

# Evaluation of immunological detection systems (Abicap, Bioveris M1M, Bioplex 200, and Sector Imager 6000) using vaccinia-virus as a model

Rahel Groeflin<sup>1)</sup>, Olivier Engler<sup>2)</sup>, Marc Strasser<sup>2)</sup>,

<sup>1)</sup> ZAHW, Life Science and Facility Management, Institut for Biotechnology, CH-8820 Wädenswil, Switzerland

<sup>2)</sup> SPIEZ LABORATORY, CH-3700 Spiez, Switzerland

Immunological detection systems have been widely used for the rapid identification of pathogens. Due to the high infectivity of biological warfare agents the diagnosis of these pathogens requires particularly sensitive methods. Using vaccinia-virus as a surrogate model for smallpox we have evaluated several of the antibody-based detection systems on the market.

## Introduction

For the rapid identification of biological warfare agents antibody-based detection systems are propagated by several companies. In order to be usable for a primary diagnostic these systems need to be sensitive (in the range of 1-100 infective particles/ml), specific and safe to handle. For the evaluation of newly developed immunological detection systems we used a well characterized vaccinia-virus suspension in combination with our own capture- and detector-antibodies.

## Methods & Results

### Vaccinia-virus suspension used for analysis

Vaccinia virus was cultured on cells at a concentration of  $3 \times 10^5$  infectious particles per ml (pfu/ml). The total number of viruses was estimated by electron microscopy at  $5 \times 10^7$ /ml. Serial dilutions of virus suspension in PBS and other matrices were used to perform the analysis. The signal- ratio between negative control and virus dilution was determined. The cut off was set at a ratio of 2.

### Abicap

The capture antibody is bound to the column-matrix and catches the virus while it filters through the column. A detector antibody, which is linked to an enzyme (Poly-HRP) leads to a visible precipitation of the substrate in the column.

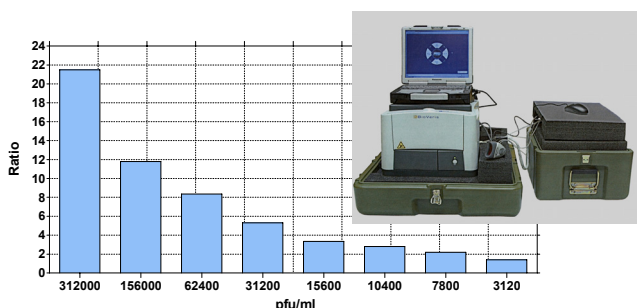


**Sensitivity:**  $10^5$  pfu/ml, **Processing time:** 1 h

**Handling:** Open system (infectious aerosols might be produced)

### Bioveris M1M

The capture antibody is coated on magnetic beads, which allows catching the viruses in a solution. A second antibody is coupled to a Ruthenium-complex and binds the virus on remaining epitopes. The beads then adhere to a magnetic plate, where they are automatically washed. The bound ruthenium-complex is stimulated electro-chemically which leads to measurable light emission.

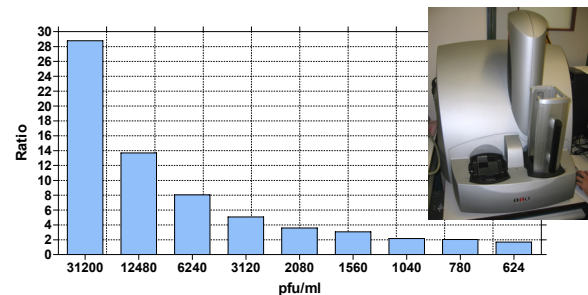


**Sensitivity:**  $10^4$  pfu/ml, **Processing time:** 2 h,

**Handling:** Closed and semi-automated system

### Sector Imager 6000

The capture-antibody is coated on a carbon plate and catches the virus in a solution. The detector-antibody, which is coupled with a ruthenium-complex, also binds to the virus. An electrode is integrated in the bottom of the plate and activates the bound antigen-antibody-complex leading to an electrochemical signal.

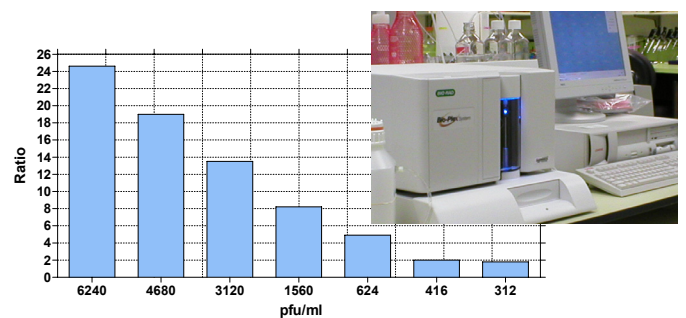


**Sensitivity:** 1000 pfu/ml, **Processing time:** 3 h,

**Handling:** Open system (infectious aerosols might be produced)

### Bioplex 200

The capture-antibody which is fixed on the beads catches the virus while the detector-antibody binds to free epitopes on the virus. Via a biotin-streptavidin-interaction a green fluorescent molecule is coupled to the detector antibody. The fluorescent molecules bound to the beads are stimulated with a laser and can be monitored.



**Sensitivity:** 600 pfu/ml, **Processing time:** 2.5 h,

**Handling:** Open system (Infectious aerosol might be produced)

## Conclusions

- The best results were achieved with the Bioplex 200 and Sector Imager 6000.
- The detection limit was around 600 to 1000 pfu/ml in an ideal solution of PBS, which is 10-50 times better than results achieved with the "in house" ELISA.
- Nevertheless neither system could detect viruses at the infectious dose of 1-100 pfu/ml.
- Only the Bioveris M1M allows secure and automated procession of the probes.

