# Electronic Supporting Information

## A multi-loop aptamer-based fluorescent aptasensor for enhanced detection of 17β-estradiol

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## 1. The designed aptamer sequences

The designed aptamers (O1-O5).

| Aptamer | Sequence |
|---|---|
| O1 | 5′-GCCGTTTGGGCCCAAGTTCGGC-3′ |
| O2 | 5′-GCCGTTGCCGTTAGTTCGGCAGTTCGGC-3′ |
| O3 | 5′-GCCGTTGCCGTTGCCGTTAGTTCGGCAGTTCGGCAGTTCGGC-3′ |
| O4 | 5′-GCCGTTGCCGTTGCCGTTGCCGTTAGTTCGGCAGTTCGGCAGTTCG GCAGTTCGGC-3′ |
| O5 | 5′-GCCGTTGCCGTTGCCGTTGCCGTTGCCGTTAGTTCGGCAGTTCGGC AGTTCGGCAGTTCGGCAGTTCGGC-3′ |

## 2. Raw data

Data Availability of Fig. 2.

| Aptamer | n1 | n2 | n3 | n4 | n5 | Maen | SD |
|---|---|---|---|---|---|---|---|
| O1 | 7937 | 8264 | 8079 | 7933 | 8256 | 8093.4 | 162.7400 |
| O2 | 9290 | 8896 | 8105 | 9337 | 8006 | 8726.2 | 637.5384 |
| O3 | 9567 | 9602 | 8901 | 9606 | 9005 | 9336.2 | 352.0663 |
| O4 | 9600 | 10236 | 10788 | 10546 | 10231 | 10280 | 445.8212 |
| O5 | 12058 | 13029 | 12903 | 12975 | 12370 | 12667 | 430.3179 |

Data Availability of Fig. 4(A).

| Buffer | n1 | n2 | n3 | n4 | n5 | Maen | SD |
|---|---|---|---|---|---|---|---|
| MQ | 10428 | 9786 | 10070 | 10405 | 9779 | 10093.6 | 317.3882 |
| MOPs | 11688 | 12343 | 12576 | 12688 | 11924 | 12243.8 | 426.8187 |
| Tris-HCl | 8050 | 8072 | 8745 | 8571 | 8004 | 8288.4 | 343.8362 |
| PBS | 8375 | 9012 | 7788 | 8984 | 7789 | 8389.6 | 604.8862 |

Data Availability of Fig. 4(B).

| pH | n1 | n2 | n3 | n4 | n5 | Maen | SD |
|---|---|---|---|---|---|---|---|
| 5 | 9785 | 9555 | 9385 | 9361 | 9789 | 9575 | 207.4801 |
| 6 | 10280 | 9754 | 10327 | 9810 | 10430 | 10120.2 | 314.0879 |
| 7 | 11564 | 12760 | 12178 | 12689 | 11646 | 12167.4 | 561.0934 |
| 8 | 8758 | 9314 | 9285 | 8776 | 9462 | 9119 | 328.3291 |
| 9 | 5829 | 5015 | 5578 | 5052 | 5897 | 5474.2 | 419.6829 |

Data Availability of Fig. 4(C).

| SGI Conc. | n1 | n2 | n3 | n4 | n5 | Maen | SD |
|---|---|---|---|---|---|---|---|
| 1.6x | 12378 | 12565 | 12306 | 12302 | 12530 | 12416.2 | 124.2345 |
| 0.8x | 12114 | 11970 | 12619 | 11879 | 12589 | 12234.2 | 347.9838 |
| 0.4x | 6115 | 4940 | 5874 | 5018 | 6269 | 5643.2 | 623.068 |
| 0.2x | 1895 | 2620 | 3194 | 2063 | 3211 | 2596.6 | 614.7953 |
| 0.1x | 358 | 155 | 93 | 88 | 316 | 202 | 126.9035 |

Data Availability of Fig. 4(D).

