Supporting Information

Experimental Section

Materials and Instrumentation: Molybdenum disulfide (MoS2 crystals) was purchased from SPI Supplies. DNA oligonucleotides were synthesized and purified by Integrated DNA Technologies Pte Ltd. Other chemicals were purchased from Sigma-Aldrich Pte Ltd. The deionized water was purified using a Millipore filtration System and used in all experiments. Fluorescence images were taken on a fluoscopy (Leica MC120 HD). Fluorescence spectra were measured by Ramen spectroscopy (WITec alpha300 R). All measurements were performed in 1 x phosphate buffered saline (PBS, pH 7.4) at room temperature.

Preparation of single-layer MoS2 nanosheets: ultrathin MoS2 nanosheets were prepared by chemical exfoliation according to the previous method.¹ Briefly, lithium intercalation was achieved by immersing 0.3 g of natural MoS2 crystals in 3 mL of 1.6 M butyllithium solution in hexane for 2 days in a flask filled with argon gas. The LixMoS2 was retrieved by filtration and washed with hexane to remove excess lithium and organic residues. Exfoliation was achieved immediately after this by probe ultrasonicating LixMoS2 in DI water for 1 h.



Figure S1. Design of the PDMS microfluidic channels. Inset: optical image of partial multi-microchannel. The microchannel height is 40 μm and width is 100 μm .



Figure S2. AFM measurement of a typical MoS2 nanosheet deposited on Si/SiO₂, with an average thickness of ~0.8 nm.



Figure S3. Original data of fluorescence spectra obtained by Ramen spectroscopy.

 G. Eda, H. Yamaguchi, D. Voiry, T. Fujita, M. Chen and M. Chhowalla, *Nano Letters*, 2011, 11, 5111-5116.