



binding affinity compared with probe DNA under any condition.

Changes in the drain current during DNA hybridization were monitored in real time and we demonstrated an I-V measurement method for direct detection of DNA. Figure 2 shows representative *in situ* DNA hybridization result of I-V measurements. We performed continuous monitoring of the drain current at a 5 V drain source bias and a 4 V gate bias during exposure with complementary target DNA solution and pure buffer solution as a control. DNA hybridization induces an exponential decrease in the drain current for up to 1.5 h. In contrast, the control experiment showed no changes in the drain current. We were thus able to demonstrate a real-time decrease in the drain current during DNA hybridization.

Table 1 Comparison of the  $T_m$  value of the PNAs/DNAs with that of DNAs/DNAs and their dependence on the salt concentration.

	probe PNA		probe DNA	
	<sup>a</sup> 300mM	<sup>b</sup> 30mM	300mM	30mM
target DNA	72.4°C	72.1°C	68.2°C	52.7°C

<sup>a</sup>300mM : 2×SSC-1mM EDTA

<sup>b</sup>30mM : 0.2×SSC-0.1mM EDTA

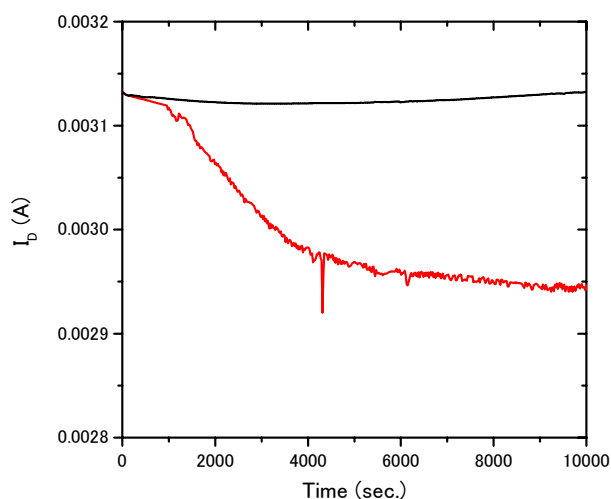


Figure 2 *In situ* hybridization results of I-V measurement. Continuous monitoring of drain current at a 5 V drain source bias and a 4 V gate bias during exposure to complementary target DNA solution (line) and pure buffer solution as a control (broken line).

## Conclusions

Using an ISFET based on PNA, we observed through the I-V characteristics that the hybridization of surface-immobilized PNA with complementary DNA induces a decrease in the saturation current and a positive shift in the threshold voltage. These variations correspond to changes in the surface potential at or near the gate insulator / electrolyte interface induced by complementary DNA recognition. These results demonstrate the possibility of using an ISFET based on PNA as a DNA sensor and we expect potential applications in medical diagnostics and molecular biology. In subsequent studies, we will design and fabricate the ISFET micro-array and control the amount of gate surface-immobilized PNA in order to ensure reproducibility.

## Reference

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