

Introduction to SCARfish

Andrea Marsella



Update on SWG Fish activities and possible interaction among WGs

Chair: Ciaran Kelly

Co-chair: Andrea Marsella

ToR 2023-2026



- ❖ To forge a strong linkage between MS and AC Ministries in charge of activities in the aquatic domain related to the production and use of biological aquatic resources, including fisheries and aquaculture, and the European Commission (DG RTD, DG MARE, DG ENV)
- ❖ To ensure that R&I are effectively addressed between MS and AC, on a long-term basis, to achieve a cost-efficient system of R&I effort in the areas of sustainable fisheries and aquaculture aligned with the relevant policies, directives, and strategies
- ❖ To provide evidence-based information on R&I needs to advise R&I policymakers so that they can design and implement efficient and effective initiatives and policies at EU and national levels for sustainable fisheries and aquaculture
- ❖ To collate existing information and where necessary collect new information in the areas of foresight and common research agendas with other SCAR groups

Current activities



Fisheries dependent data as
a tool for real-time advice
*Follow up to SCAR-Fish
document of October 2022*



Finalisation and soon published on website

Portfolio analysis on off-
shore wind energy impacts
on aquatic environments and
interactions with Aquaculture
and Fisheries



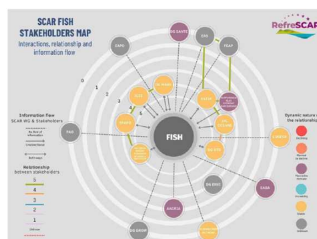
Focus on environmental impacts and space competition

Lot of work still on-going

Designed to address all relevant basin

RefreSCAR
support

Establishing and
strengthening connections
with other SCAR CWGs and
SWGs and stakeholders
relating to the aquatic domain



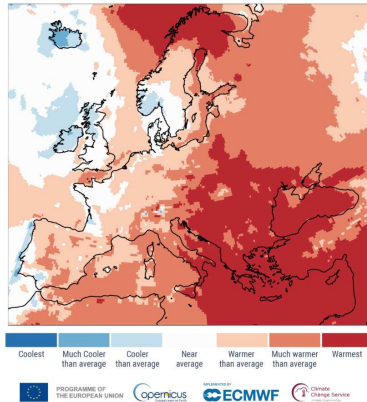
Climate change within EU



Summer 2024

Anomalies and extremes in surface air temperature for June–August 2024

Data: ERA5 1979–2024 • Credit: C3S/ECMWF



Anomalies and extremes in surface air temperature for June–August 2024. Colour categories refer to the percentiles of the temperature distributions for the 1991–2020 reference period. The extreme (“coolest” and “warmest”) categories are based on rankings for the period 1979–2024. Data source: ERA5. Credit: Copernicus Climate Change Service/ECMWF.

Seasonal average temperatures were predominantly above average over almost all of the continent, with record-high temperatures in southeastern Europe and northern Fennoscandia. In stark contrast, some regions in the western part of the continent, including Iceland, Ireland, northern and western parts of the United Kingdom (which overall experienced its coolest summer since 2015), and southern Norway were cooler than average.

The seasonal averages largely reflect the temperature distribution observed in July and August, while in June, a comparably larger area of western Europe experienced colder-than-average temperatures.

Parts of Europe saw substantial heatwaves during the summer. For example, in June, southern Italy, southeastern Europe and Türkiye were impacted by a heatwave, with temperatures reaching 40°C in many locations, and local temperature records broken. In July, heatwaves affected Italy, Greece, and Bulgaria, while in August, much of southeastern Europe, including Italy, Portugal, and Spain, experienced similar conditions. For more information on monthly variations in temperature anomalies, see the monthly bulletins of June, July and August.

The effect of the heatwaves is reflected in an above-average number of ‘warm daytimes’ over much of Europe throughout summer.

