

Electrophoretic Assembly of Immunocomplexes for Highly-Sensitive Serological Lateral Flow Immunoassay

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- Serological assays detect immunoglobulins G (IgGs) in blood for diagnostics and assessing the immune response to vaccination;
- New methods for rapid (≈ 10 min), inexpensive and highly-sensitive point-of-care serological testing are practically desired;
- Lateral flow immunoassay (LFIA) partly meets these criteria. The use of LFIA is limited by its low sensitivity arising from the competition for complexes formation between specific IgG (IgG_{sp}) and background IgG (IgG_{bg}) with the gold nanoparticles conjugated with IgG-binders (label).
- We developed electrophoresis-driven LFIA (eLFIA) that avoids the competition for binding and facilitates ≈ 1000 -times higher sensitivity.

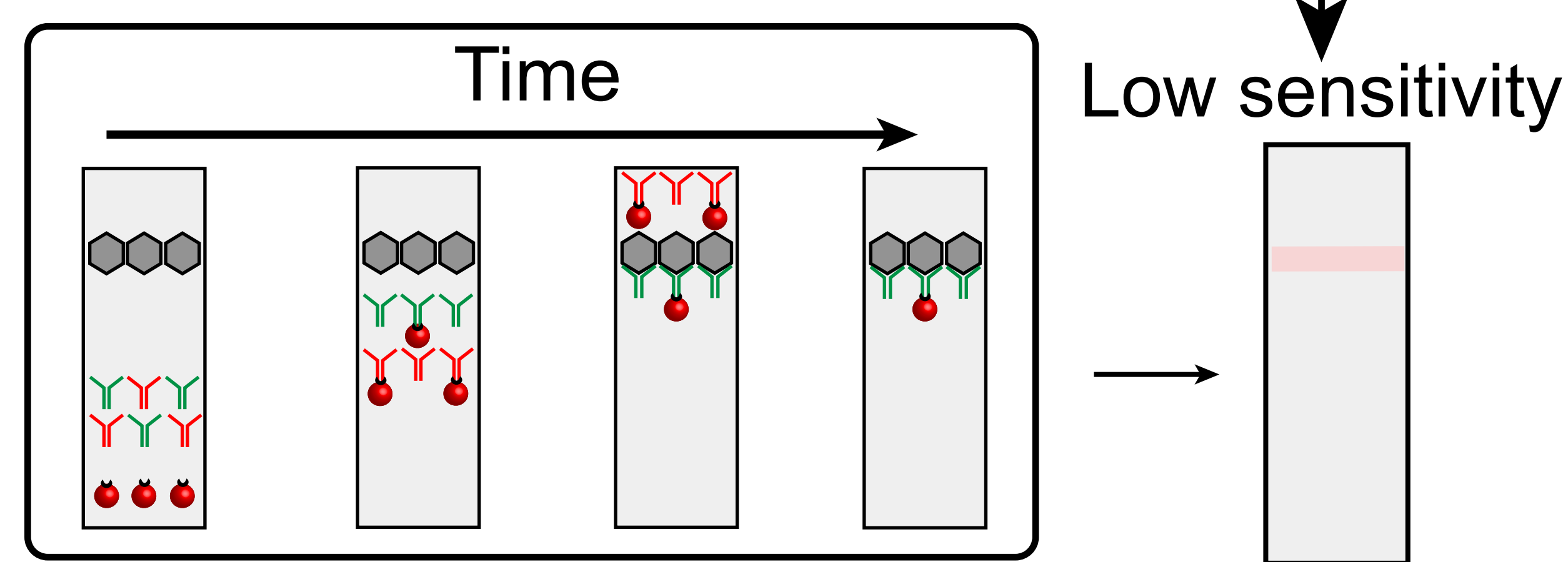
Principle of serological LFIAs

In conventional LFIA, the antigen (Ag) is immobilized on the membrane. The competition of IgG_{sp} with IgG_{bg} for binding with label leads to low sensitivity.

