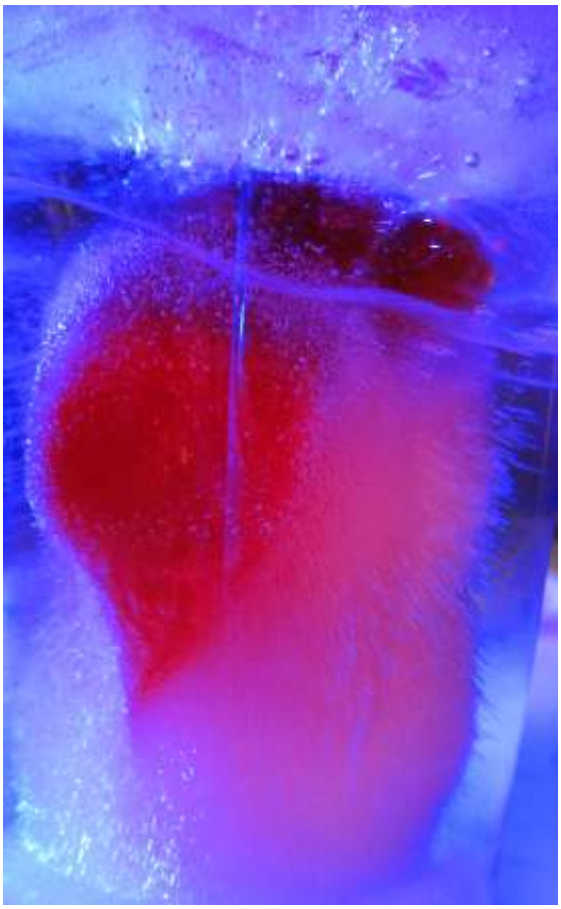
TEAM IMAGE # 1



Shane Schabow

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The image that I submitted for Team Assignment #1 was somewhat of an accident. My original intention was to capture the effects of super-cooling water. However, in our group's first iteration of attempting to produce super-cooled water, we managed to freeze all of our water samples. Some of these samples were tall shot glasses and 16oz glass filled with distilled water, and some filled with tap water. We had placed the assortment of glasses in a freezer set to -20ºC. The glasses had been allowed to cool for approx. one hour before they were inspected by members of the team. The 16 oz glasses were found to have a thin layer of ice on the surface of the water. The ice formation glass that eventually became the subject of my submitted image was removed from the freezer at the one hour mark. This glass contained clear, pure distilled water. The team members observed the thin layer of ice at the top surface of the water. It was decided to try introducing another solution into the distilled water. A glass of tap water, with red food dye mixed in, was poured into a hole in the ice at the center of the glass. It was observed that the dyed water did not disperse beyond the center region of the water in the glass. After the team members did not observe anything resembling the expected results of super-cooled water, the glasses were placed back in the freezer for an extended period of time. Once retrieved, all of the glasses were observed to have frozen solid. The resulting ice formation in the specific glass used for the selected photograph was one of the most interesting and perplexing ice crystal formations I have ever examined. My submitted image for this assignment appears on the cover page of this report.

The physical setup to capture this image was not complicated, and included only the glass with the crystallized ice formation, a plastic crate, and a lamp with a blue tinted bulb. The plastic crate was placed upside down on a table, with the glass placed on top of the crate bottom, and the lamp placed behind the glass to illuminate the ice crystal formation. The blue bulb provided by a member of the team helped to highlight the features of the ice formation, especially the bubbles present in the ice. I suspect these bubbles to be dissolved oxygen gas present in the tap water which was poured into the distilled water along with the red dye. The radial arrangement of the bubbles probably derives from the introduction location of the red dye tap water mixture. I suspect that the freezing process slowed and halted the diffusion of the red dye and oxygen bubbles into the distilled water present in the glass. Radial diffusion appears to be the reason for the positioning of the bubbles and their frozen streamlines in the ice formation. The red dye was introduced at the center of the very cold water in the glass, and was found to only dissipate a very limited amount in the confines of the glass. The dissipation of the dye was hampered by the decreased molecular activity in the increasingly cooling solution. The cold temperature stopped the diffusion of the dye-saturated tap water, and created the beautiful curved form in the center of the ice seen in the submitted photo.

This image was captured indoors on February 22, 2011 at 12:40pm MST, in the Durning Projects Laboratory at the University of Colorado, College of Engineering and Applied Science. The approximate field of view is 6 inches across by 10 inches high, with a distance from lens to

the glass of approximately 12 inches. The digital camera used is a Canon PowerShot SD 500, with an F-stop of f/2.8, image focal length of 7.7 mm, and shutter speed of 1/15 sec. Background lighting was provided by a commercial blue compact fluorescent light bulb, while the ambient/overhead lighting was provided by the fluorescent lights in the Durning Lab of the Mechanical Engineering Department. The flash was not used due to the ample lighting conditions provided by the aforementioned lamp setup. The original image's dimensions are 2304 x 3072 pixels, vs. the edited image's size of 1626 x 2643 pixels. Editing was completed using Adobe Photoshop CS5, and included cropping out the background and edges of the glass to eliminate light reflection, as well as enhancing both brightness and contrast to bring out the red and blue coloration in the ice formation. The original image is shown in Figure 1 on page 3.

