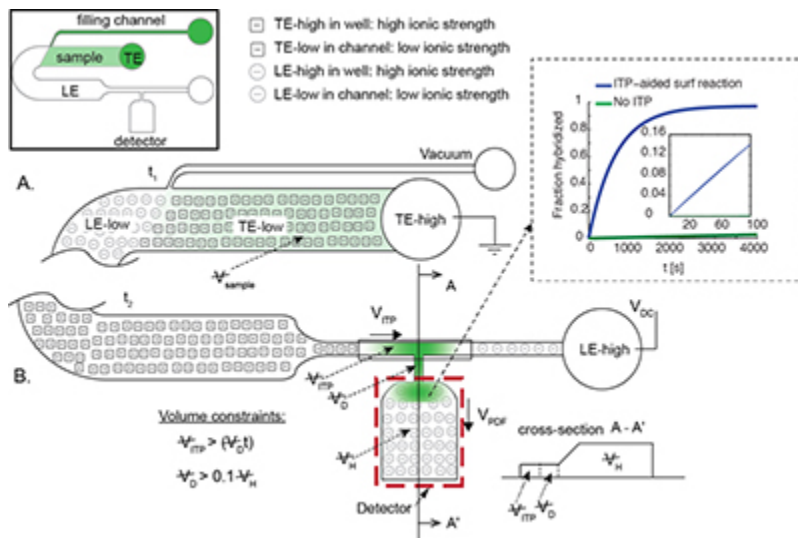


# **A Method for Faster, Sensitive Biomolecular Detection in Surface Reaction Assays**

Stanford Prof. Juan Santiago and a team of engineers have developed a method of speeding up chemical reactions between a probe on a surface and a molecule in solution. They use isotachophoresis (ITP) to preconcentrate biomolecules in solution and then automate transport of the ITP-focused target molecules onto a region of probes immobilized onto a surface. For example, they use ITP to focus and then transport the ITP-focused species onto a metallic surface for Surface Plasmon Field Enhanced Fluorescence Spectroscopy (SPFS). In complex samples, the ITP purifies and 'pre-concentrates' the target analytes. The concentrated sample can then be delivered to a SPFS sensor for ultra-rapid detection – the capture molecules in the SPFS sensor bind the ITP-focused targets. The result is a much faster (30x faster) and more sensitive detection (almost 10x) of biomolecular analytes for bioassays, such as immunoassays and nucleic acid hybridization arrays.

## **Stage of Research**

The inventors successfully built and tested the microfluidic chip that integrates ITP with SPFS, and demonstrated feasibility of integrating ITP with surface reaction assays that use conductive surfaces.



**Schematic of microfluidic device integrating ITP and a surface sensor (e.g., SPFS)**– Two reservoirs contain a low-mobility trailing electrolyte buffer and a high-mobility leading electrolyte buffer to use ITP to focus target biospecies. The main fluid channel bridges the two reservoirs and transports the ITP-focused molecules to the entrance of a side channel for the surface detector. Pressure driven flow is then used to transport the ITP-focused molecules onto the metallic surface of the surface plasmon sensor.

## Applications

- **Bioassays** and **molecular diagnostics**, such as immunoassays, or DNA and RNA hybridization assays.

## Advantages

- **Faster and more sensitive** - ITP speeds up chemical reactions between molecules in solution and molecules immobilized on a metallic surface. The resulting reaction time decreases by an order of magnitude, while sensitivity increases by an order of magnitude.

## Publications

- Yamamoto, Noriaki, Juan Santiago, and Denitsa Milanova. "[Detection of biological molecules using surface plasmon field enhanced fluorescence](#)"

[spectroscopy \(spfs\) combined with isotachophoresis \(itp\).](#)" U.S. Patent Application No. 15/071,714.

## Patents

- Published Application: [20160209407](#)
- Issued: [9,939,435 \(USA\)](#)
- Issued: [10,408,827 \(USA\)](#)

## Innovators

- Juan Santiago
- Denitsa Milanova
- Noriaki Yamamoto

## Licensing Contact

### Chris Tagge

Technology Licensing Program Manager

[Email](#)