

NDnano Undergraduate Research Fellowship (NURF) 2012 Project Summary

- 1) Student name: Shannon Huey
- 2) Faculty mentor name: Dr. Marya Lieberman
- 3) Project title: Inexpensive Paper-Based Tests for Determining the Quality of Pharmaceuticals

4) Briefly describe any new skills you acquired during your summer research:

I learned to use a Biomek 96-well-plate replicating robot.

5) Please briefly share a practical application/end use of your research:

Paper analytical devices (PADs) can be used to determine the quality of pharmaceuticals in areas where low-quality medicine is a problem. The tests are inexpensive and easy to use, and so can be run by someone without a chemistry background.

Project Summary:

Low quality pharmaceuticals contain little or no active pharmaceutical ingredient. These medicines do not help, and may even harm, those taking them. Paper analytical devices, or PADs (see Figure 1), are inexpensive, easy-to-use tests for both active pharmaceutical ingredients and excipients that may be found in low-quality pharmaceuticals. Each lane contains a test which produces a color depending on what is present in the pharmaceutical being analyzed. My project was to develop a test for antimalarial pharmaceuticals to be used on PADs.

I adapted a test for use on paper for the antimalarial pharmaceutical sulfadoxine. This test turns red in the presence of sulfadoxine (see Figure 2). This test has a sensitivity of 95.8% and a selectivity of 98.0%. I also worked on a cobalt thiocyanate for detecting amodiaquine and chloroquine, two other antimalarial pharmaceuticals. In the presence of amodiaquine, this test gives a green color, while in the presence of chloroquine it gives a bright blue color (see figure 3). For amodiaquine, this test has a sensitivity of 100%; for chloroquine, the sensitivity is also 100%. This test has a selectivity of 99.2%.

I also worked on the fabrication, testing, and analysis of β -lactam PADs. Using a Biomek 96-well-plate replicating robot to put reagents on the PADs, over 50 β -lactam PADs were fabricated. These PADs were run with both active pharmaceuticals and excipients. Following the testing, the tests on these PADs were looked at to determine sensitivity and selectivity. I also analyzed the PADs run by Dr. Marya Lieberman and Gail Weaver in Kenya, June 2012, looking at each of the lanes individually and at the results of each PAD as a whole. The β -lactam PADs have been included in a patent application, which I helped to write sections of.

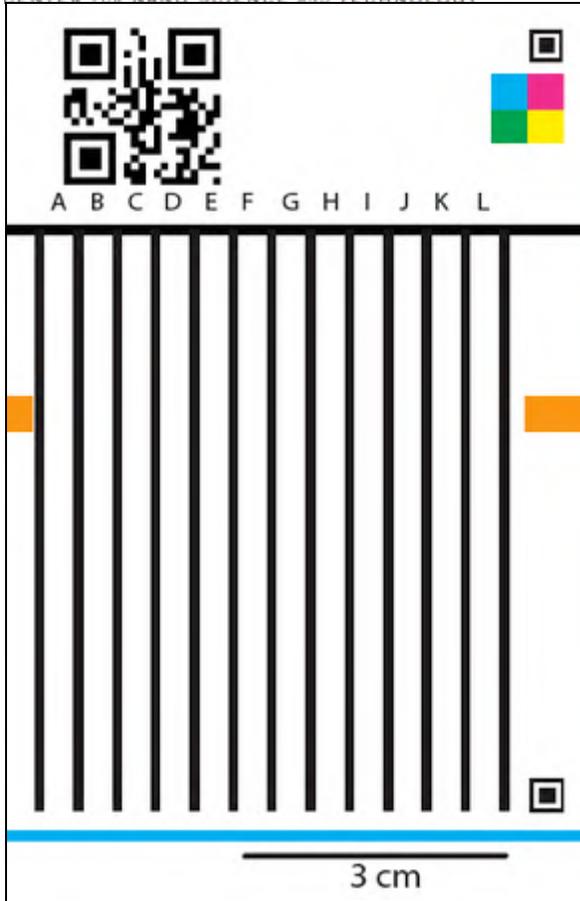


Figure 1. Design of a 12-lane PAD.



Figure 2. Sulfadoxine test positive result, left. Sulfadoxine test negative result, right.



Figure 3. Cobalt Thiocyanate test positive result for amodiaquine, left; positive result for chloroquine, center; negative result, right.

Publications (papers/posters/presentations):

An oral presentation, *Inexpensive Paper-Based Tests for Determining the Quality of Pharmaceuticals*, was given at the 2012 Undergraduate Research Summer Symposium at the University of Notre Dame on August 3, 2012.