Fish virology: from suspect to diagnosis

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National Reference Laboratory for fish diseases

WOAH Webinar on Aquatic Animal Health
“Strengthening National Capacities for Sustainable Aquaculture”
02 September 2026

List of WOAH notifiable diseases

SECTION: 10. DISEASES OF FISH

Chapter: 10.1. Infection with epizootic haematopoietic necrosis virus ★

~~Chapter: 10.2. Infection with Aphanomyces invadans (Epizootic ulcerative syndrome)~~ ★

~~Chapter: 10.3. Infection with Gyrodactylus salaris~~ ★

Chapter: 10.4. Infection with infectious salmon anaemia virus ★

Chapter: 10.5. Infection with salmonid alphavirus ★

Chapter: 10.6. Infection with infectious haematopoietic necrosis virus ★

Chapter: 10.7. Infection with koi herpesvirus ★

Chapter: 10.8. Infection with Megalocytivirus pagrus1 ★

Chapter: 10.9. Infection with spring viraemia of carp virus ★

Chapter: 10.10. Infection with viral haemorrhagic septicaemia virus ★

Chapter: 10.11. Infection with tilapia lake virus ★

OTHER RELEVANT NOT NOTIFIABLE VIRAL DISEASES

- Viral encephalopathy and retinopathy
- Channel catfish virus diseases
- Oncorhynchus masou virus disease

} WOAH Ref. Lab presence

- Carp Edema Virus
- IPN
- Carp reovirus
- Sturgeon Viruses
- ……

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Advances in Fish Health

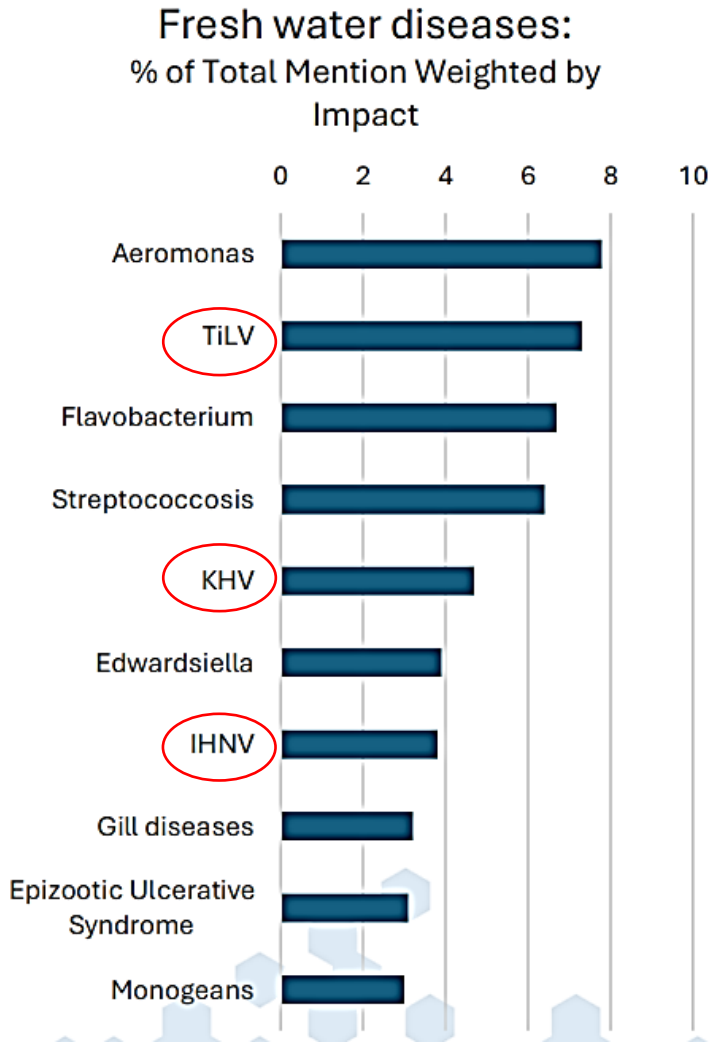
In 2025, the World Organisation for Animal Health (WOAH) and the STAR-IDAZ International Research Consortium, presented the results of a **global expert consultation** aimed at identifying and prioritizing research needs in aquaculture health, with a particular focus on finfish diseases.