I am generally pleased with this image, but would like have the ability to focus in on the details of the bubbles and radiating elements surrounding the core of red dye at the center of the ice formation. In order to attempt this experiment again with better focus I would need to have access to a DSLR camera, which will allow me complete control of focus and aperture settings.

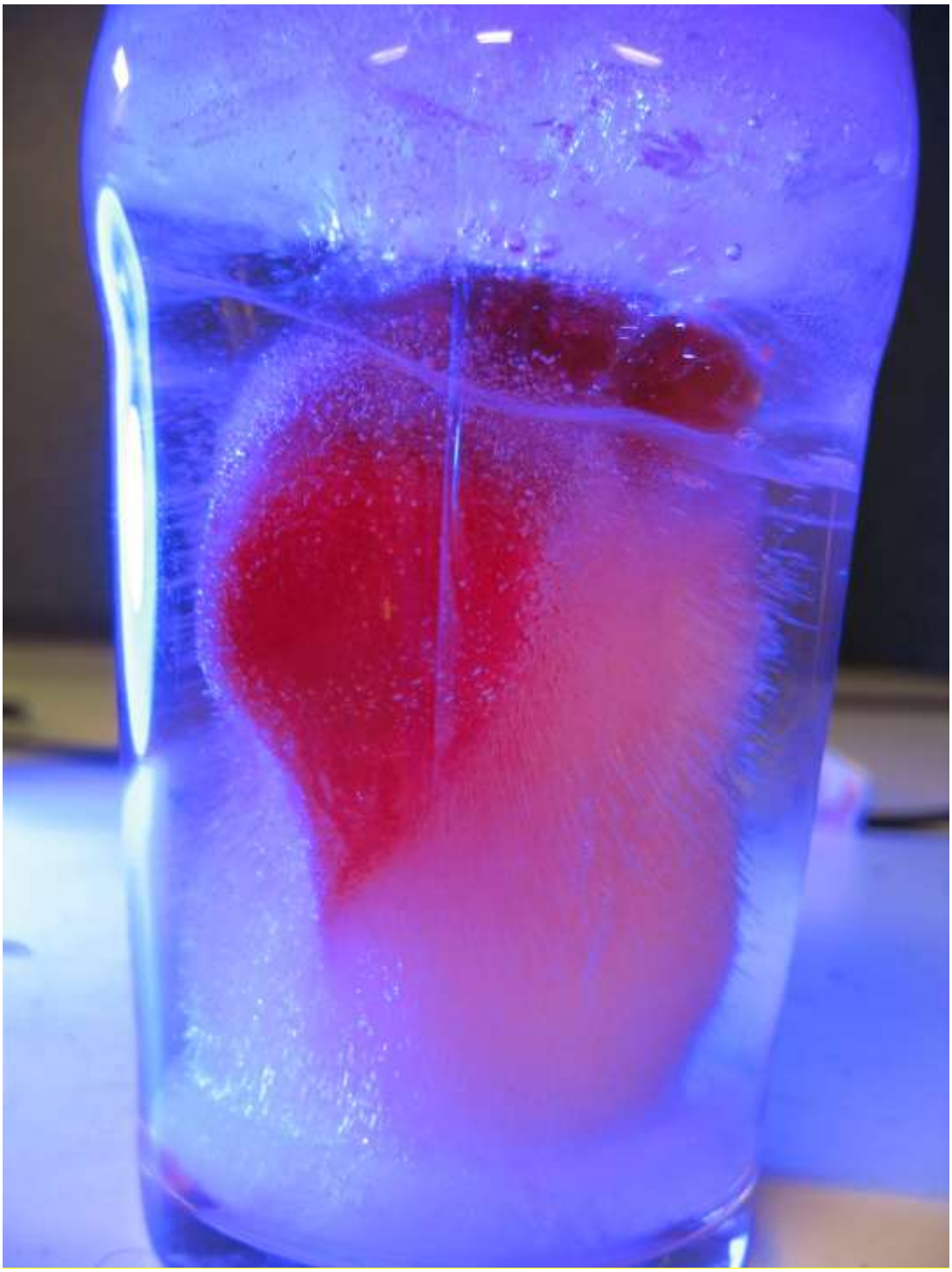

Figure 1: Original, unedited image taken on 22 Feb 2011.