Supplementary Information

Figure 1: Fluorescence micrographs of QD patterns with different ink compositions. -, +, ++ indicate the pattern quality. All patterns were written at 50% RH and using 10 s dwell time (if not mentioned otherwise) with a plasma cleaned M type DPN tip-array (B side). The scale bars equal 10 µm.

(a) Left - QD (590 nm) : cholesterol = 45 : 4 (volume ratio in µl, less bright dots)
(a) Right - QD (590 nm) : cholesterol = 15 : 2 (volume ratio in µL, brighter dots)
(b) QD (590 nm) : cholesterol : DOPC = 10 : 2 : 1
(c) QD (610 nm) : cholesterol : DOPC = 20 : 2 : 1 (60% RH, dwell time 20 s)
(d) QD (590 nm): cholesterol: DOPC = 15: 2 : 1

The ratio of the different admixtures plays an important role in terms of ink transfer. (a) The darker dots on the left hand side belong to a higher QD concentration. Only the carrier is transferred to the substrate, QD can hardly be found in the pattern. A lower QD ratio (right hand side) increases the transfer rate of the QDs to the substrate as the brighter fluorescence signal indicates. (c) A similar pattern quality, but smaller features, can be realized using larger QDs. (b, d) Examples for average and weak pattern quality with admixtures of DOPC.
Figure 2: Overlay of a bright field and fluorescence micrograph of a PPL stamp (top view). The brighter spots in the middle of the squares represent the QDs coating the PPL pens. A prior approach of the pens into a stamp pad coats the stamp. The stamp pad is an ink-coated silicon wafer.

Figure 3: (a) and (b) show the fluorescence images of the 5 x 5 dot patterns by PPL with 10 um spacing and 1 s dwell time with the ink-composition QD : cholesterol = 15 : 2 (volume ratio in µL).
Figure 4: AFM investigation of PPL features (QD: cholesterol = 10:1) (a) shows the tapping mode image (topography) of four dot patterns (distance between two dots is 40 µm). The feature heights range from 15-70 nm. The scale bar equals 10 µm. (b) shows the magnified image (topography) of one dot (top-left one). The feature heights in this area range from 5-25 nm. The scale bar equals 2.5 µm. (c) and (d) show the further magnified image of the same dot (topography and phase respectively). The scan size is 1µm in both the cases and the feature heights range from 2-15 nm. In the phase image two different contrasts are clearly visible, which correspond to two different materials present in the ink mixture – QDs and cholesterol. It seems that the QDs get agglomerated into spherical structures of diameter 20 nm (brighter regions) and these structures are surrounded by cholesterol (less bright regions). The scale bar equals 250 nm.

Figure 5: shows the stability of the QD patterns (QD: Cholesterol = 30 : 4 (volume ratio (µl))) under MCF7 cell culture condition. Micrographs are overlays of fluorescence image of red QDs and a dark field image to identify the cells. While imaging the samples with cells, PBS buffer solution was added to the sample surface in regular interval.