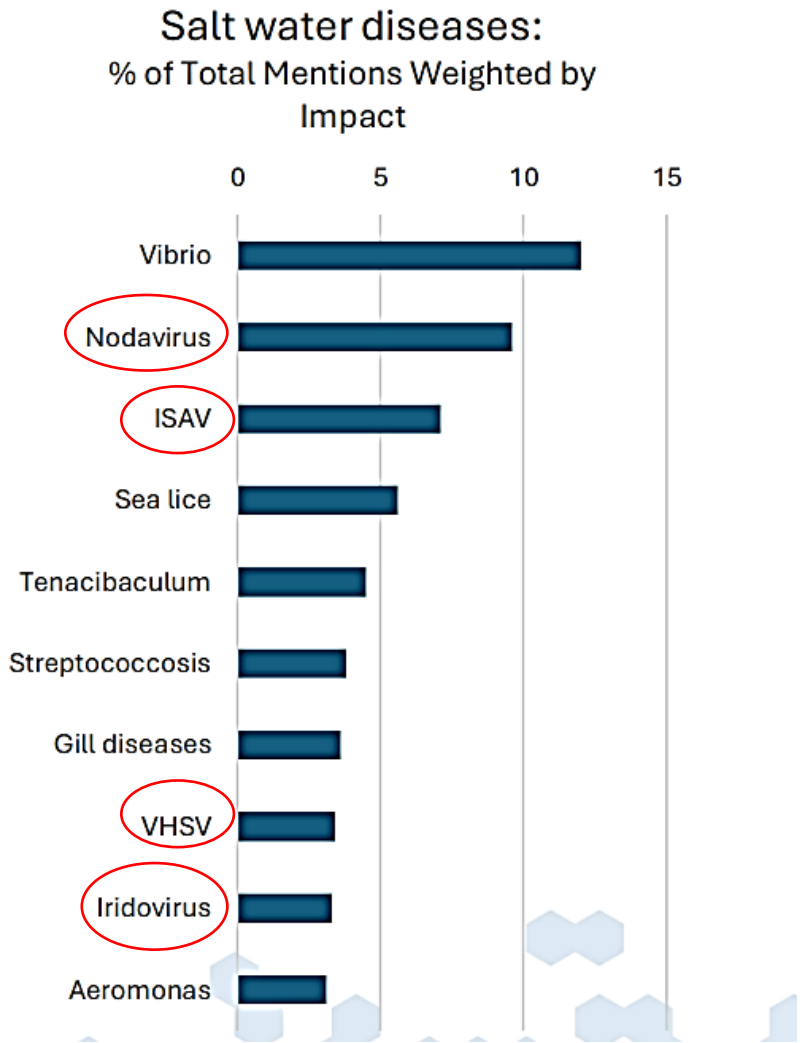
440 people in 187 countries

WOAH & STAR IDAZ IRC (2025). Report of the pre-workshop global consultation on aquaculture research priorities. Available online at: https://www.star-idaz.net/priority-topic/aquatic-diseases/#reports

Advances in Fish Health

Participants were asked which diseases they consider the most impactful in their sector





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To correctly recognized viruses the laboratory support is essential

Viruses as a cause of disease and pathology in aquatic environments have historically been underestimated