| Apt Conc. | n1 | n2 | n3 | n4 | n5 | Maen | SD |
|---|---|---|---|---|---|---|---|
| 800 | 11898 | 12604 | 12552 | 13147 | 13334 | 12646.67 | 526.3169 |
| 600 | 12332 | 12076 | 13262 | 12028 | 12933 | 12493 | 495.6918 |
| 400 | 11863 | 13161 | 11473 | 12968 | 12097 | 12374.67 | 666.2128 |
| 200 | 6554 | 5603 | 5868 | 7128 | 7681 | 6698.167 | 835.6433 |
| 100 | 3799 | 4387 | 4401 | 3994 | 4160 | 4211.333 | 277.9803 |
| 50 | 2124 | 2710 | 2748 | 2937 | 2914 | 2903.167 | 607.0059 |
| 25 | 1279 | 1506 | 1539 | 1783 | 1880 | 1615.333 | 217.7619 |
| 0 | 1 | 2 | 3 | 1 | 3 | 2 | 0.894427 |

Data Availability of Fig. 4(E).

| Time | n1 | n2 | n3 | n4 | n5 | Maen | SD |
|---|---|---|---|---|---|---|---|
| 10 | 11306 | 12721 | 13435 | 13717 | 13762 | 12988.2 | 1028.438 |
| 20 | 12646 | 13370 | 13445 | 11778 | 13679 | 12983.6 | 776.7273 |
| 30 | 12916 | 12066 | 12280 | 12105 | 14302 | 12733.8 | 940.7084 |
| 40 | 12422 | 13993 | 13679 | 11359 | 11769 | 12644.4 | 1157.277 |
| 50 | 8843 | 9697 | 8761 | 10663 | 10743 | 9741.4 | 951.6863 |
| 60 | 9072 | 8919 | 8390 | 7652 | 8545 | 8515.6 | 555.5981 |

Data Availability of Fig. 4(F).

| Time | n1 | n2 | n3 | n4 | n5 | Maen | SD |
|---|---|---|---|---|---|---|---|
| 5 | 13204 | 11970 | 11947 | 11670 | 13078 | 12373.8 | 711.6314 |
| 10 | 12726 | 12175.5 | 11823 | 11786 | 12696 | 12241.3 | 455.0519 |
| 15 | 12663 | 11835 | 11988 | 11711 | 12603 | 12160 | 443.3024 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 20 | 6000 | 7066 | 5881 | 5664 | 6968 | 6315.8 | 652.2631 |
| 25 | 5125 | 5649 | 5010 | 4919 | 5603 | 5261.2 | 341.3095 |
| 30 | 2658 | 2796 | 3483 | 2555 | 3403 | 2979 | 433.041 |

Data Availability of Fig. 5(A).

| E2 Conc. | n1 | n2 | n3 | n4 | n5 | Maen | SD |
|---|---|---|---|---|---|---|---|
| 1 | 323 | 237 | 429 | 414 | 387 | 358 | 78.87332 |
| 5 | 701 | 933 | 1009 | 946 | 1324 | 982.6 | 223.8019 |
| 10 | 1317 | 1563 | 1539 | 1372 | 1248 | 1407.8 | 138.1691 |
| 20 | 2580 | 2046 | 2393 | 2508 | 2387 | 2382.8 | 205.0115 |
| 40 | 2574 | 2317 | 2428 | 3255 | 2965 | 2707.8 | 391.9486 |
| 80 | 4237 | 5206 | 5019 | 4693 | 4615 | 4754 | 375.7858 |
| 120 | 6828 | 6946 | 6871 | 6808 | 6002 | 6691 | 388.7814 |
| 160 | 8452 | 8580 | 8379 | 8617 | 8574 | 8520.4 | 100.5351 |
| 200 | 8610 | 8941 | 8672 | 8553 | 9215 | 8798.2 | 276.3977 |
| 400 | 9690 | 8728 | 8694 | 8685 | 9419 | 9043.2 | 476.7533 |
| 600 | 9551 | 9314 | 10866 | 9754 | 10117 | 9920.4 | 605.1192 |
| 800 | 12162 | 12115 | 12532 | 11921 | 11150 | 11976 | 511.9458 |
| 1000 | 12758 | 12439 | 12489 | 13215 | 11644 | 12509 | 573.1409 |
| 2000 | 11830 | 12964 | 13673 | 13136 | 13474 | 13015.4 | 718.5247 |

