



Protein Array Fabrication with E-jet Printing

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We demonstrate the feasibility of fabricate biosensors with direct protein printing without complicated processes at high resolution and area coverage. Printed single protein, streptavidin-fluorescein, binds to biotin labeled with fluorescent DNA without denaturation; therefore a fluorescence microscope can detect the printed droplets as shown in Figure 7.1(a). The standard deviation of the spot size and spacing is 7.26 % and 0.693%, respectively. The e-jet printing is capable to print large area, e.g., one inch size. Half droplets of streptavidin-Cy5 are printed in 15 minutes (Figure 7.1(b)). Four-inch size printing is also available. Moreover, we have developed the multi-syringe head [1]. The head prints multiple inks by rotation. Even complicated patterns of multiple proteins (e.g., peacock shown in Figure 7.1(c)) can be printed. Printed primary antibodies can be detected under a fluorescence microscopy by incubating with fluorescently-labeled secondary antibodies [2]. These capabilities show that the e-jet printer with the multi-syringe head has feasibility to make protein chips to detect multiple proteins at lower cost than the conventional chips.

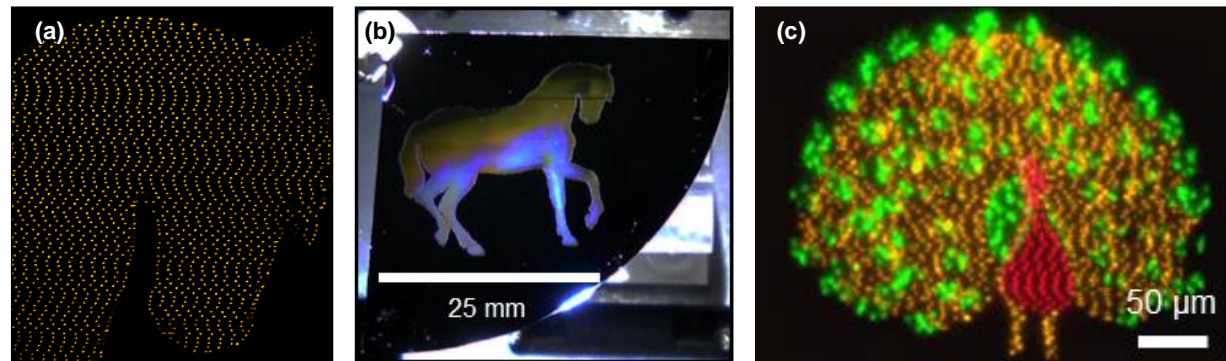


Figure 7.3: (a) Horse pattern of streptavidin printed and incubated biotin-fluorescent DNA. (b) Large area printing of streptavidin-Cy5. (c) Three fluorescently labeled proteins printed with multi-nozzle head.

[1] E. Sutanto, K. Shigeta, Y. K. Kim, P. G. Graf, D. J. Hoelzle, K. L. Barton, A. G. Alleyne, P. M. Ferreira, and J. A. Rogers, "A multimaterial electrohydrodynamic jet (E-jet) printing system," *Journal of Micromechanics and Microengineering*, 22, 045008, 2012.

[2] K. Shigeta, Y. He, E. Sutanto, S. Kang, A.-P. Le, R. G. Nuzzo, A. G. Alleyne, P. M. Ferreira, Y. Lu, and J. A. Rogers, "Protein Patterns Formed by Electrohydrodynamic Jet Printing with Applications in Biosensing Assembly," in preparation.