

Principle of the PepTenChip®

The fundamental principles of the novel bio-detection system (PepTenChip®)

1. A microarray-based novel bio-detection system, designated PepTenChip®

HiPep Labs. have been focusing on R&D of exploration and applications of bio-recognition. PepTenChip® has recently been completed with indispensable four key technologies. Those are *de novo* designed labeled structured peptides as capturing molecules, novel chip substrates made from amorphous carbon, array-technologies and a detector PepTenCam, maintenance free & on-site use. Due to issues with sensitivity and reproducibility caused by immobilization, most previous protein-chip developments have failed, instead, assays in solution, such as ELISA, have been the mainstream. However, the innovative bio-detection system by us operates on a principle entirely different from conventional detection system, which relies on 1:1 correspondence between capture molecules and targets. ^[1]

2. Measurement principle of the PepTenChip® system

The PepTenChip® system does not require so-called bio-markers, such as disease responsible molecules. That is, the use of this system has enabled diagnostic testing not relying on known molecules as markers. Recognition of the analyte is reflected in dose-dependent manner in fluorescence intensity changes with and without analytes. These changes can be visualized as a pattern designated a "Protein Fingerprint". Datamining is carried out by statistical analyses such as multivariate analyses; thus, the discovery of undefined materials related to diseases can be realized. Due to the immobilization chemistry and characteristics of chip-substrate PepTenChip® is reusable rather than disposable, offering a highly cost-effective and environmentally friendly testing method. ^[1]

3. Clinical applications

The PepTenChip® system is a medical device offering non-invasive testing platform that utilizes body fluids collected at the time of diagnosis as analytes. By utilizing this system, clinicians can obtain objective results that do not rely on personal skill or experience, enabling real-time, on-site (point-of-care testing). By collaboration with clinical specialists, advanced applications using this system have been performed: (1) Oral-healthcare focusing on periodontal disease ^[2]; (2) classification of precancerous lesions (pre-symptomatic states) for early detection of gastric cancer using gastric juice ^[3], and (3) Testing and pathological classification of multiple sclerosis (Designated Intractable Disease 13 in Japan)—a rare neurological disorder—and its related diseases using cerebrospinal fluid. (publication in preparation).

References

[1] Tominaga, Y. and Nokihara, K. (2025) Anal. Meth. (Royal Society of Chemistry), 17, 4590-4598.

[2] Tominaga, Y., Usui, K., Hirata, A., Ito, H. and Nokihara, K. (2018) Bioorg. Med. Chem., 26, 3210-3216, 2018.

[3] Tominaga, Y., Wu, X., Wei, M., and Nokihara, K. (2026) J. Pharm. Biomed. Anal. 268, 117210.

Key Features of the PepTenChip® System, a Novel Biosensing Technology for Diagnostic Testing in the Next-Generation, Does not Rely on Known Biomarkers

- ① Rapid testing using just one drop of sample
- ② No labeling nor washing steps required
- ③ Provides objective criteria for diagnoses
- ④ Applicable, even when no established diagnostic method is available and to diseases for which no biomarkers have yet been identified
- ⑤ Not disposable, Reusable, cost-effective
- ⑥ No large, expensive instruments, No specialized reagents nor extensive training is required
- ⑦ Real time on-site manner contribute to reducing regional disparities in access to healthcare