Sep 25, 2017

Sophomore Biomedical Engineering Design Lab
107 W. Dean Keeton, C0800
Austin, TX 78715

Dear valued design engineers,

Two-One-Four Biomedical Company is seeking to retain the services of a biomedical engineering team to evaluate the blood flow in the carotid artery bifurcation. This contract shall have a term of 3 weeks, with the project report due the week of 10/16/2017. The contract amount award of 100 points toward your BME 214L grade shall be offered for successful completion of the project, paid upon submission and subsequent evaluation of the results.

Two-One-Four Biomedical is designing an endovascular stent to repair stenosis in the carotid artery bifurcation and are in need of blood flow simulation data to properly shape the bifurcation angle of the stent.

The design team is requesting that the biomedical engineering consultants evaluate a bifurcated stented blood vessel with a circular cross-sectional area under the following given conditions:

- 20 degree bifurcation (Figure 1A)
- 90 degree bifurcation (Figure 1B)
- Straight common carotid to internal carotid artery / 45 degree split to external carotid artery (Figure 1C)
- Straight common carotid to internal carotid artery / 70 degree split to external carotid artery (Figure 1D)

The simulation models do not have to exactly replicate the drawings given in Figure 1. The angles and inner diameter of the arteries is required as specified, but the transition from common carotid artery to branch arteries can be designed in any reasonable manner. Carotid artery flow conditions to be used are listed in Table 1.

Preliminary results shall be reported to Two-One-Four Biomedical in the form of a technical memorandum. All reports submitted before the due date will be evaluated by company representatives. The factors that will be considered in evaluation are:

1. A concise executive summary
2. Brief introduction which describes the purpose and scope of the bifurcation study
3. Evaluation of the requested bifurcation geometry using SOLIDWORKS flow simulation
4. Quality of figures demonstrating the results
5. Conclusions drawn from the data and recommendations for the bifurcated stent design

Evaluations will be conducted within established guidelines regarding equal employment opportunity and non-discrimination based upon grounds of race, color, religion, national origin, gender, sexual orientation, age, disability, or genetics.

We look forward to receiving your report.

Sincerely,

Dan Puperi, PhD
CEO and President,
Two-One-Four Biomedical

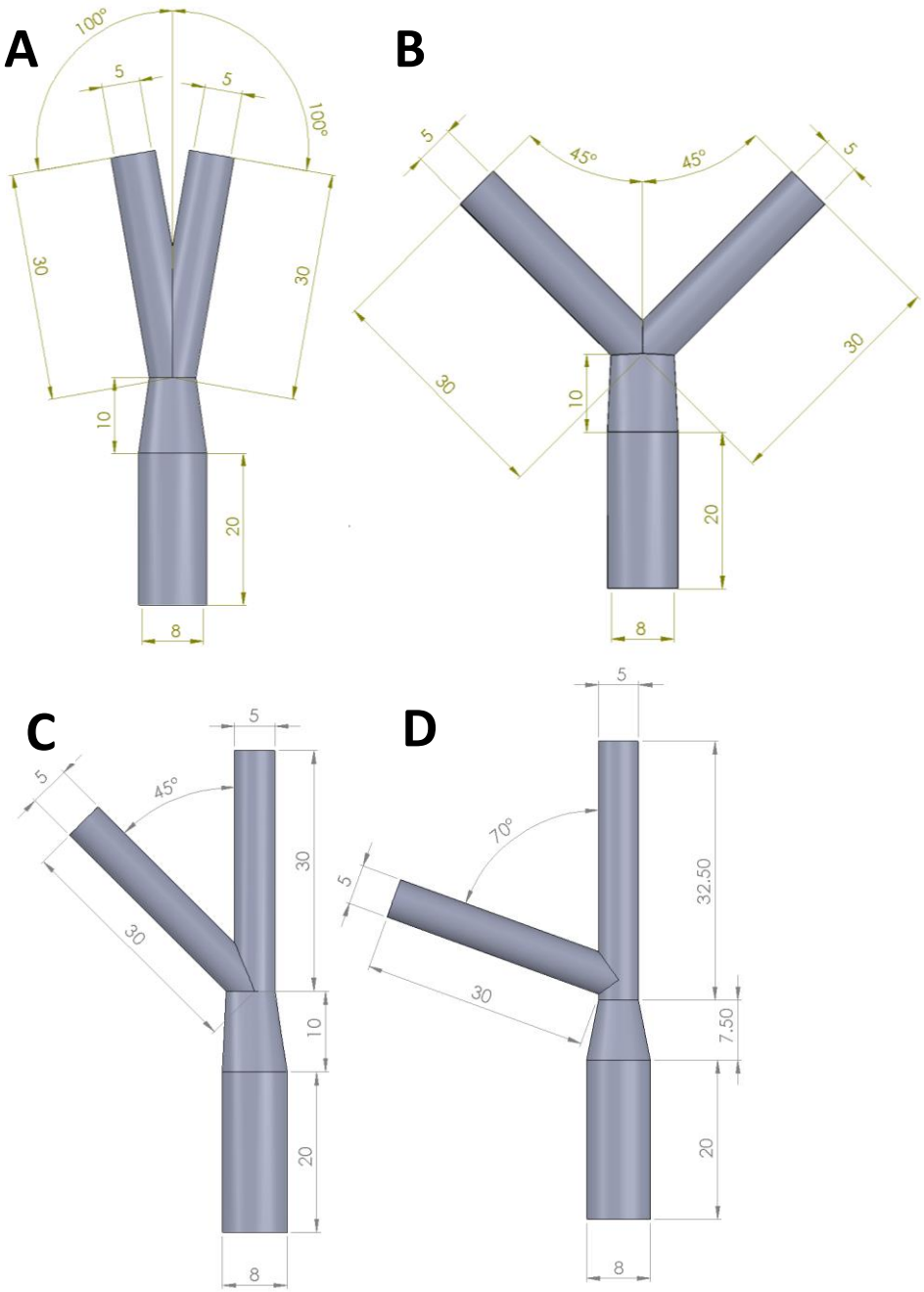

Figure 1: Carotid artery bifurcation geometry to be analzyed: (A) 20 degree equal bifurcation; (B) 90 degree equal bifurcation; (C) 45 degree external carotid artery bifurcation; (D) 70 degree external carotid artery bifurcation

Table 1: Carotid artery flow properties

Common carotid artery diameter	8 mm[1]
Internal carotid artery diameter	5 mm[1]
External carotid artery diameter	5 mm[1]
Flow rate into common carotid artery	320 ml/min[2]
Pressure at outlet of external and internal carotid arteries	70 mmHg
Carotid artery luminal surface roughness	10 μm[3]

References

1. Williams, M. A. & Nicolaides, A. N. Predicting the normal dimensions of the internal and external carotid arteries from the diameter of the common carotid. *Eur. J. Vasc. Surg.* **1,** 91–6 (1987).
2. Likittanasombut, P., Reynolds, P., Meads, D. & Tegeler, C. Volume flow rate of common carotid artery measured by Doppler method and Color Velocity Imaging Quantification (CVI-Q). *J. Neuroimaging* **16,** 34–8 (2006).
3. Kitamura, K., Hasegawa, H. & Kanai, H. Accurate Estimation of Carotid Luminal Surface Roughness Using Ultrasonic Radio-Frequency Echo. *Japapense J. Appl. Phys.* **51,** (2012).