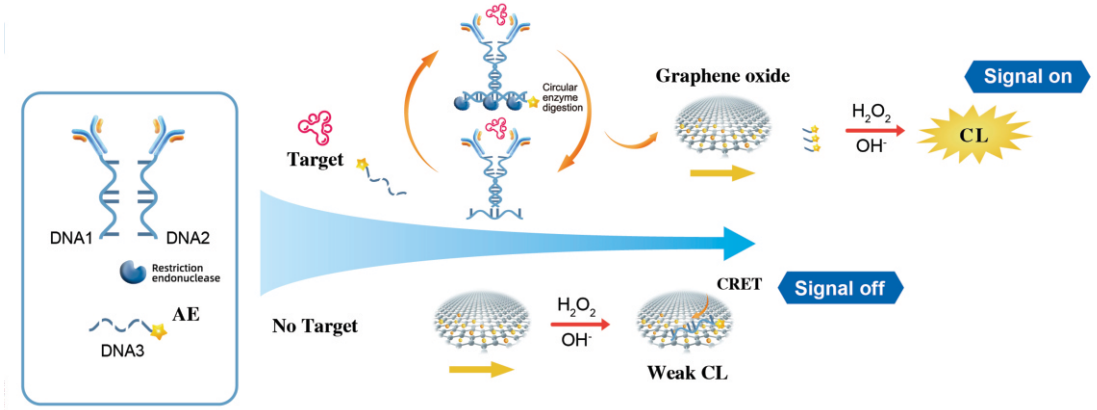

Enlight
5th Generation of Homogeneous CLIA
Let's enlighten diagnostics
together with "Enlight"!

Working Principle of CRET (Chemiluminescence Resonance Energy Transfer)

The Chemiluminescence Resonance Energy Transfer (CRET) method is based on the energy transfer between a donor(antigen) molecule and an acceptor (antibody) molecule. This energy transfer enhances the chemiluminescent signal and is employed in advanced diagnostic applications to achieve high sensitivity, precision, and efficiency.

Chemiluminescence Resonance Energy Transfer (CRET) Principle



STEPS OF CRET

1. **Chemical Reaction:**
   A chemical reaction excites a donor (antigen) molecule, giving it energy.
2. **Energy Transfer:**
   The donor (antigen) molecule passes this energy to a nearby acceptor (antibody) molecule. This happens through a process called resonance energy transfer (like a wireless energy transfer between two molecules).
3. **Light Emission:**
   The acceptor (antibody) molecule uses this energy to emit a bright light signal, which is stronger and easier to detect than the donor's original light.
4. **Signal Detection:**
   The emitted light is detected and measured, and its intensity tells how much of the target analyte (e.g., a hormone or protein) is present.

Advantages of CRET

- High Sensitivity : Amplified signals allow detection of low-concentration analytes.
- Fast Response : Minimal reaction steps make CRET-based assays rapid.
- Stable Signals : The energy transfer mechanism ensures a more stable and reliable output.
- Compact Design : CRET enables the development of portable diagnostic systems, suitable for POCT (Point of Care Testing).

