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Biointerface Control toward Bioelectronics and Nanomedicine

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Biointerface control on solid substrates, such as protein/solid[1] and lipid-bilayer/solid,[2] attracts much interest because biointerfaces are fundamental elements of nanobiodevices and nanomedicine. Supported lipid bilayers on solid substrates (SLBs) are versatile platforms as basic components for novel nanodevices operated in aqueous environment. Figure 1 shows an example of two-dimensional nanodevice structures consisting of graphene electrodes and metal nanoparticles embedded in a SLB. Metal nanoparticles can be incorporated into preformed lipid membranes by vesicle-membrane fusion.[3]

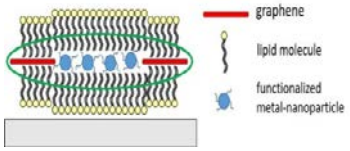

Figure 1. Two-dimensional nanodevice structure.

Exosomes, nanovesicles with 30-150 nm diameters, are released from any cell including cancer cells, and their characterization is expected to be a new method for early diagnosis of cancer. We immobilized exosomes derived from cancer cells to solid surfaces and observed their deformation fashions by atomic force microscopy. We have found that the deformation caused by immobilization contains much information about exosome membrane properties. We applied machine learning to this technique to more precisely predict the host cells (secreting cells) and analyzed the prediction accuracy by principal component analysis, as shown in Fig. 2. We have found that substrate selection is essential to improve the prediction accuracy, demonstrating the importance of the biointerface control.

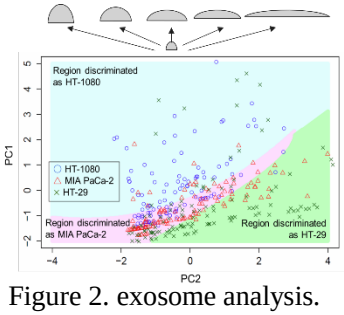

Figure 2. exosome analysis.

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References

1) K. Yamazaki, et al. *J. Colloid Interface Sci.*, 361, 64-70 (2011)
2) K. Yokota, et al. *Chem. Phys. Lipids*, 191, 147-152 (2015)
3) N. Sakaguchi, et al. *J. Phys. Chem. B*, 121, 4474-4481 (2017)