Electronic Supplementary Material (ESI) for Analytical Methods.
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Supporting Info:

Fluorescent polyelectrolyte for the visualization of fingermarks

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Experimental

Materials

Poly(allylamine hydrochloride), M_w= 58000, (3-aminopropyl)triethoxysilane (APTES), HCl and NaOH were obtained from Sigma-Aldrich and were used as obtained. 7-Fluoro-1-methylquinolinium iodide was synthesized as described in Reference 19a. Deionized water was obtained from a Millipore filter apparatus.

Analytical methods

Confocal microscopy glass slides were analysed using a confocal fluorescence microscope Zeiss LSM710 with a Fluar 2.5*0.12 M27 objective and a Lasos Ar laser exciting at 458 nm.

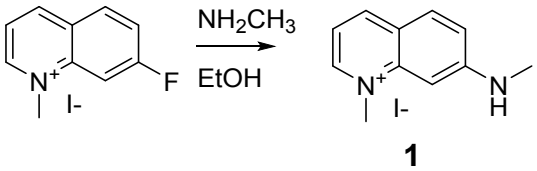
^{1}H and ^{13}C NMR spectra were taken with a Varian Mercury 400 in D_2O with the delay time (d1) set at 1 s. Chemical shifts are reported in ppm relative to 3-(trimetylsilyl)propionic-2,2,3,3-d4 acid, sodium salt.

UV-VIS measurements were performed on a Shimadzu spectrophotometer. The degree of functionalization x of **P1a-c** has been determined using a molar exctinction coefficient of ε(412)= 11500 for the quinolinium chromophore and an 80% degree of protonation for the dry polymer. Fluorescence measurements were taken on a SPEX Fluorolog 3 spectrophotometer. Fluorescence lifetime measurements were taken using an Edinburgh Instruments F900 Life Spec-ps instrument.

X-ray Photoelectron Spectrometry (XPS) spectra were obtained with a Thermo Scientific K-Alpha XPS instrument equipped with a monochromated Al-Kα X-ray source. XPS measurements were taken in normal emission with a spot size of 400 μm at a base pressure of 10^{-9} mbar. During all XPS measurements the flood gun was enabled to compensate for the potential charging of surfaces. For each sample a survey spectrum was obtained with a pass energy of 200 eV. Si2p, C1s, N1s, O1s, F1s region spectra were obtained using a pass energy of 50 eV. All spectra were averaged over 10 scans. The spectra were analysed using Avantage processing software. The XPS spectra were background corrected using the "Smart" base line function available in the software, and peak fitting was done using a Gaussian (70%)-Lorentzian (30%) convolution function. Two different samples have been studied: a glass slide dip-coated in an aqueous solution of **P1a** (10mg/ 50ml, 2 mM) and a glass slide as control. Glass slides were washed with a glass cleaner, rinsed with deionised H_2O and acetone and dried with air. A print was made on the plates and left to dry for an hour. The plates with fingerprints were immersed in solution for five minutes, rinsed with H_2O and dried with air. For each sample, the measurements were performed at three different spots, which all showed similar results.

Table S1. Absorption and emission wavelengths and fluorescence quantum yields and lifetimes of the fluorescent polymers **P1a-P1c** in water.

	P1a			**P1b**			**P1c**		
	pH = 3	pH = 7	pH = 9	pH = 3	pH = 7	pH = 9	pH = 3	pH = 7	pH = 9
λ_{Abs} (nm)	411	417	418	411	416	419	411	416	419
λ_{Em} (nm)	502	506	510	500	505	507	501	502	510
Φ_F	0.50	0.36	0.10	0.53	0.40	0.12	0.62	0.46	0.14
τ_F (ns) (rel area)		10.77(81.4) 4.25(15.6) 1.01(3.0)			10.87(80.8) 4.37(16.3) 1.07(2.9)			11.06(89.8) 2.68(10.2)	



Scheme S1. Synthesis of fluorescent compound **1**.