<https://climate.copernicus.eu/c3s-seasonal-lookback-summer-2024#:~:text=Data%20source%3A%20ERA5-,Credit%3A%20Copernicus%20Climate%20Change%20Service%2FECMWF,;C2%BC%20from%20July%202023.>

Climate change within EU



Summer 2024 in Italy

- ❖ Increased water temperatures severely impacted aquaculture and fisheries in the Mediterranean

- Mortalities related to environmental parameters
- Shift in distribution of wild aquatic animals
- Several disease outbreaks in both farmed and **wild fish**



Climate change within EU



- ❖ Climate change has been addressed by several international and European institutions and frameworks (EU Green deal, Horizon 2020 etc.)
- ❖ Several SCAR CWGs and SWGs have identified the climate change as one of the priority topics



Future activities and collaborations



- ❖ Who and from which perspective is dealing with climate change within EU?
- ❖ Are all involved institutions and stakeholders interconnected?
- ❖ Are aquaculture and fisheries taken into account in relation to climate change?
- ❖ What are gaps and needs of climate change adaptation plans for aquaculture and fisheries?
- ❖ Are effects of climate change on aquatic animal diseases sufficiently monitored?
- ❖ Are R&I outputs sufficiently transferred to the policy/industry level?





Thank you for your attention



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Coffee Break
until

Invited talk: Diagnostics of virosis

Antonio Lavazza
IZSLER, IT

SCAR Animal Health & Welfare Research CWG
Plenary meeting, 10 December 2024
Ministry of Health Rome, 10th December 20124



ISTITUTO ZOOPROFILATTICO SPERIMENTALE
DELLA LOMBARDIA E DELL'EMILIA ROMAGNA
"BRUNO UBERTINI"
ENTE SANITARIO DI DIRITTO PUBBLICO



DIAGNOSTICS OF VIROSIS: THE MIND IN THE FUTURE WITH A LOOK INTO THE PAST

Antonio LAVAZZA

Retired - Former responsible for the Virology Unit and the Animal Health and Welfare Department
Istituto Zooprofilattico Sperimentale della Lombardia e dell'Emilia Romagna (IZSLER), Brescia, Italy

10/12/2024



Diagnostic tools



- The tools are there....
- We have to use them....
- And above all, knowing how to use them.....



.....with judgment, pertinence and competence!



The diagnostic meaning.....



A correct interpretation of the results



A certain result



Activate alert systems, set corrective measures, direct and indirect (vaccination) mitigation and prevention measures, antiviral therapies.....





How should we approach the diagnosis ?



- Open the mind
- Explore all possibilities
- Be inclusive



The diagnostic approach (1)



**It increases
the level of
confidence
and
accuracy of
the result
obtained**



**It allows to
acquire
important
information on
any induced
viral disease**

- ▶ properties of the identified virus in terms of viability, i.e. the infective capacity
- ▶ resistance/tenacity in the environment
- ▶ the ability to infect one or more species
- ▶ the presence of any reservoir species, intermediate hosts or vectors
- ▶ the methods of dissemination and transmission, etc.



The diagnostic approach (2)



The identification of a whole virus or its traces (genome or antibodies)

- ▶ it is not, as often happens, a mechanical and repetitive action
- ▶ in which the samples are "processed" in a mentally aseptic way
- ▶ often without information on their origin and characteristics
- ▶ and just as "ignorantly" processed by high-performance machines, with high analytical sensitivity but certainly not "thinking"

- ▶ it is a meticulous process
- ▶ which follows precise rules
- ▶ assisted by a reasoned approach
- ▶ deriving from basic knowledge of clinics, epidemiology, pathology, etc



The anamnesis



It is crucial to acquire all available information on the "case"

- regardless of the diagnostic method(s) you intend to use
- indeed, precisely to define which is/are the most suitable for the purpose

breeders
(livestock species)



owners
(pets)



hunters, naturalists,
zoophile provincial guards,
rehabilitation centres etc
(wild animals)



Data, whether
individual,
collective or
environmental

Disease course:
onset, clinical
course,
symptoms

Age of infected
animals, species
involved

Morbidity,
mortality

Climate, farm
equipment and
structures
conditions,
treatments,
translocations,
etc.

Information
acquired during
the necropsy
(lesions,
anomalies,
dating of death,
etc.).

Most correct diagnoses depend on from an accurate anamnestic data collection!



The "quality" of the sample



For accurate virological diagnosis, it is important to consider:

- ▶ the origin, timing and characteristics of the sampling
- ▶ the facility for collection of materials
- ▶ the methods of storage and transport of samples

It is therefore necessary that:

- ▶ the sampling is accurate and aimed at the diagnostic suspect
- ▶ the sample is representative (high viral titer), preferably in the acute phase (viremia). Hyperthermia is a highly indicative sign
- ▶ the material is protected from physicochemical damage (excess T°C, extreme pH, disinfectants, light, irradiation and drying)
- ▶ the samples are stored adequately during transport (better if frozen) and delivered to the laboratory as soon as possible