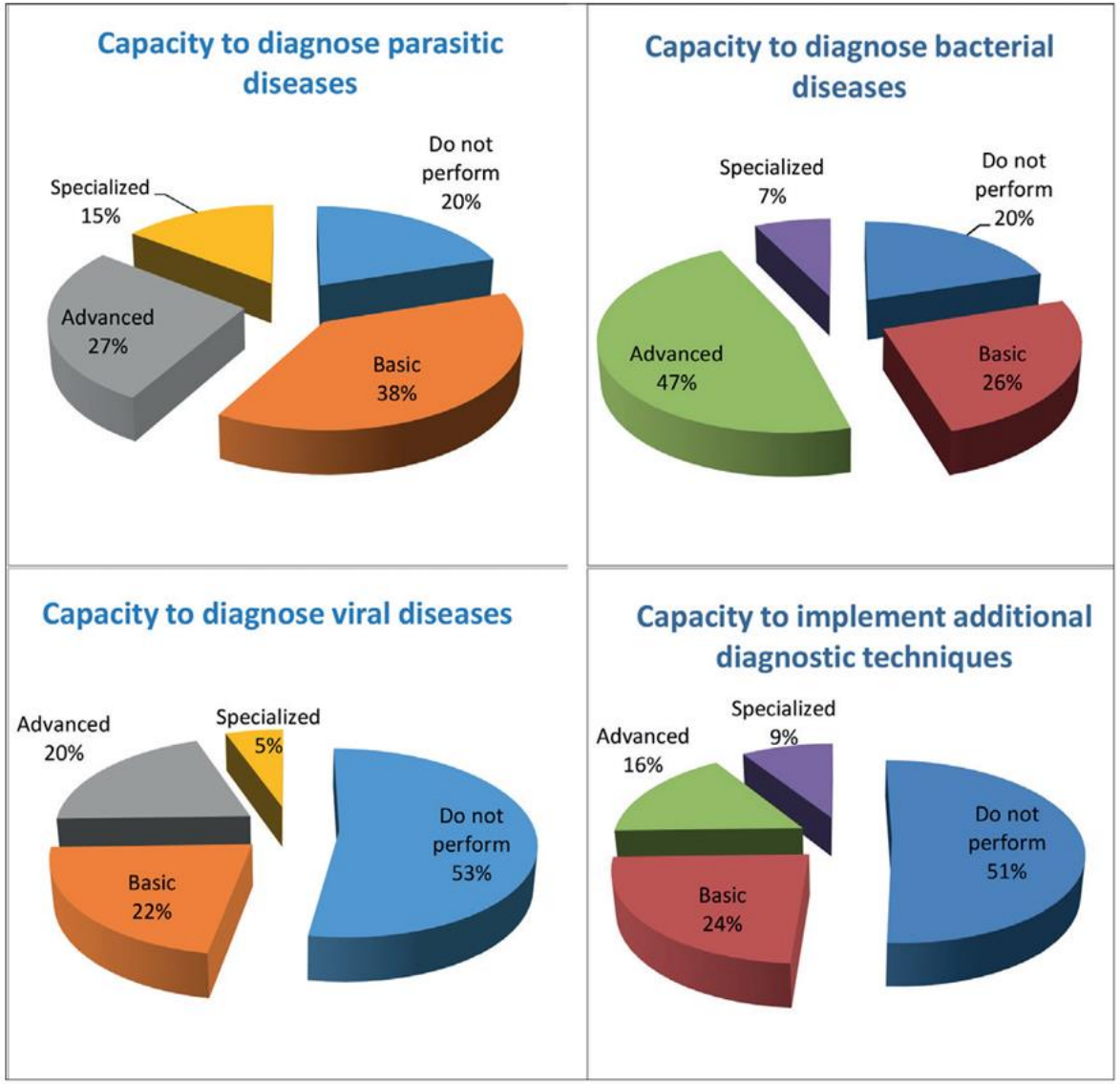
To correctly recognized viruses the laboratory support is essential

Zrnčić and colleagues (2021) found an important **lack of capacity to diagnose viral diseases** in the Mediterranean countries

Efforts should be engaged in capacity building in the countries missing techniques for viral disease diagnosis

Training is a priority

Zrnčić, S., et al. 2021. "Survey on Laboratories and Consultants Working in the Diagnostics of European Seabass and Gilthead Seabream Diseases: Preliminary Results." *EAFP Buletin* 41 (2): 81–90.