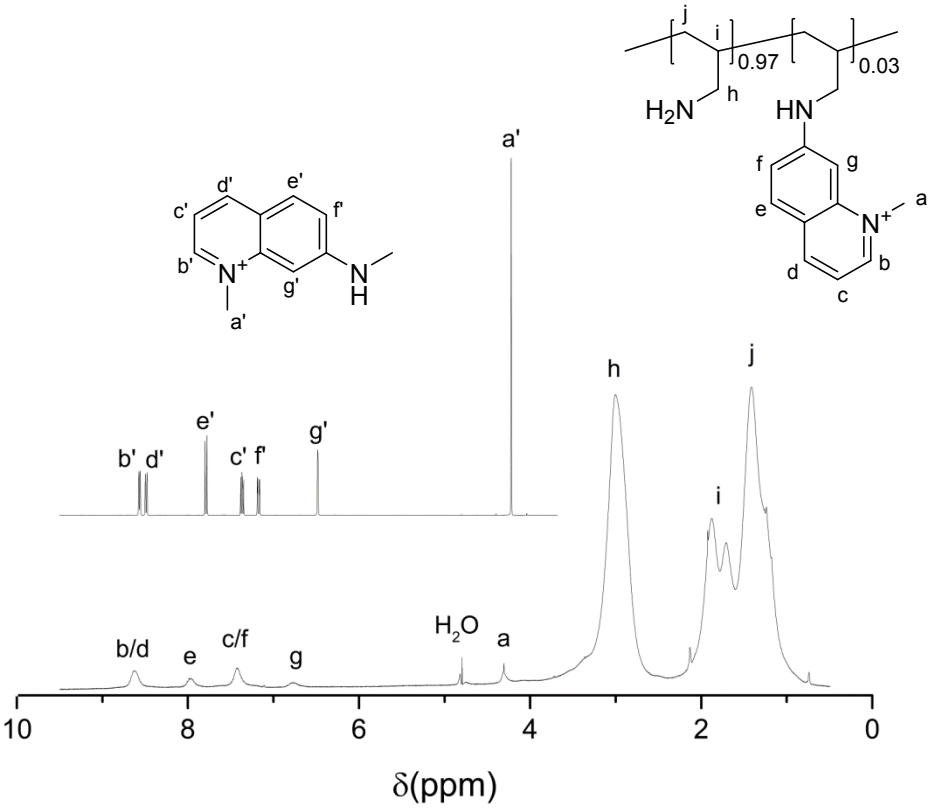


Figure S1. ^{1}H NMR spectrum of **P1a** in D_2O. The spectrum of **1** is shown in the inset of the figure for comparison.

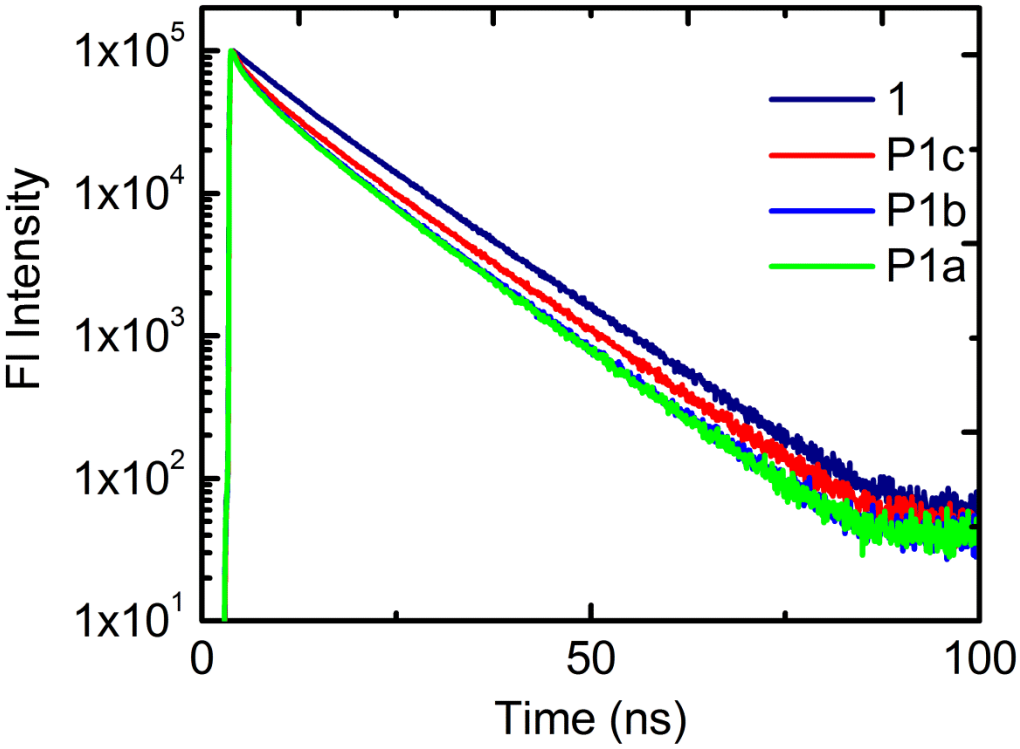


Figure S2. Fluorescence lifetimes measured for **1** and **P1a-P1c** in water. The excitation wavelength is 405 nm.