Diagnostic procedure

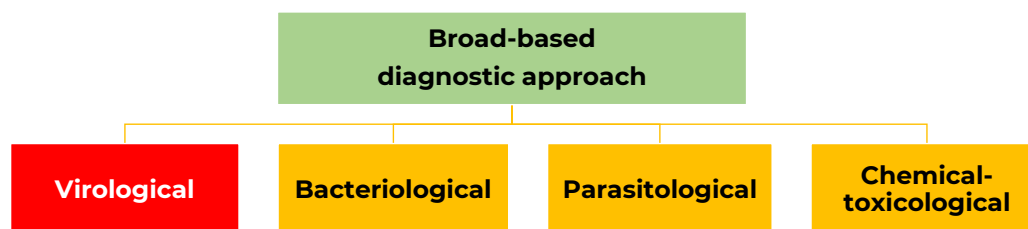


In the absence of a diagnostic hypothesis, for the samples taken:



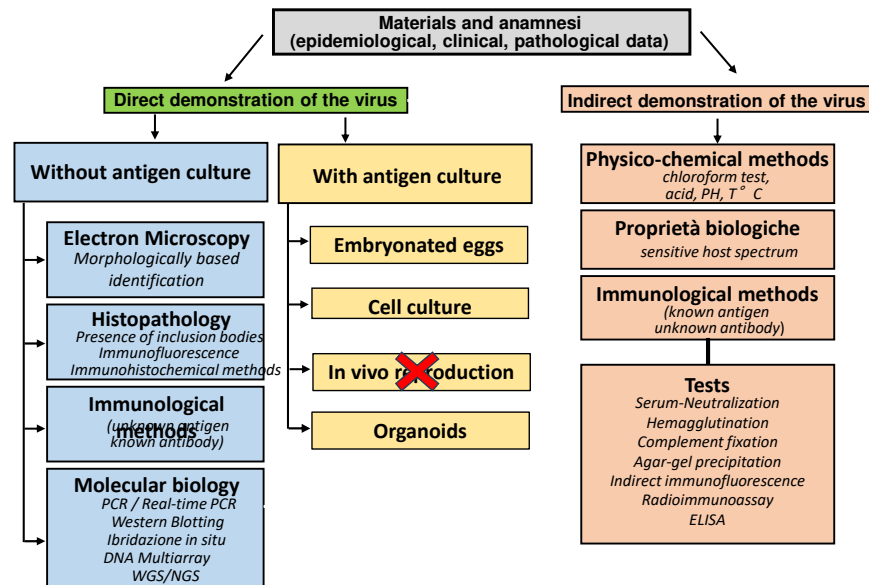
intra-vitam (feces, blood, swabs, urine, saliva, secretions, exudates, scabs, papules, vesicles, nodules, hairs, feathers, etc..)

post-mortem during necropsy (tissues, organs, intestinal contents, body fluids, blood, etc.)





Working scheme in virological diagnosis



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Diagnosis of new and/or unknown viruses



TARGETED METHODS FOR DIAGNOSIS

- ▶ Almost all virological methods, whether direct or indirect, are based on the principle of exclusion/confirmation of a given viral agent
- ▶ Diagnosis targeted from time to time against one or more known pathogens (possibly also at the level of the viral family)
- ▶ Although multiplex molecular or multiarray methods (which identify a large number of viruses with a single test) can be used simultaneously or in series, it is not always possible to identify unknown, unsuspected or completely new viruses



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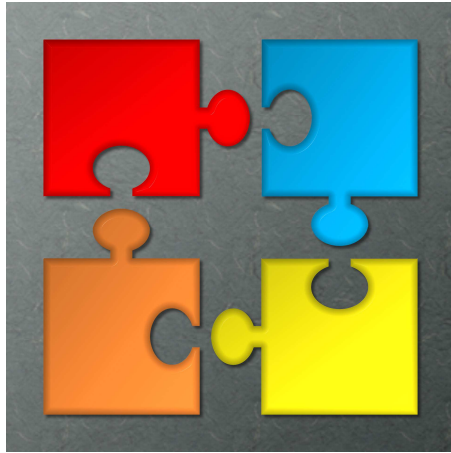
22



