-small cell lung cancer (NSCLC), ovarian cancer and Prostate cancer.

There are several available compounds that can be perfused into animals which are radio-opaque and will appear on a microCT scan, thus making the vasculature stand out from the surrounding tissue. Numira has generated tools to quantify various vessel parameters to aid in this research, and continues to develop additional metrics to further advance this analysis.