Figure S3. Fluorescence image of fingerprints stained by a 0.2 % mg/ml solution of P1a at pH 7. The left image shows a fresh fingerprint, the right one an "old" fingerprint that is three weeks old.

Figure S4. Fluorescence microscopy images of stained fingerprints on glass. The concentration of the dye **P1a**, from left to right: 0.02 mg/ml, 0.2 mg/ml, 2 mg/ml.

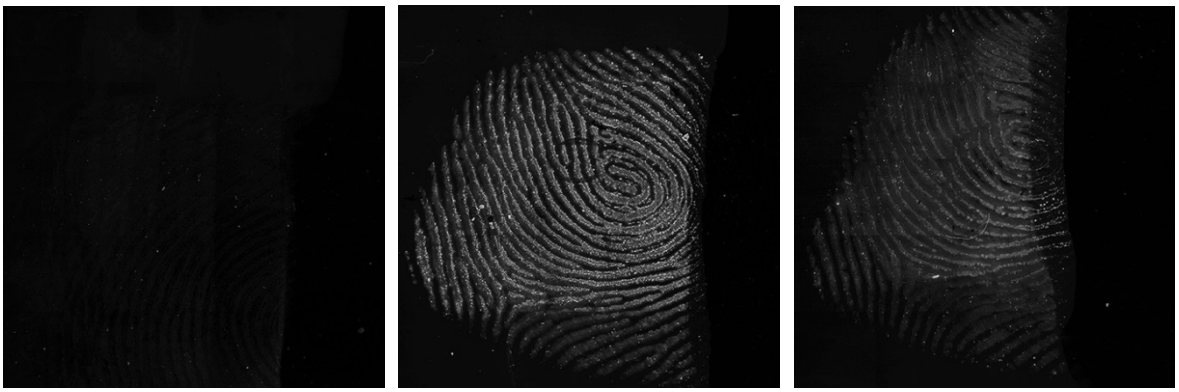


Figure S5. Fluorescence microscopy images of stained fingerprints on glass (**P1a,** 0,2mg/ml, standard conditions) as a function of the pH; from the left to the right pH = 3, pH = 7 and pH = 9.

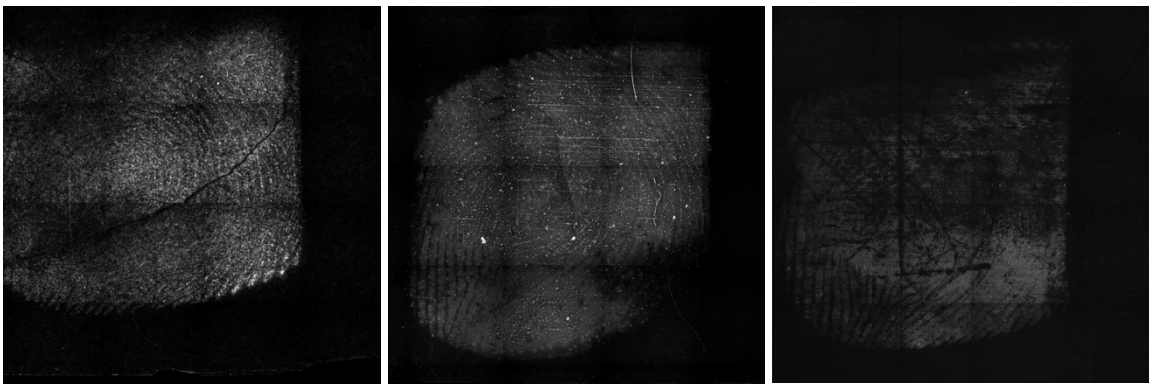


Figure S6. Fluorescence microscopy images of fingermarks developed with **P1a** on different substrates. High pressure laminate (Trespa interior panel) (left), PVC (middle), Aluminum (right).

