Abstract

The Institut Galli-Valerio is the veterinary diagnostic laboratory of the canton of Vaud, Switzerland. The legacy of Professor Bruno Galli-Valerio, the institute was established following his death in 1943 to investigate diseases of domestic and wild animals. Nowadays, the institute offers a broad range of diagnostic tests for infectious diseases, performs necropsies of domestic and wild animals, is the national reference laboratory for epizootic bee diseases, and has an active applied research program. The institute’s routine veterinary diagnostics for the presence of bovine virus diarrhea virus (BVDV) forms part of the Swiss authorities’ ongoing program to eliminate BVDV from the domestic cattle population.

The resulting need for reliable high throughput screening has been met using a Tecan Freedom EVO® liquid handling workstation to fully automate all of its ELISA testing. Close cooperation with IDEXX Laboratories has enabled fast and efficient transfer of all ELISA tests to the Freedom EVO system.

BVDV eradication program

In 2008, the Swiss authorities began an ambitious program to eradicate BVDV, which can cause mucosal disease in cattle. The Swiss BVDV eradication campaign aims to eliminate persistently infected (PI) animals from the cattle population within a short time. To minimize the risk of new infections after the start of the program, all cattle which had not yet calved and were destined for shared mountain pastures in 2008 were tested in spring 2008. In the initial phase from October to December 2008 all cattle were individually tested, and PI animals were slaughtered.

During the ongoing secondary phase, all newborn calves have to be tested using ear notch samples taken as part of the regular tagging process. From 2011 onwards, a routine monitoring program, most likely based on antibody detection in milk of first lactating cows, will be established to ensure the cattle population remains free from BVDV.

In order to standardize ear notch sampling, the Swiss authorities decided on the nationwide usage of Allflex® ear tags.
Diagnostics

Analyzing thousands of ELISA samples each day means long hours of repetitive work. A reliable, high throughput diagnostic method was required to avoid both false positive results, which would be unacceptable for the animal’s owner, and false negative results, which could jeopardize the success of the whole eradication program. The Institut Galli-Valerio chose to perform BVDV testing using the IDEXX HerdChek® BVDV Antigen/Serum Plus. This is the only ELISA test directed against the Erns antigen, and offers high diagnostic sensitivity and specificity, for reliable detection of PI animals with minimal false positive results.

In addition to BVDV testing, the laboratory performs a range of other ELISA tests from IDEXX Laboratories, including infectious bovine rhinotracheitis (IBR), brucellosis, enzootic bovine leukosis (EBL) and caprine arthritis encephalitis (CAE), as well as an in-house ELISA for Salmonella abortus-ovis.

All ELISA testing within the institute has now been automated using a Tecan Freedom EVO 150 workstation, and close cooperation with IDEXX Laboratories Inc. has enabled fast and efficient transfer of all ELISA tests to the Freedom EVO system. This platform has the flexibility to meet the varying throughput demands of the laboratory, with a maximum throughput of 26 plates per day for BVDV (two runs of 10 plates during the day, and an overnight run of six plates). Any errors which occur during testing are corrected automatically, where possible, and recorded in the results file. This maximizes walkaway times and enables overnight testing, without compromising sample security and traceability for ISO/IEC 17025 compliance.

Configuration of the Freedom EVO platform

The Freedom EVO 150 platform is equipped with an 8-channel liquid handling (LiHa) arm using fixed ceramic tips, a robotic manipulator (RoMa) arm, shelving with a 16 microplate capacity, a room temperature incubator and a 37 °C incubator.

A Sunrise™ absorbance reader and a Power Washer 384™ plate washer (using a 96-channel head) have been integrated onto the side of the platform, using a special extension plate. Wash buffers, system liquids and a waste container are conveniently located next to the instrument, and can easily be accessed from the rear of the platform.

In addition, Tecan has designed a special carrier to allow Allflex sample racks containing ear notch samples to be installed on the worktable, along with a designated loading area for regular blood tubes.
Processing of ear notch samples
During extraction of ear notch samples into reaction vials, each vial is identified by its barcode using an Allflex tube opener. Reaction vials are then put into an Allflex rack. A pressure sensor verifies the position of each vial, allowing the Allflex system software to create a worklist for the workstation’s Freedom EVOware® software. Visual inspection of the extracted samples prevents false negative results by identifying empty vials, or vials containing only debris from ear tags.

Figure 4. Sample extraction with the Allflex tube opener. The specially designed sample rack is equipped with a pressure sensor to verify the position of each sample, and this is linked with barcode identification to create a worklist for each sample.

Process security
A worklist for each sample can be loaded into the Freedom EVOware software, and samples are traced throughout the process based on their respective loading position. Automated error handling ensures that sample errors are recorded and displayed next to the results, as part of the audit trail and sample log file. Error handling discriminates between controls and samples, because faulty controls would render full plates invalid. This allows ELISA testing to be performed without supervision, both during the day and overnight.

The automated process has been validated for all ELISA tests at the Institut Galli-Valerio, allowing the Freedom EVO platform to be used for a wide range of IDEXX Laboratories’ serological tests, including BVDV, IBR, Brucellosis, EBL and CAE.

Conclusions
The flexibility of the fully automated Freedom EVO platform offers effortless switching between ELISA tests. This allows the laboratory to respond rapidly to changing sample loads on any given day, and to cope with the demanding sample numbers of the Swiss BVDV eradication program, in addition to other testing demands during peak seasons.

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