Data Availability of Fig. 5(B).

| E2 Conc. | n1 | n2 | n3 | n4 | n5 | Maen | SD |
|---|---|---|---|---|---|---|---|
| 1 | 486 | 737 | 629 | 994 | 812 | 731.6 | 191.1761 |
| 5 | 1707 | 1782 | 1033 | 1066 | 1845 | 1486.6 | 402.1645 |
| 10 | 2266 | 1725 | 1779 | 1636 | 2210 | 1923.2 | 292.5435 |
| 20 | 2685 | 2024 | 2006 | 2222 | 2553 | 2298 | 308.5895 |
| 40 | 3780 | 3287 | 4000 | 3322 | 4056 | 3689 | 366.0546 |
| 80 | 4793 | 5384 | 4620 | 5347 | 4956 | 5020 | 337.287 |
| 120 | 5864 | 5970 | 5719 | 5724 | 5978 | 5851 | 126.503 |
| 160 | 7772 | 7796 | 7497 | 7483 | 7871 | 7683.8 | 180.7116 |
| 200 | 8077 | 7814 | 8623 | 7402 | 8588 | 8100.8 | 519.9035 |
| 400 | 7896 | 8319 | 8460 | 7861 | 8532 | 8213.6 | 315.5936 |
| 600 | 8369 | 8101 | 8618 | 8095 | 8631 | 8362.8 | 263.3215 |
| 800 | 8619 | 8629 | 8865 | 8791 | 8830 | 8746.8 | 115.1703 |
| 1000 | 8238 | 8396 | 9082 | 8898 | 8956 | 8714 | 372.6741 |
| 2000 | 8936 | 8816 | 8905 | 8810 | 8952 | 8883.8 | 66.83712 |

Data Availability of Fig. 6.

| Substance | n1 | n2 | n3 | n4 | n5 | Maen | SD |
|---|---|---|---|---|---|---|---|
| CPL | 360 | 144 | 372 | 249 | 150 | 255 | 109.654 |
| DES | 178 | 86 | 149 | 84 | 164 | 132.2 | 44.29673 |
| BPA | 363 | 378 | 305 | 215 | 220 | 296.2 | 76.86156 |
| P4 | 112 | 271 | 92 | 145 | 282 | 180.4 | 89.82928 |
| GEN | 448 | 250 | 95 | 103 | 458 | 270.8 | 177.4393 |
| E2 | 8407 | 8896 | 8454 | 8645 | 8225 | 8525.4 | 255.4433 |
| Blank | 256 | 278 | 231 | 260 | 258 | 256.6 | 16.7869 |

Data Availability of Table 2.

| Artificial urine | | | | | | | |
|---|---|---|---|---|---|---|---|
| Detection | n1 | n2 | n3 | n4 | n5 | Maen | SD |
| 80 | 82.79 | 81.92 | 94.04 | 81.32 | 82.21 | 84.46 | 5.38 |
| 40 | 42.66 | 38.44 | 39.21 | 38.65 | 38.49 | 39.49 | 1.80 |
| 20 | 22.57 | 21.29 | 19.20 | 20.64 | 20.42 | 20.82 | 1.24 |
| 2 | 2.27 | 1.96 | 2.26 | 1.98 | 1.96 | 2.09 | 0.16 |
| Artificial serum | | | | | | | |
| 80 | 78.23 | 82.68 | 76.11 | 85.94 | 77.15 | 80.02 | 4.15 |
| 40 | 39.10 | 39.96 | 43.60 | 43.91 | 44.33 | 42.18 | 2.45 |
| 20 | 18.37 | 21.19 | 18.09 | 20.34 | 21.46 | 19.89 | 1.57 |
| 2 | 2.13 | 2.34 | 2.08 | 2.06 | 2.28 | 2.18 | 0.13 |