INK-JET OLFACTOMETER

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Relevant to the field of bioengineering is the study of human and animal responses to odors. The devices used to deliver these odors are called olfactometers. In the past, the problem with these olfactometers has been their inaccurate computation of how much odor is being delivered to the subject.

Mark Lehmkuhle, a bioengineering graduate student with whom I worked closely this summer, hypothesized that using an ink-jet nozzle to deliver odor would solve this problem because of the extremely small and accurate droplet size. He further hypothesized that if we used a nozzle with sufficiently fast responses, the concentration of odor would not, if graphed over time, slowly rise and fall, like a bell curve, but would rise and fall quickly over time, looking like a rectangle. This rectangular shape would prove that the subject received a fixed concentration of odor over time. To test this, we machined an olfactometer out of Teflon and used the 1000 Hertz Direct Dispensing VHS-LT, with Integral Nozzle made by the Lee Company to deliver picoliter-sized droplets. Then we used a photo-ionization detector made by S + J Engineering, Inc. to graph the concentration of the odor. This fast-response photo-ionization detector detects and measures the presence of various ions.

The graphs from the photo-ionization-detector did produce a rectangular shape, leading us to conclude that the ink-jet nozzle will be a fairly accurate way to deliver odor in olfactometers in the future. However, there are still various problems with this product: first, the nozzle seems to have a problem with clogging. The Lee Company has suggested various remedies, including filtration of and more pressure on the odor being delivered. Secondly, although the graphs are rectangular, there are rather large differences in the graphs of the same parameters and the graphs in general are somewhat unpredictable. For example, opening the ink-jet nozzle for twice the amount of time does not produce a graph of twice the amplitude. Nevertheless, if these problems can be solved upon further research and testing, the ink-jet olfactometer will certainly prove useful to the bioengineering community.