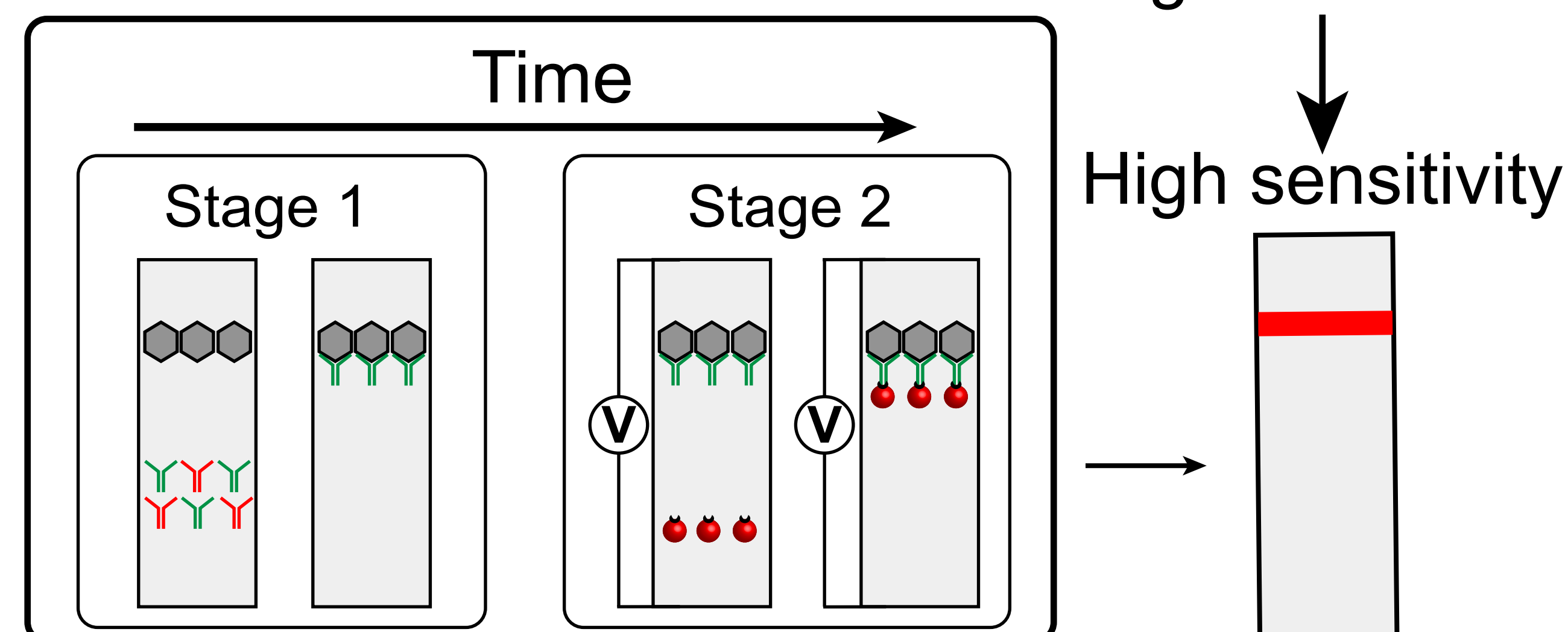
In eLFIA, in stage 1, all IgG_{sp} react with Ag, while IgG_{bg} are washed away by capillary action. In stage 2, label is moved by electrophoresis and binds with $\text{IgG}_{\text{sp}}\text{-Ag}$ on the membrane.

The absence of competition for binding with label facilitates high sensitivity.