Diagnosis of new and/or unknown viruses



«CATCH ALL» METHODS FOR DIAGNOSIS



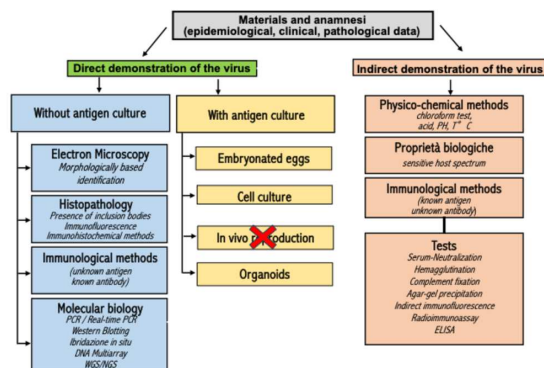
A metagenomics approach can be used for diagnostic purposes, with consequent still possible difficulties in interpreting the results



Use of classical methods such as isolation on cell culture and/or embryonated eggs for cultivable viruses only, and electron microscopy with negative staining methods



The added value in virological diagnostics



1. To be able to modulate the use of all these methods
2. To have the technical-logistical possibility of being able to apply them all in a single laboratory



And instead.....



There is Increasingly a tendency to favour a single or a few methods



1. for mere cost issues
2. to simplify and make the diagnostic outcome as quick as possible
3. to avoid investing in the training and knowledge of operators
4. to limit the number of them as much as possible in favour of advanced automation



The current situation



The approach with molecular methods (real-time-PCR, Multiplex PCR, digital-PCR, WGS/NGS etc.) is becoming almost the norm in most diagnostic laboratories



The methods of "classical virology" (immuno-enzymatic methods, in vitro isolation, phenotypic study of viruses, morphological identification by EM, remain the privilege of a few laboratories and less and less the subject of training and education



The risk to avoid



Bioinformaticians, molecular biologists

"Classic" virological diagnosis technicians



Figures that are now most in demand to fill the deficit in processing and interpreting the meaning of the large amount of data produced with WGS/NGS approach systems,

Figures capable of recognising a cytopathic effect, developing, validating and standardising an ELISA method, and observing and identifying a virus at the EM based on its shape and appearance.



Negative staining Electron Microscopy (nsEM)



Is it still a method with potential use in virological diagnosis?

It allows us to.....

1. quickly acquire diagnostic indications, even for non-cultivable viruses, present in association or unknown (**Catch-all method**)
2. be a complement to the virologist for a quick referral to further diagnostic tests from infected cultures with or without cytopathic effect
3. plan fixative interventions on necropsy and biopsy samples for both optical and electron microscopy
4. **give indications for further investigations** (e.g. genetic and molecular characterisation of viruses, pathogenesis of infections and disease epidemiology)