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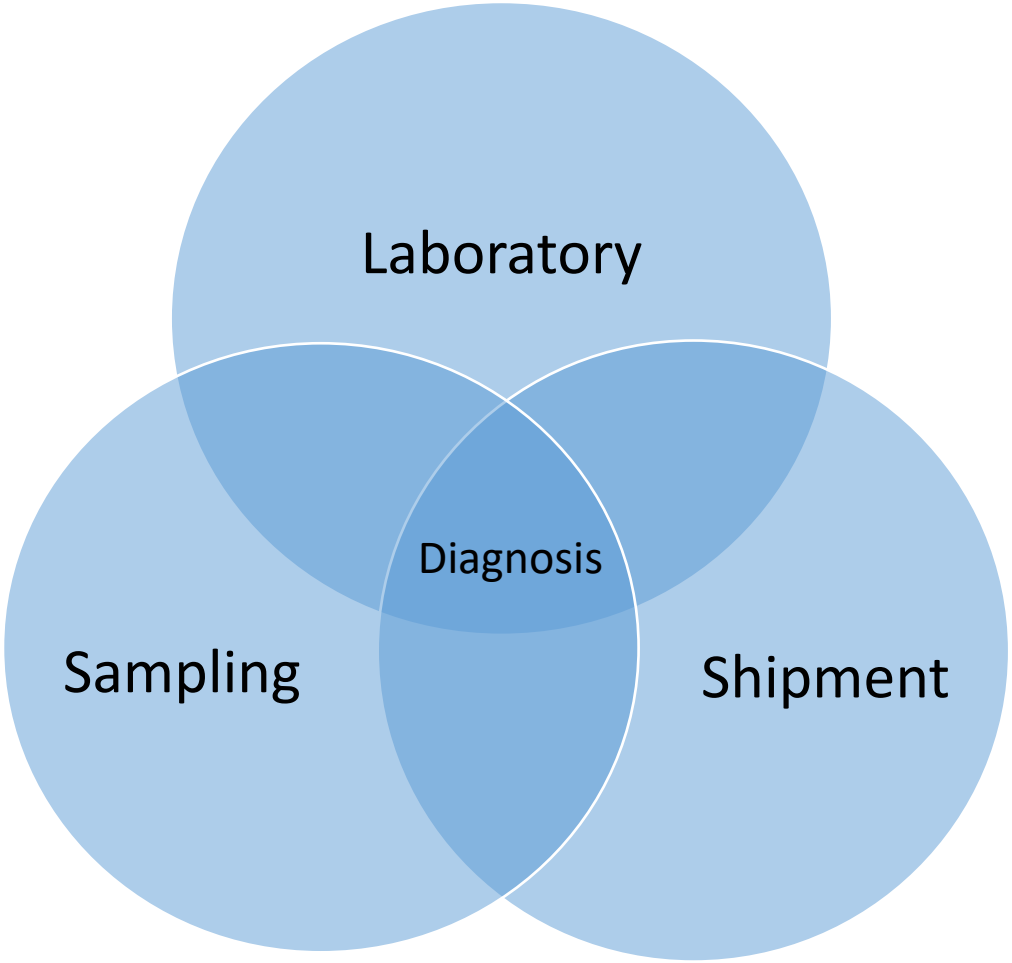
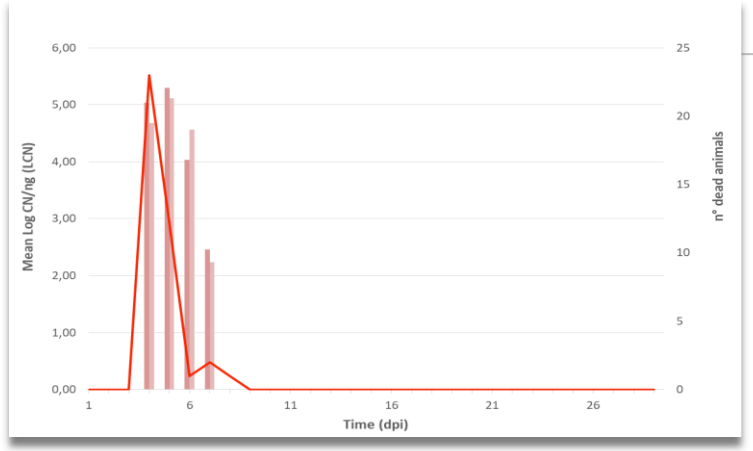
Diagnosis of viral diseases: a difficult but essential task

- Viral diagnosis requests specialized laboratories with :
- Knowledge of the diseases:
  - Target species of each virus
  - Target organs
  - Environmental parameters affecting disease manifestation
  - Main transmission route
  - Differential diagnosis
- Good sampling
- Good shipment



Clinical signs

- Acute or hyperacute mortality
- Only one specie is affected
- Mainly juveniles are affected
- Generally unspecific clinical signs:
  - Loss of appetite
  - Dyspnea
  - Change in color
  - Skin lesions/congestion