Conventional LFIA



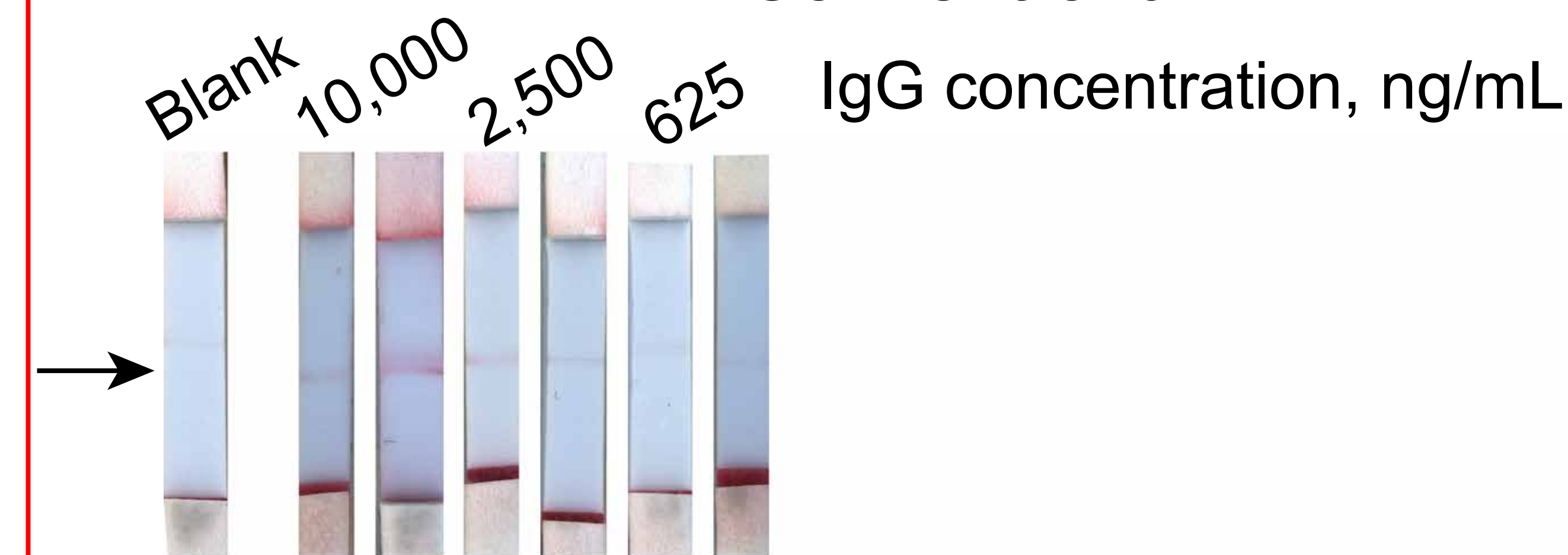
eLFIA



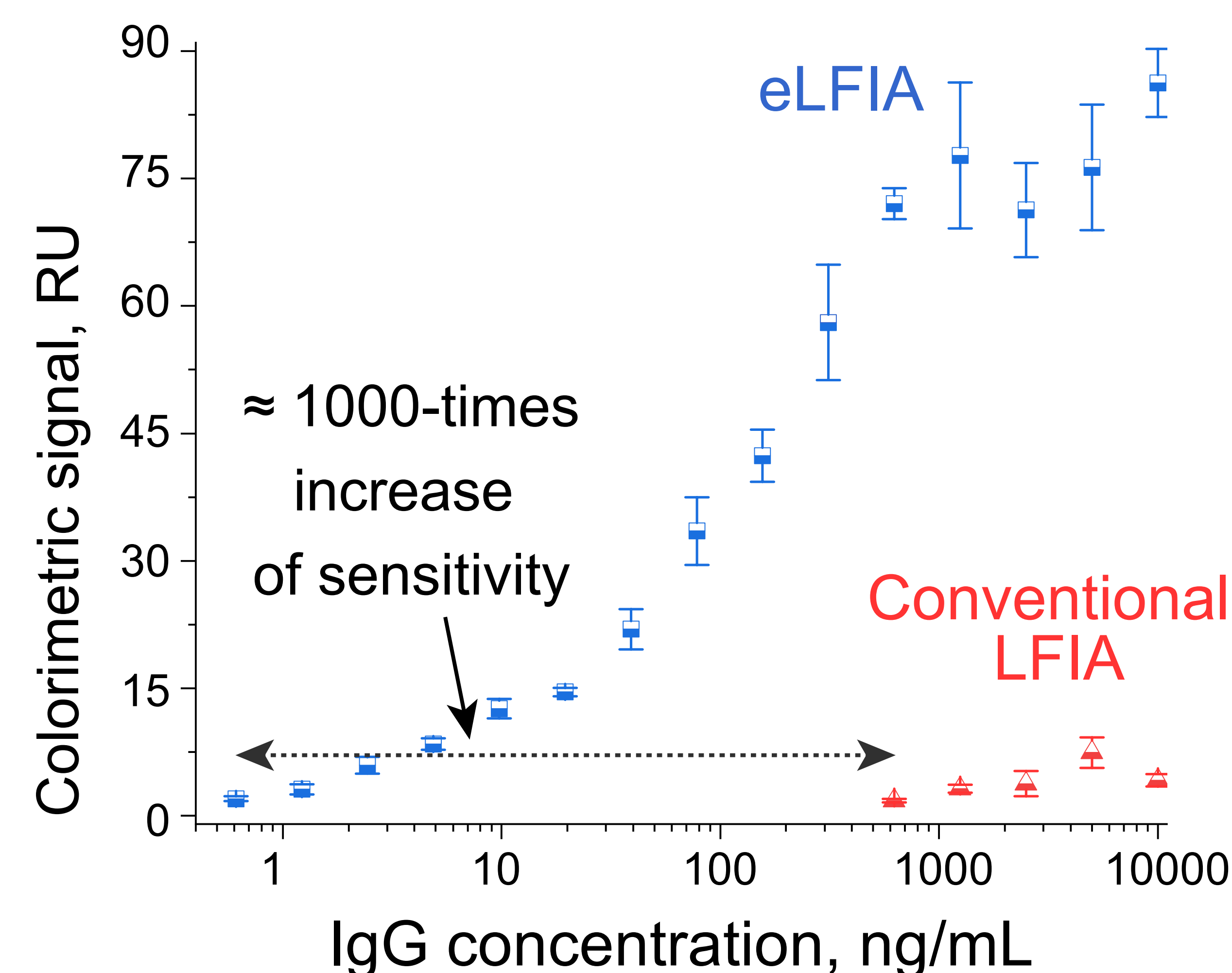