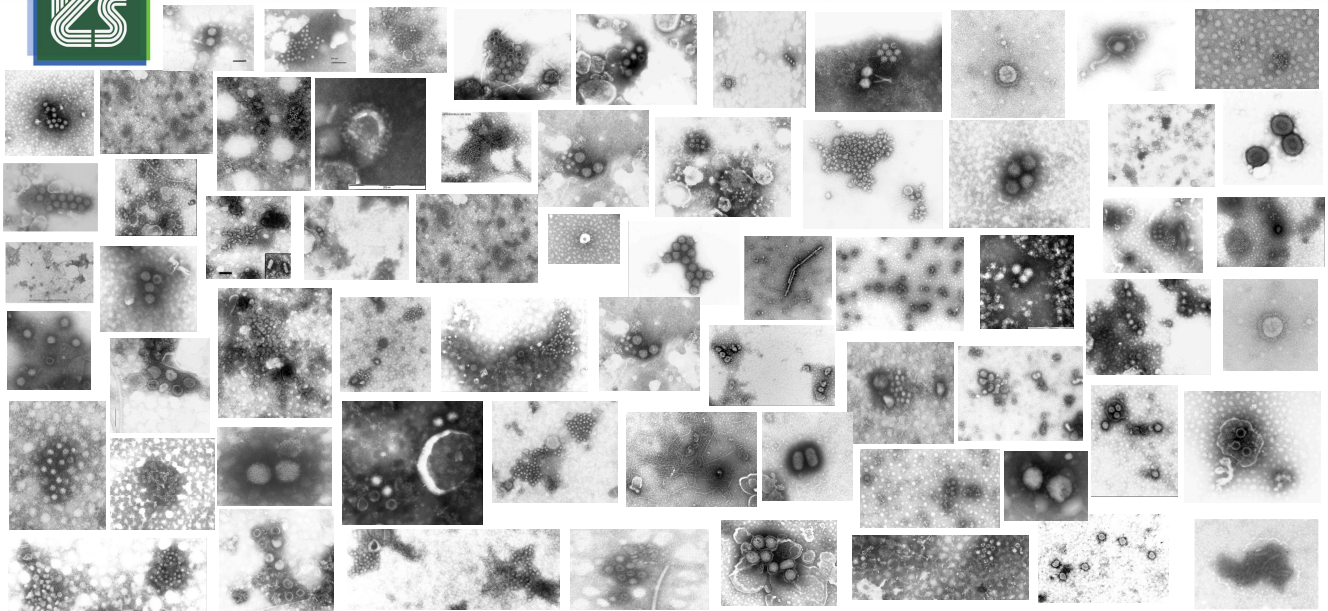
Drawbacks

1. Limited to a few labs
2. Variable sensitivity depending on the preparation method used (at least 10^3 particles/ml)
3. Not suitable for viruses that do not have peculiar morphological characteristics
4. Identical morphology within the same family (overcome with ImmunoEM)





In 38 years, a few thousand viruses observed



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Virtuous behaviour/approach to diagnosis.....(1)

..... projecting the mind into the future while keeping a look into the past



Modern molecular and complete genome sequencing methods benefit the entire diagnostic process by:

- *the greater sensitivity*
- *the automation and standardisation of processes*
- *the ease of reading and interpreting the data (at least diagnostic PCR)*



They can provide us with additional information that goes beyond the mere diagnosis, such as:

- *the determination of pathogenicity (e.g. HPAI)*
- *the distinction between vaccine and field strains (deleted viruses)*
- *the geographical origin and temporal genesis in evolutionary terms (phylogeography and molecular clock)*
- *the presence in the individual strains of evolutionary mechanisms (mutation, reassortment and recombination phenomena, etc.)*

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Virtuous behaviour/approach to diagnosis.....(2)

..... projecting the mind into the future while keeping a look into the past

Knowing how to combine these methods with a "classic" approach offers the virologist the opportunity to:

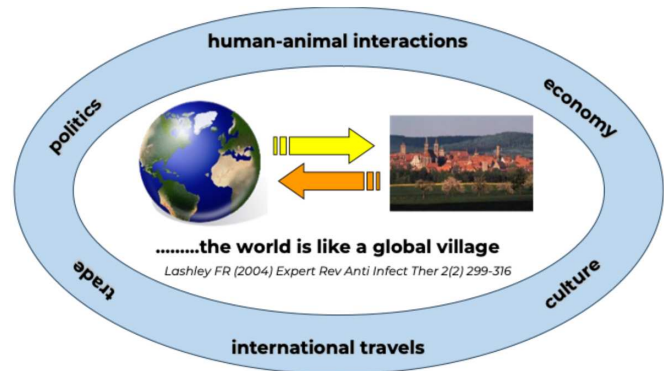
- opening the mind to broader possibilities of making diagnoses,
- going beyond the mere initial suspicion,
- sometimes making imponderable and unexpected discoveries.



The current global context

It is characterised by an increased «mobility» of viruses and bacteria and their vectors or vehicles of transmission.....

....as an effect of the globalisation process, climate change, habitat reduction and modification, social, environmental, political and economic changes



Transboundary animal diseases (TADs), originally confined to tropical countries, are on the rise worldwide

More and more often, we are facing the occurrence of spillovers from wild reservoirs to domestic animals and humans

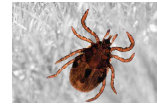
Significant increase in the number of incidents and alerts for viral diseases that subject public and animal health to constant and serious threats



Focus on.....



- Increasing frequency and diffusion of **invasive vectors and vector-borne viral infections**, causing exotic and emerging diseases



- Attention to the role of **peri-urban wild animals** (hedgehogs, rats, bats, birds, etc.) as carriers and vectors of viral infections



- Role of **minor and invasive domestic and wild animal species** in the epidemiology of epidemic and zoonotic infections



- Use of **on-site tools** (e.g. lateral flow, swabs with superior elution efficiency and high conservation properties) for testing and sampling in a more straightforward manner also under challenging conditions and for sending samples remotely



Conclusions.....(1)