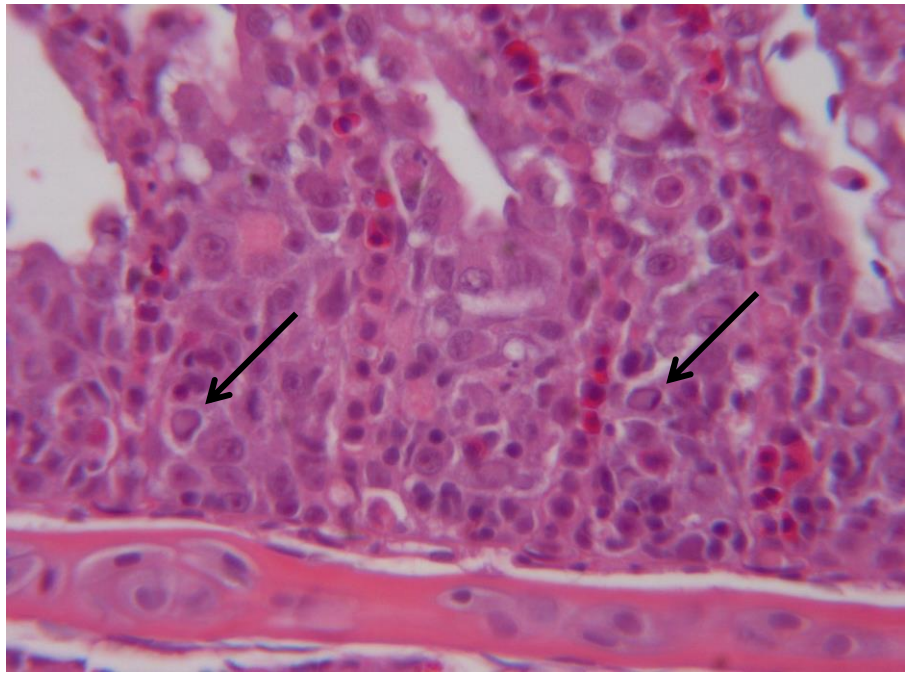


Gross lesions

- Generally unspecific gross lesions are present:
  - absence of ingesta
  - congestion or haemorrhages
  - necrosis of internal organs

- Coinfection can be present!

- Histology in some case can raise a strong suspect of viral infection, but it is not sufficient to make diagnosis



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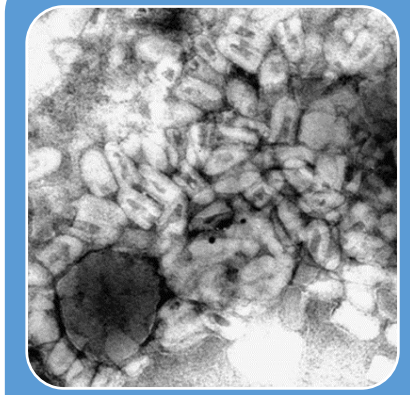
Virological methods



Direct methods (= antigen detection)

- Cell culture isolation
- Molecular methods
- Antigen detection assay (IFAT, ELISA…)
- Transmission electron microscopy (TEM)

Indirect methods

- Serological methods (= Ab detections)

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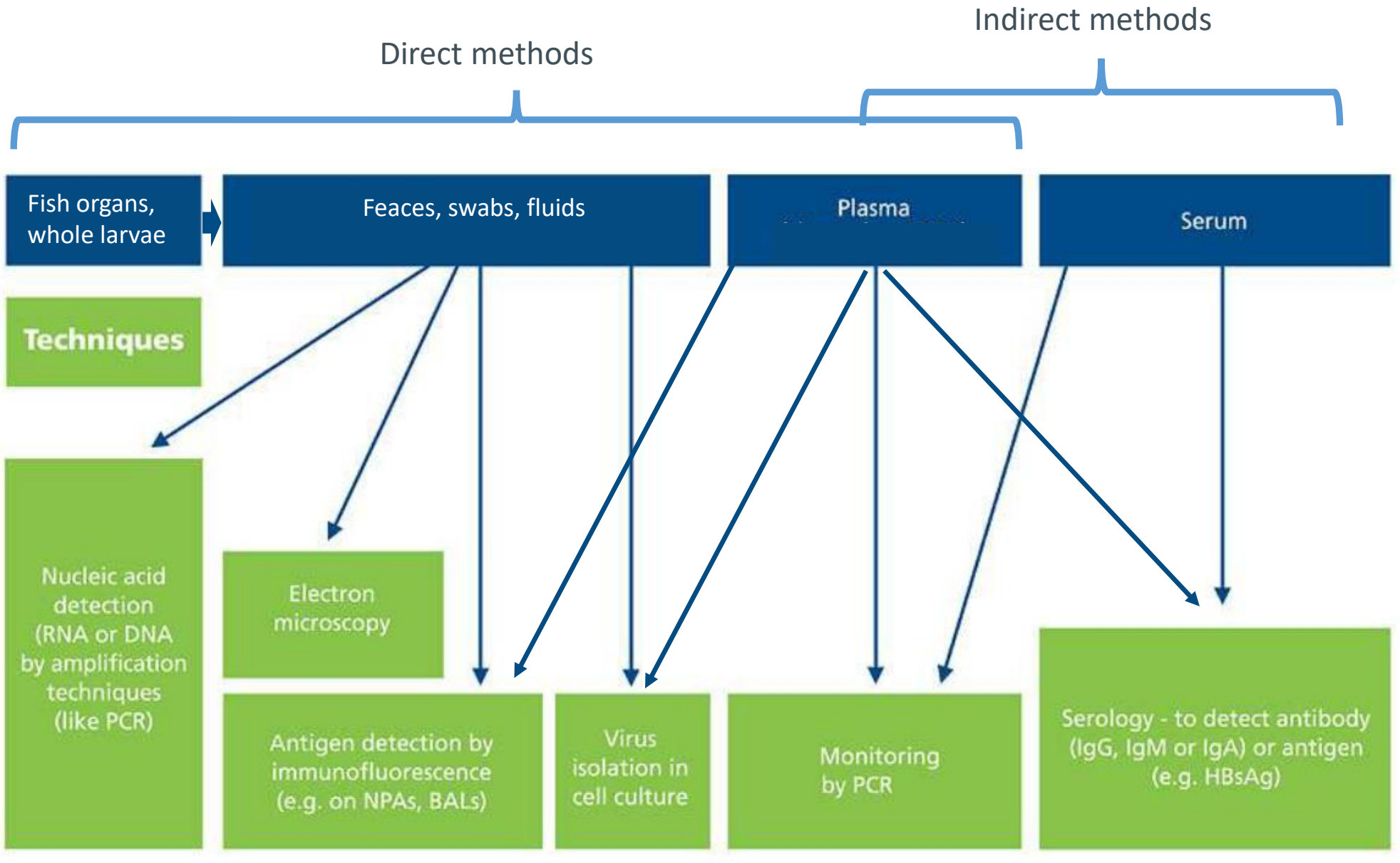
The right sample at the right moment and for the right assay