COMPARISON of CRET, CLIA, and ECLIA

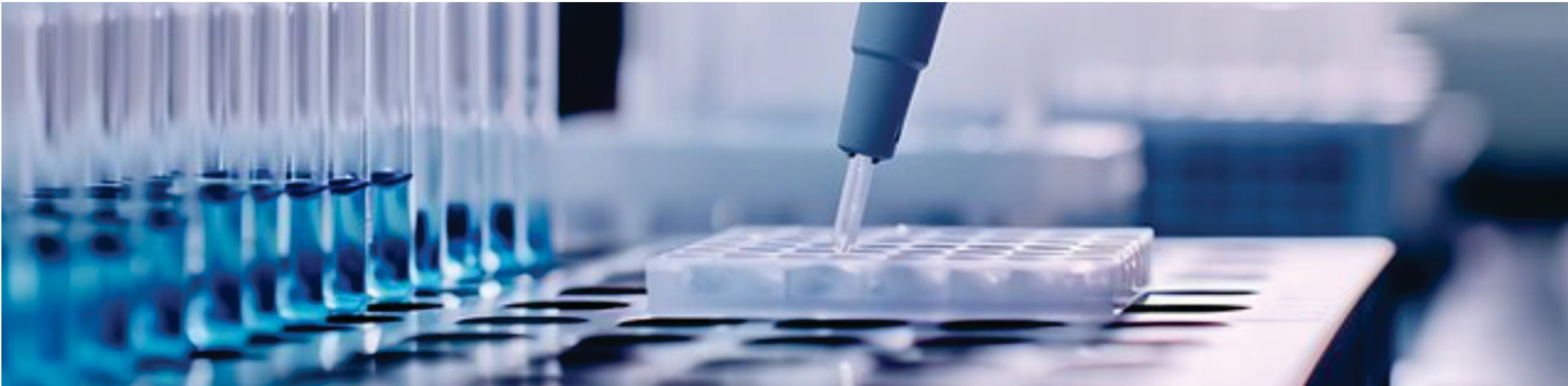
FEATURE	CRET	CLIA	ECLIA
Principle	Resonance Energy Transfer (RET) between antigen and antibody molecules, enhancing the chemiluminescent signal.	Enzyme-substrate reactions producing light, proportional to the an alyte concentration.	Electrochemical excitation of luminescent molecules, generating light at an electrode
Sensitivity	Highest sensitivity due to amplified signal via RET.	High sensitivity; suitable for detecting low concentration an alytes.	Very high sensitivity; ideal for precise diagnostics.
Speed of Analysis	Fastest, with fewer reaction steps.	Moderate; enzymatic reactions may require washing and incubation steps.	Fast; electrochemical reactions are efficient and controlled.
Signal Stability	Highly stable due to donor-acceptor specificity.	Variable; depends on enzyme and substrate stability.	Extremely stable; electrochemical control ensures reproducibility.
Cost (Setup)	Moderate; advanced RET materials increase initial cost.	Affordable; uses well established reagents and methods.	Expensive; requires specialized electrodes and equipment.
Cost (Operational)	Cost-effective; minimal reagent usage and faster testing.	Moderate; reagent consumption may increase costs.	High; involves costly reagents and maintenance of electrodes.
Portability	Highly portable; compact design ideal for POCT.	Moderate portability; typically requires medium sized systems.	Low; requires large, laboratory-based systems.
Applications	POCT, rapid testing in clinics and rural areas.	General diagnostics in centralized labs with high throughput.	Specialized diagnostics for cancer markers, cardiac panels, and critical care
Throughput	Medium to high; optimized for smaller setups.	High; suitable for bulk testing in large labs.	High; designed for fully automated, high throughput systems.
Maintenance	Low; fewer mechanical components.	Moderate; periodic enzyme and reagent management required.	High; regular electrode maintenance and calibration needed.
Example Machines	Enlight DC80 Dry Chemiluminescence Analyzer	Abbott Architect i1000SR, Mindray CL900i	Roche Cobas e411, Siemens ADVIA Centaur

Chemiluminescence Resonance Energy Transfer (CRET) VS Traditional Chemiluminescence Immunoassay (CLIA)

FEATURE	CRET METHOD	TRADITIONAL CLIA
Working Principle	• Based on energy transfer between a donor molecule and an acceptor molecule. • The energy transfer occurs when the donor molecule is excited and emits energy, which is then transferred to the acceptor molecule. • The resulting chemiluminescent signal is enhanced by the resonance energy transfer, improving sensitivity and efficiency.	• Involves the use of a chemical reaction where a chemiluminescent substrate emits light as a by-product. • The light emission is directly proportional to the analyte concentration. • Typically uses enzymatic or electrochemical reactions to generate the luminescent signal
Sensitivity and Accuracy	• **Higher sensitivity** due to the enhanced signal from resonance energy transfer. • More accurate at detecting low concentration an alytes because of its ability to amplify the luminescent signal.	• Highly sensitive, but may not reach the amplification levels of CRET. • Accuracy is dependent on enzyme efficiency and substrate purity.
Speed of Analysis	• Faster due to the direct and efficient energy transfer mechanism. • Requires fewer steps in signal generation, reducing assay time.	• Relatively slower, as it depends on enzymatic reactions or secondary processes for signal generation. • Some protocols involve washing and incubation steps, increasing total assay time.
Stability and Reliability	• Chemiluminescent signal is more stable due to the specific donor-acceptor pairing. • Less prone to interference from external factors like temperature or pH.	• Signal stability can vary based on the enzyme and substrate used. • More prone to variability due to external factors.

Chemiluminescence Resonance Energy Transfer (CRET) VS Traditional Chemiluminescence Immunoassay (CLIA)

FEATURE	CRET METHOD	TRADITIONAL CLIA
Cost and Complexity	▸ Initial setup may be costlier due to advanced materials and specific donor-acceptor pairs. ▸ Cost-effective in the long run due to lower reagent consumption and faster analysis.	▸ More affordable initially, as it uses established chemistries and reagents. ▸ May require higher reagent volumes, increasing operational costs over time
Compactness and Portability	▸ Designed for **compact and portable systems**, making it ideal for POCT (Point of Care Testing). ▸ Simplifies the hardware requirements for light detection.	▸ Generally requires more sophisticated laboratory equipment, making it less portable.
Applications	▸ Suitable for rapid testing and decentralized diagnostics, such as POCT devices in clinics or rural areas. ▸ Ideal for assays where speed, sensitivity, and compactness are critical.	▸ Widely used in centralized labs for high throughput testing. ▸ Preferred for established protocols and a wide range of assays.



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