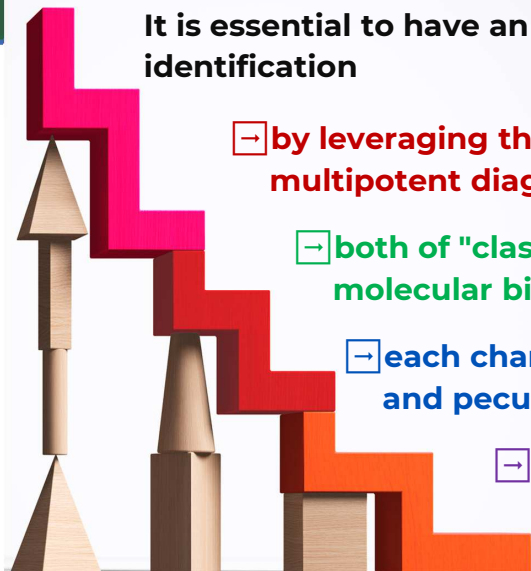
It is essential to have an "integrated" approach to viral identification

→ by leveraging the use of a broad variety of multipotent diagnostic methods

→ both of "classical" virology and based on molecular biology techniques

→ each characterised by specific prerogatives and peculiarities

→ versatility, flexibility of use, sensitivity, specificity, speed of execution, etc.





Conclusions.....(2)



Only with this approach can we become more confident and ready....

in the early detection of
viral pathogens, even
emerging or re-emerging
unknown ones



in the application of
surveillance and control
measures (which also
extend to the wild)

in the implementation of
efficient alert systems and
networks

in the correct definition of
biosecurity measures and
prophylaxis, mitigation, and
eradication

which are all necessary as effective tools
for prevention, control and eradication



TAKE HOME MESSAGE: The «BASS» diagnostic approach



Broad
Affordable
Simple & Speedy
Smart (Specific & Sensitive)

Thank you for your attention!



The Socratic paradox

"Surely I am wiser than this man; even if perhaps neither of us knows anything at all, but the difference between us is that he believes he is wise even if he knows nothing at all. I, at least, know that I don't know."



Antonio Lavazza (alavazza0@gmail.com)

CWG AH & W

Invited talk: Artificial Intelligence
and AH&W

*Alasdair Cook,
University of Surrey, UK*

Artificial Intelligence in Animal Health Research

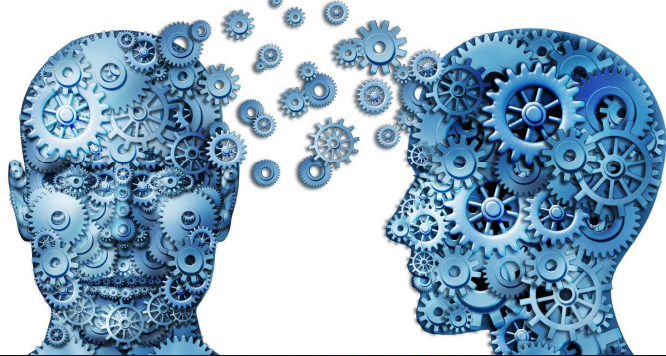
Prof. Alasdair Cook
University of Surrey

Standing Committee on Agricultural Research (SCAR) Animal Health &
Welfare Collaborative Working Group 10 December 2024

Illustration: Petra Péterffy

<https://www.nature.com/articles/d41586-024-03905-1>

AI meant Artificial Insemination when I was young ...





WHAT IS ARTIFICIAL INTELLIGENCE (AI)?



- AI is an umbrella term for technologies that simulate human intelligence
 - All current AI capabilities are narrow – trained to perform single tasks
 - Generative AI creates realistic new content from vast training data
 - Artificial General Intelligence (AGI) is a theoretical concept in which models learn to conduct new tasks without human engagement
- Machine Learning uses algorithms to identify patterns in data without explicit programming
 - Supervised learning predicts outcomes from labelled data eg images
 - Unsupervised learning analyses unlabelled data (eg clustering)
 - Reinforcement learning uses trial and error to maximise rewards (eg gaming)
- Large Language Models (LLMs) are generative AI tools that use neural networks and train on text data to deliver human-like language

USING GENERATIVE AI

Q: How often do you use generative AI tools (such as ChatGPT) at work?