Cell culture isolation + antigen detection assay

PROS

- Gold standard technique
- Can grow more than one virus at the same time
- Provide info on the vitality of the virus
- Allow to obtain large amount of antigens to be fully characterized and investigated

CONS

- Time consuming and expensive methods
- Require skilled and trained staff
- Samples have to be shipped timely and under refrigerated conditions
- Many viruses are not cultivable → lack of suitable cell cultures
- Require cultivated agent identification
- Lack of laboratory performing this assay

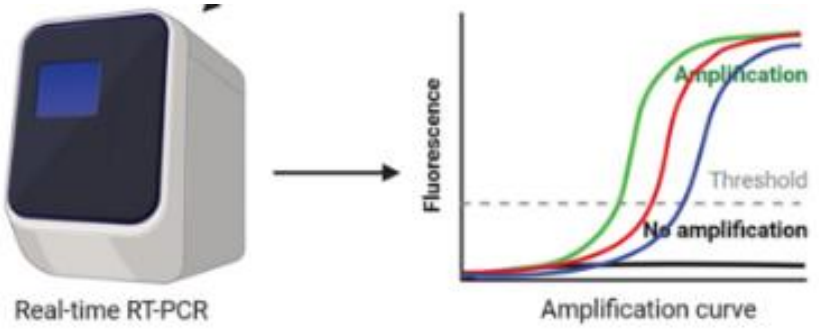
Molecular methods

PROS

- Fast
- Sensitive
- Specific
- Allow the implementation of molecular epidemiology
- Allows to carry out studies of pathogenesis with precise titration on copy number

CONS

- Specific (too much??)
- Need for primer sets specific per virus
- No indication about virus viability
- Affected by inhibitors present in the sample



New techonologies

Avaliable methods:

- NGS
- Nanopore sequencing
- CRISPR-Based Diagnostics
- Virus discovery

PROS

- Rapid (?)
- Suitable for large number of samples
- Can potentially identifies completely new or unexpected viruses

CONS

- High costs
- Data analysis complexity
- Lack of hosts genomes
- Sequences annotation mistakes
- Unknown clinical relevance

Serology (indirect method)

Avaliable methods:

- ELISA
- Serum-neutralization

PROS

- Not lethal sampling
- Repetable
- Suitable for large number of samples
- Provide information about the immunological history of the fish

CONS

- Assays not officially recognized
- A few methods has been validated
- A few laboratory available
- Sometimes difficult to be interpreted

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After the diagnosis

When a viral disease is detected no pharmaceutical treatment is possible

So why it is still important to correctly identity viruses?

<u>It can be legally required</u>

To acquire epidemiological data

Application of the “know your enemy strategy”:

- eradication
- vaccination
- increased biosecurity
- control of the clinical disease (i.e. by managerial procedure adaptation)

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