

## Fluorescent Biosensors: The Little Living Lasers

- Chinmay Garg, B16CS041

Application of fluorescence in the field of biosensors is a relatively recent phenomenon, emerging only in the late 1990s. With time it became the growing and persistent obsession of almost every biologist to observe their favorite biomolecule, after all 'seeing is believing'. Much like lighthouses in the night, these fluorescent biosensors illuminate target molecules even within the deepest depths of a cell.

Fluorescent biosensors are classically defined as biological components that bear a receptor, responsible for recognition of a target or its biological activity, which is genetically, enzymatically or chemically coupled to one (or several) fluorescent probe(s), responsible for conversion of the recognition event into a detectable and measurable optical signal.

Because the fluorescent properties of most organic fluorophores are susceptible to environment changes, these biosensors find wide usage in detecting and quantifying biological compounds. The most important advantage of these biosensors is that they are proposed for general use, thus, they provide the possibility of multiple compounds detection within a single device, they are able to perform remote sensing and they are easy to build.

The intrinsic sensitivity of fluorescence allows for detection of dynamic and reversible variations, with high spatial and temporal resolution in living cells, thereby providing means of deciphering the precise activation and inactivation of enzymes within complex signaling pathways. Fluorescent biosensors come in all sizes, shapes and flavors.

These biosensors generally employ one of the two strategies: FRET (Forster Resonance Energy Transfer) or BiFC (Bimolecular Fluorescence Complementation). In FRET, two different fluorescent proteins (FPs) are used, which in proximity give a different signal. Whereas in BiFC, two fragments of a single FP are brought in proximity to reconstitute an intact FP.

These biosensors find extensive applications in detection of biomarkers in various pathological settings, development of alternative diagnostic approaches, monitoring disease progression, evaluating response to therapeutics, developing screening assays for drug discovery programs, and many more.

And thus, time and again these biosensors have proved themselves to be every biologist's darling, a very precious and potent tool for detection of biomolecules in their very home ground – their natural cellular environment, thereby providing precious information on the dynamic nature of fundamental processes.