- I use them every day
- I use them more than once a week
- I use them occasionally
- I've used them only a few times
- Never

Respondents who study AI



Respondents who use AI in research



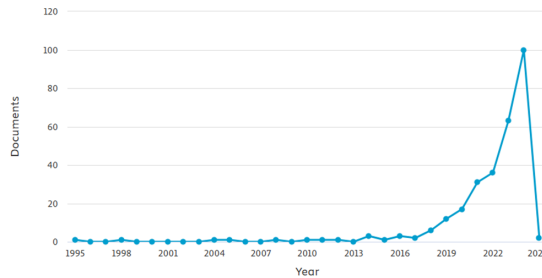
Respondents who don't use AI in research



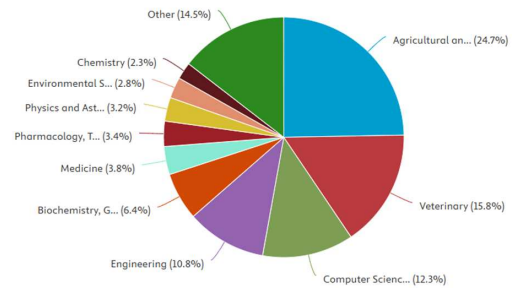
SCOPUS: (ARTIFICIAL AND INTELLIGENCE) AND (ANIMAL AND WELFARE)



Documents by year



Documents by subject area



WHY USE AI IN RESEARCH? THE FOUR VS



Value

Transformation of raw data into actionable insights eg optimising operations, enhancing decision-making, driving innovation

Delivering a positive RoI, aligned with goals



Velocity

AI can generate, process and analyse data at a previously unimaginable speed and efficiency



Volume

AI demands and uses vast amounts of data

Requires efficient data storage, management & accessibility; data assurance

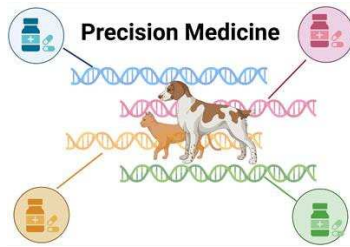


Veracity

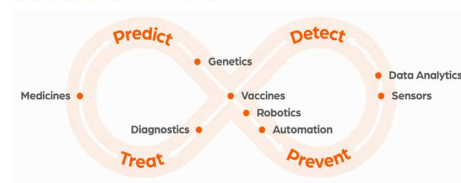
Validity, quality, accuracy & trustworthiness of data

- Rubbish in, Rubbish out
- Bias in training data, misrepresentation
- Incomplete, inconsistent or falsified data
- Integrity/ repeatability

AI APPLICATIONS IN ANIMAL HEALTH



Continuum of Care



<https://www.zoetis.com/products-and-science/research-development>

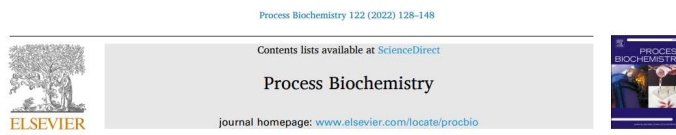


<https://www.who.int/multi-media/details/one-health-definition>



<https://www.mdpi.com/2504-446X/6/10/276> <https://creativecommons.org/licenses/by/4.0/>

REVERSE VACCINOLOGY AND ARTIFICIAL INTELLIGENCE



An *in silico* reverse vaccinology study of *Brachyspira pilosicoli*, the causative organism of intestinal spirochaetosis, to identify putative vaccine candidates

Myron Christodoulides^{a,*}, Daysiane de Oliveira^b, David W. Cleary^{a,c}, Maria Victoria Humbert^a, Ricardo A. Machado-de-Avila^b, Roberto M. La Ragione^d

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^b Programa de Pós-Graduação em Ciências da Saúde, Universidade do Extremo Sul Catarinense, Criciúma, 88806-000 Santa Catarina, Brazil

^c NIHR Southampton Biomedical Research Centre, University Hospital Southampton NHS Foundation Trust, Southampton, UK

^d Department of Pathology and Infectious Diseases, School of Veterinary Medicine, Faculty of Health and Medical Sciences, University of Surrey, Guildford, England GU2 7AL, UK



Brachyspira pilosicoli is a zoonotic spirochaete bacterium that can infect humans, pigs and poultry

USE OF ARTIFICIAL INTELLIGENCE TO IMPROVE ANTIBIOTIC STEWARDSHIP



> IEEE/ACM Trans Comput Biol Bioinform. 2022 Feb 7;PP. doi:10.1109/TCBB.2022.3148577.
Online ahead of print.