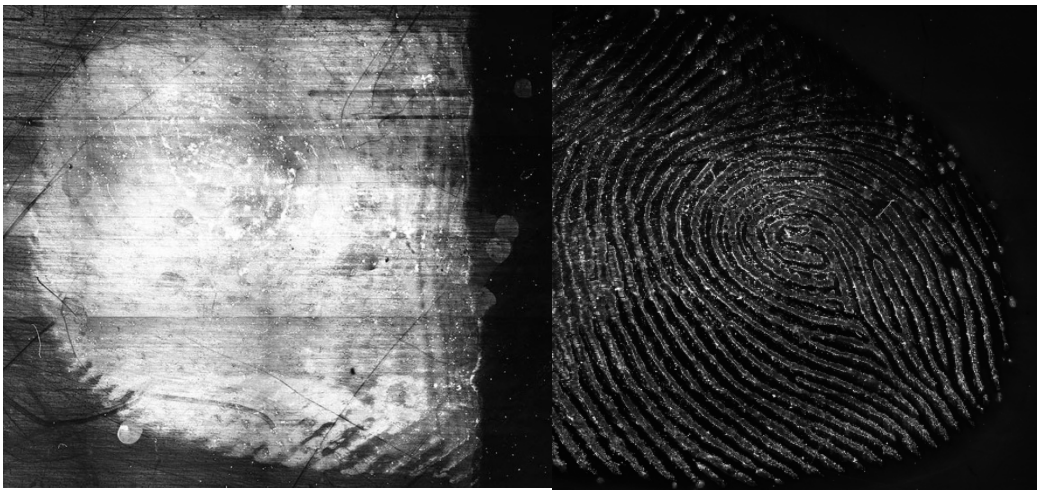


Figure S7. Fluorescence microscopy images of fingermarks on glass plates developed with **1** (left) and **P1a** (right).

Samples dipped in a solution of **P1a** showed about 3-4 atomic% of N, whereas reference samples did not show a detectable amount of N. From this we conclude that **P1** does adsorb onto glass. Figure **S8** shows a duplicate result of the XPS analysis.

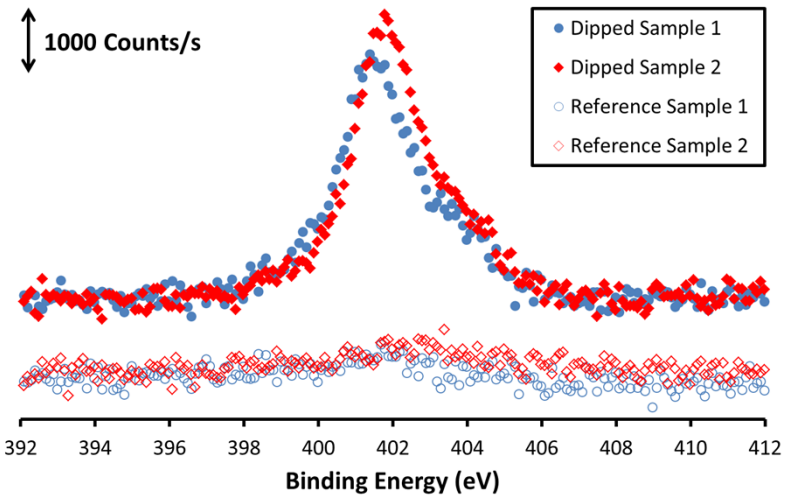


Figure S8. Collection of the N1S regions of XPS spectra of two dipped (solid symbols) and two reference (open symbols) samples.