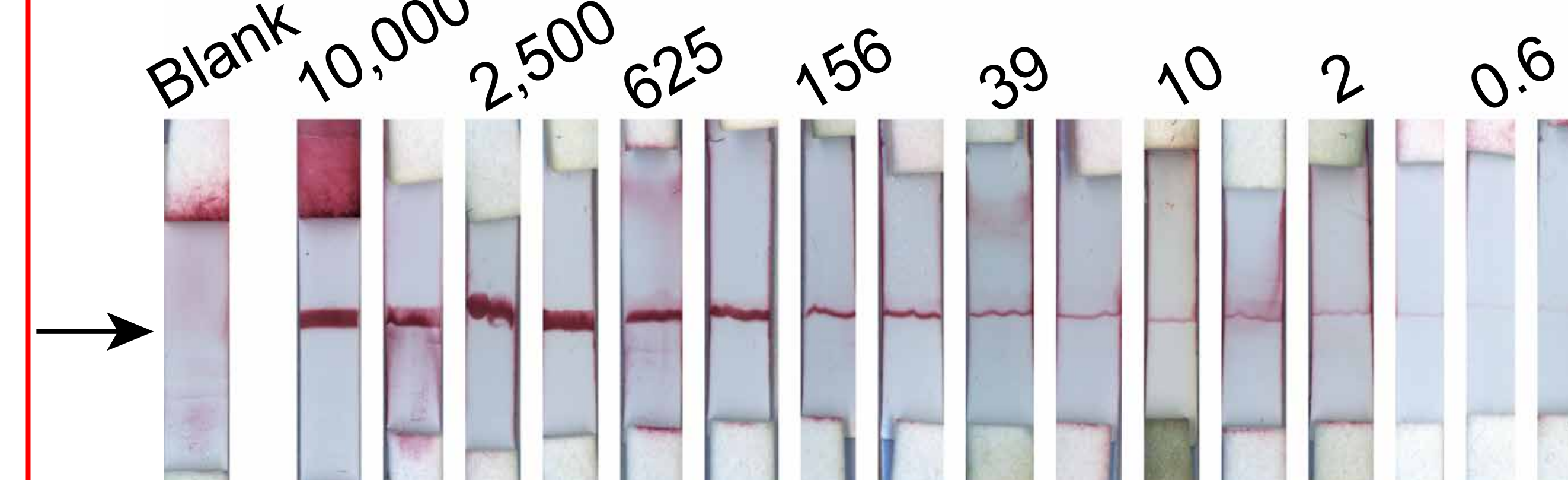
Label IgG_{bg} IgG_{sp} Antigen

