Figure 1-1: Schematic structure of DNA: (a) two strands of DNA in the helix or twisted-ladder shape with a sugar-phosphate support backbone and nitrogenous base rungs and (b) duplication of DNA according to the base pairing rule.
Figure 1-3: Schematic process of a typical toxicology experiment.
Figure 1-4: Schematic mechanisms of DNA microarray fabrication techniques.
Figure 2-1: DNA immobilization by electrochemical adsorption. (A) DNA probes adsorption to an electrochemical transducer applying a positive potential. (B) Hybridization between the probe and the target, holding the same positive potential. (C) Transduction: (C1) Transduction using the guanine oxidation signal. (C2) Indicator preconcentration in the dsDNA at a fixed positive potential and transduction based on the electroactive hybridization indicator.
Figure 2-2: DNA immobilization involving avidin-biotin complexation. (A) Avidin adsorption onto the graphite electrode. (B) Complexation between avidin and biotinylated DNA probes. (C) Hybridization of avidin-biotin probes with DNA target. (D) Signal transduction using CPSA based on an electroactive hybridization indicator preconcentrated into the dsDNA.
Figure 2-3: Some common reactions used for the covalent binding of DNA. (A) Attachment through 5’phosphate group of ssDNA onto aminoethanethiol modified gold electrode. (B) DNA immobilization onto a mercaptosilane coating of a platinum surface via the amino groups of the bases, (NH2) ssDNA (TMSPT: 3-trimethoxysilyl-1-propanethiol; CDI: N-cyclohexyl-N’- [2-(N-methylmorpholino)-ethyl]-carbodiimide-4-toluene sulfonate). (C) Immobilization using fictionalized polypyrrole (Py: 3-acetic acid pyrrole; Py: 3-N-hydroxyphthalimide pyrrole; (NH2...DNA): an amino-substituted oligonucleotide).
Figure 2-4: Typical immobilization process on silicon dioxide.
Figure 2-9: Fluorescence image taken by microscope: (a) Hybridization of Complementary DNA oligonucleotides, (b) Hybridization of DNA oligonucleotides with single base mismatch mutations and (c) Hybridization of noncomplementary DNA oligonucleotides.
Figure 2-10: Atomic force microscopy on silicon dioxide surface after MPTS formation.
Figure 2-11: Atomic force microscopy on silicon dioxide surface after complementary DNA oligonucleotides were hybridized and silver stain is done.
Figure 2-12: Atomic force microscopy on silicon dioxide surface after non-complementary DNA oligonucleotides are hybridized and the silver stain is done.
Figure 3-1: Moore’s Law for gene chips.
Figure 3-2: Typical DNA microarray by using the printing technology on glass.
Figure 3-3: Fluorescence image from scanner on which, a silicon square is in the middle and testing materials on the outside. (a) Au is used as the insulating material, (b) Pt is used as the insulating material, (c) Si3N4 is used as the insulating material, and (d) Poly-Si is used as the insulating materials.
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Figure 3-5: Layout for patterning silicon nitride and polysilicon on silicon dioxide.
Figure 3-6: Fluorescence images showing the isolation effect of silicon nitride. (From left to right, the width of silicon nitride is 1 μm, 2 μm, 5 μm, 10 μm, 25 μm, 50 μm, 75 μm and 100 μm.)

Figure 3-7: Fluorescence images showing the isolation effect of polysilicon. (From left to right, the width of silicon nitride is 1 μm, 2 μm, 5 μm, 10 μm, 25 μm, 50 μm, 75 μm and 100 μm.)
Figure 3-8: Fluorescence images on silicon dioxide with different size. (From the left to right, the diameter of silicon dioxide is 200μm, 100μm, 50μm, and 10μm).

Figure 3-9: Comparison of fluorescence intensity between silicon dioxide with different sizes.
Figure 4-1: ScanArray 5000™ from Packard bioscience
Figure 4-2: Schematic structure of scanner by using confocal laser technique.
Figure 4-3: Schematic structure of integrated detection system for DNA microarray.
Figure 4-5: The transmission spectrum of color filter before the deposition of agarose film and after the removal of agarose film.
Figure 4-6: Fluorescence image from scanner: (a) hybridization of complementary DNA oligonucleotides, and (b) hybridization of non-complementary DNA oligonucleotides.