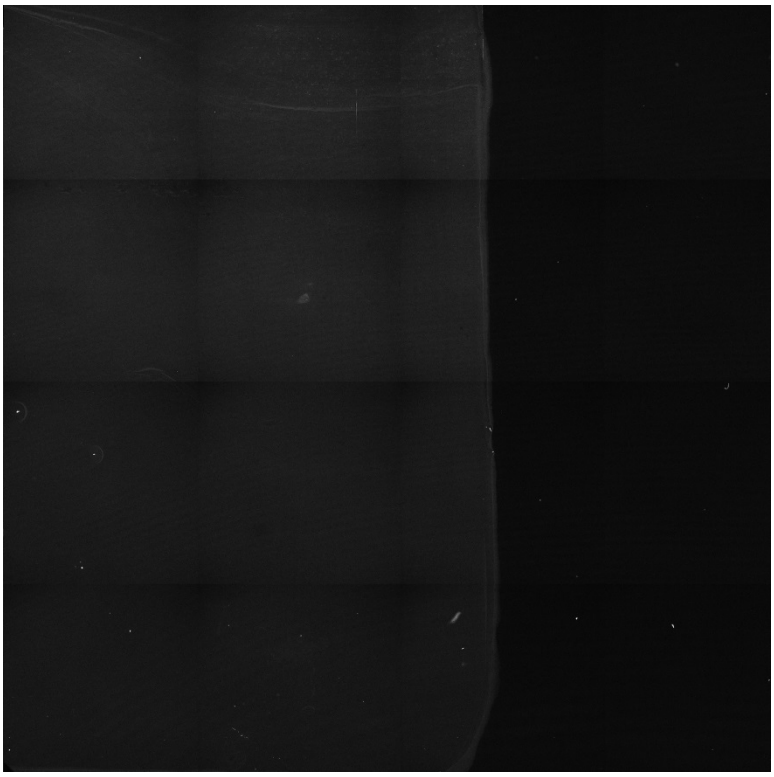


Figure S9. Fluorescence image of a clean glass plate stained with **P1a** using standard conditions, i.e. dipping in a 0.2mg/ml solution of **P1a** for 5 minutes (left part of the image).

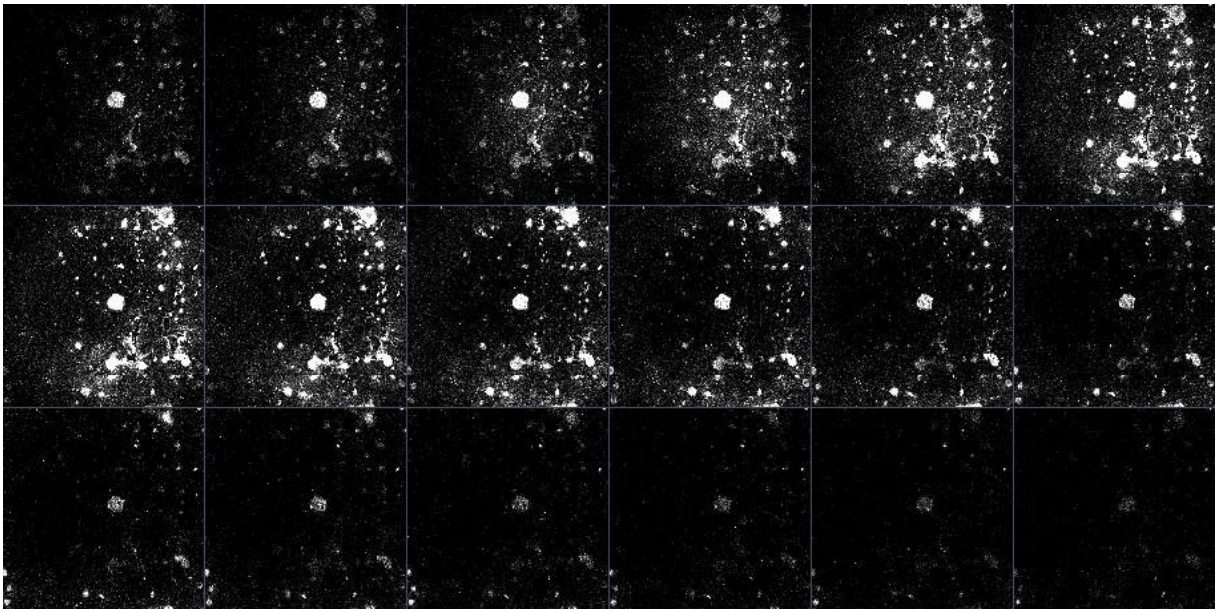


Figure S10. Confocal images at heights of 2.68, 3.13, 3.58, 4.03, 4.47, 4.92, 5.37, 5.82, 6.26, 9.84, 10.29, 10.74, 11.18 μm above the glass plate (from top left to bottom right). For images closer to the glass, apart from the large spot in the centre, which most likely is a sweat pore, no fluorescence is observed.