Biosensor Technologies

Biosensor Architecture & Signal Transduction

Analyte

Recognition Ab/Enzyme

Transducer

Surface/SAM

- **Optical**
- **Electrical**
- **Mechanical**

- SPR
- Fluorescence
- Chemiluminescence
- Amperometric
- Potentiometric
- FET-based
- QCM
- Cantilever
- SAW

Processing → **Digital Output**

125.4
mg/dL

Key Parameters: Sensitivity (LOD) • Selectivity • Response time • Dynamic range • Stability

Recognition Elements

Antibody   Aptamer   Enzyme   MIP
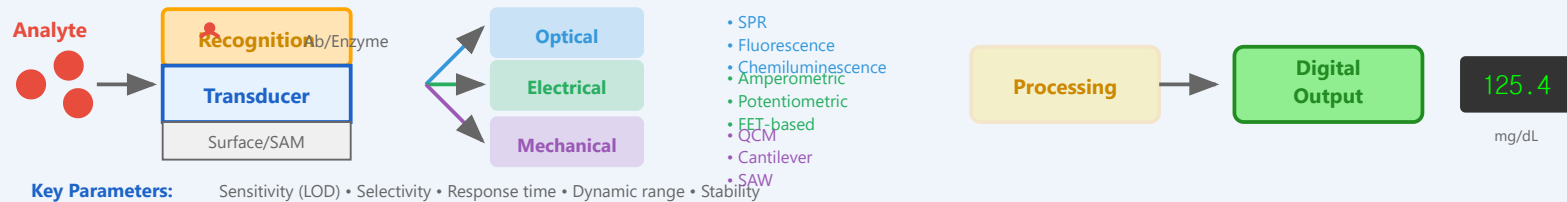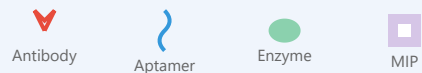
High specificity biorecognition layers

Transduction Methods

- Optical: SPR, SERS, fluorescence
- Electrochemical: CV, DPV, EIS
- Piezoelectric: QCM, SAW
- Thermal: Calorimetric

Surface Chemistry

SAMs: Self-assembled monolayers
PEG: Anti-fouling coating
Blocking: BSA, casein
Minimize non-specific binding

Signal Amplification

Enzyme cascades: HRP, ALP
Nanoparticles: Au, Ag enhancement
SERS: 10^6-10^{14} fold
Improve LOD to fM-aM range