Detection of IgG against hepatitis B

Conventional LFIA

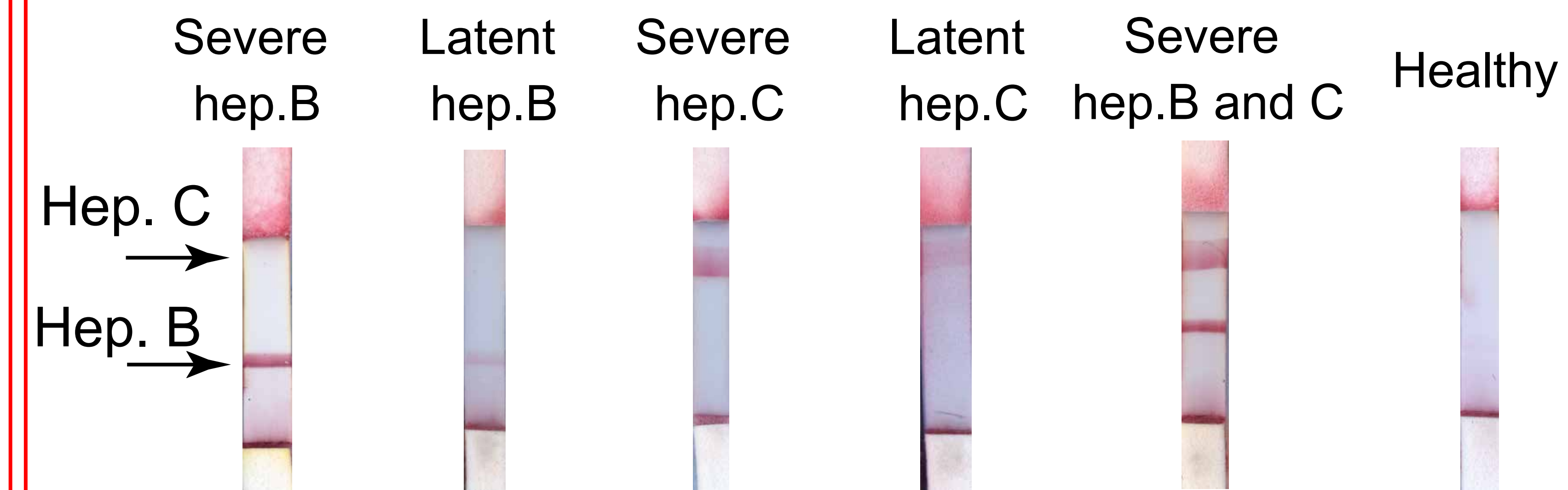


eLFIA



Detection of IgGs against hepatitis B and C

Conventional LFIA - **sensitivity 75%** (hep. B) and **65 %** (hep. C).
eLFIA - **sensitivity 98%** (hep. B) and **96 %** (hep. C).



Testing in point-of-care settings

Electrophoresis can be driven by a generic 9 V battery.

The estimated cost of the device is less than \$20.

As the device is reusable (more than 2000 assays were run), it does not contribute to the testing cost.



Publication



Laboratory website

