



# JOINT CHIARI NEUROSURGICAL FELLOWSHIP



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## IMPORTANCE FOR CHIARI PATIENTS

Chiari malformation is a complex neuropathology that requires a multidisciplinary team of neurosurgeons and engineers to work together to make clinical impact and find a cure. In this project, we are developing the world's first Neurosurgical Chiari Fellowship training program. This program will help train future neurosurgeons to become leaders in Chiari treatment and accelerate the use of engineering analysis to standard of practice.

## INTRODUCTION

The pathophysiology of disorders of the cerebrospinal fluid (CSF) system such as Chiari malformation and syringomyelia is little understood. Approximately 1 in 1000 people is affected by one of these disorders that often have devastating neurologic impacts and pain. At the core, physicians and researchers agree that these disorders are mechanical in nature. Thus, an engineering analysis of the related systems and dynamics is considered to be a critical step that is needed to improve clinical care for patients. While many clinical studies have been undertaken to examine these disorders, little engineering analysis has been undertaken. In addition, it has become clear that a multidisciplinary approach is needed to solve complex craniospinal disorders. Clinicians, basic scientists and engineers simply cannot work alone in their respective labs as they have in the past. They must also learn to speak and understand each others languages so that research can have a clinical impact.

## METHODS

The Conquer Chiari Research Center (CCRC) in partnership with Chiari Care Center, Aurora, CO will partner to create the world's first Joint Chiari Fellowship (JCF); a 9 month intense neurosurgical training focused towards helping neurosurgeons become top experts in Chiari malformation treatment (See Table 1 for timeline).

The neurosurgical fellow will be selected based on qualifications and motivation towards Chiari specialization. After selection, the JCF will complete a 3-6 month rigorous clinical component at the Chiari Care Center at Aurora Medical Center under the direction of John Oro, M.D. and Chiari specialist. Following the clinical component, the JCF will complete a 3 month research component on campus at the CCRC at the University of Akron. During this time they will work alongside the CCRC's multidisciplinary team to complete engineering based analysis of subject specific surgical procedures. This analysis will include techniques such as 3D shape matching of pre and post surgical Chiari geometries (Figure 1). The JCF will be responsible for interpretation and publication of the results in leading medical journals. Emphasis will be placed on developing lasting collaboration with the team and applying the most advanced engineering techniques to clinical practice.



Figure 1. Chiari Care Center at Aurora Medical Center, CO.

Table 1. Project timeline for the Joint Chiari Fellowship program.

Neurosurgical component (3-6 months at Aurora Medical Center, CO)			Engineering component (3 Months at Conquer Chiari Research Center, Akron, OH)		
Month 1	Month 2	Month 3	Month 4	Month 5	Month 6
Pre-surgical measurements	Processing of pre surgery data	Post surgical measurements	Processing of post surgical data	Analysis of results	Presentation of results
	Milestone 1: present pre-surgical geometries		Milestone 2: present post-surgical geometries		Final presentation of results

## BUDGET AND EXPENSES

The JCF will receive a \$10,000 stipend and \$500 travel reimbursement. Lodging will not be covered. IRB fees, miscellaneous supplies and a computer workstation will be provided. CCRC will hire a project statistician for data analysis and provide salary support for Dr. Bryn Martin and Dr. Francis Loth's contribution to the project.

## EXPECTED RESULTS AND IMPACT

We expect the JCF program to produce world-class neurosurgeons with specific training and expertise in Chiari malformation and to enable these neurosurgeons to start a career-long research path in Chiari malformation that helps improve the standard of care for Chiari patients. The information exchange between the CCRC engineering team and the JCF will break down the barriers that hold back revolutionary treatment options for Chiari malformation. We expect to develop the JCF into a program with multiple neurosurgical fellows from around the world that return home to their respective countries and revolutionize Chiari treatment.

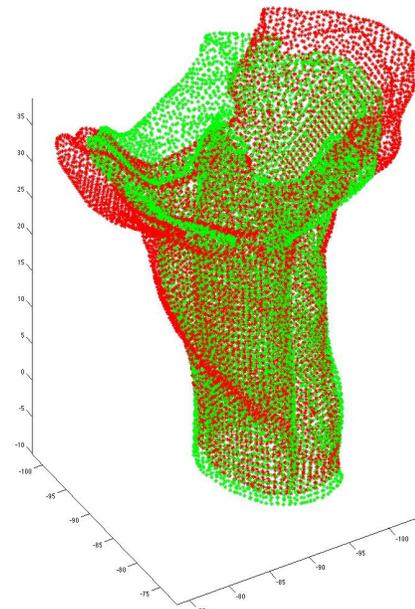


Figure 1. 3D shape matching of pre (green) and post (red) surgical Chiari geometries at the craniocervical junction. This technique is an example of how Chiari surgery can be analyzed with engineering tools to look at alterations in geometry with an extraordinary degree of detail.