Rectified Classifier Chains for Prediction of Antibiotic Resistance from Multi-labelled Data with Missing Labels

Mukunthan Thammakulasingam, Brian Gardner, Roberto La Ragione, Anil Fernando
PMID: 35130168 DOI: 10.1109/TCBB.2022.3148577
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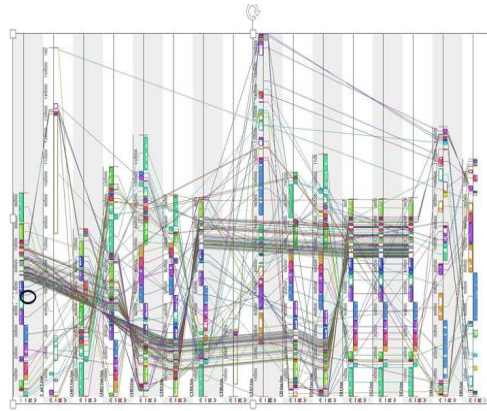
IEEE Access

Received 6 May 2021; accepted 6 July 2021; date of publication 17 July 2021; date of current version 18 July 2021.
Digital Object Identifier 10.1109/TCBB.2021.3148577

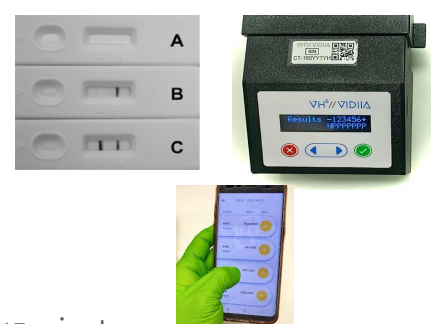
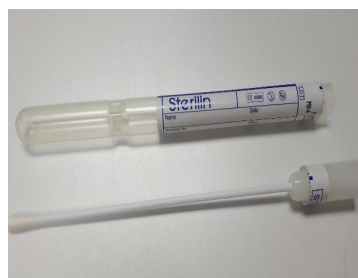
RESEARCH ARTICLE

TransAMR: An Interpretable Transformer Model for Accurate Prediction of Antimicrobial Resistance Using Antibiotic Administration Data

MUKUNTHAN THAMMAKULASINGAM¹, (Member, IEEE),
WENKUN WANG², (Senior Member, IEEE), MICHAEL KERRY³, ROBERTO LA RAGIONE^{1,4},
AND ANIL FERNANDO⁵, (Senior Member, IEEE)
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2) School of Computer Science, University of Surrey, Guildford, Surrey GU2 7XH, U.K.
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Corresponding author: Mukunthan Thammakulasingam (m.thammakulasingam@surrey.ac.uk)
This work was supported in part by the University of Surrey, and in part by Zoonosis through the Wellcome Institute.



THE USE OF AI TO IMPROVE RAPID PATIENT-SIDE DIAGNOSTICS



Patient-side test for AMR and pathogens in 15 minutes

J. Vet. Diagn. Invest. 2014 Jan;26(1):42-4. doi: 10.1177/1043986213519175. Epub 2014 Jan 7.

Design and application of a loop-mediated isothermal amplification assay for the rapid detection of Staphylococcus pseudintermedius.

Dinhe O' North S, Sawyer J, Roberts L, Fitzpatrick N, La Ragione R.

Frontiers | Veterinary Medicine

VIDIA Hunter: a low-cost, smartphone connected, artificial intelligence-assisted COVID-19 rapid diagnostic platform approved for medical use in the UK

A LAMP point-of-care test to guide antimicrobial choice for treatment of Staphylococcus pseudintermedius pyoderma in dogs

M. Prieto¹, M. Meneses¹, M. Traban¹, V. Sandegard¹, P. Carberg¹, A. C. Prieto¹, R. La Ragione², M. Schjorring³, L. Guardabassi⁴

Journal of Equine Veterinary Science

A Rapid and Simple Loop-Mediated Isothermal Amplification Assay for the Detection of Pseudomonas aeruginosa From Equine Genital Swabs

Christine Ayler¹, Noel Fitzpatrick¹, Jason Sawyer¹, Roberto La Ragione^{1,2}, Sarah North¹

Research in Veterinary Science

Rapid diagnosis of strangles (Streptococcus equi subspecies equi) using PCR

Portable Differential Detection of CTS-M ESH, Gene Variants, Muc2s, M1, and Muc2s, as well as From Escherichia coli Isolates and Animal Fecal Samples Using Loop-Primer Endonuclease Cleavage Loop-Mediated Isothermal Amplification

Microb. Biotechnol. 2023 May;16(5):977-989. doi: 10.1111/1751-7915.14227. Epub 2023 Feb 3.

Rapid culture-independent loop-mediated isothermal amplification detection of antimicrobial resistance markers from environmental water samples

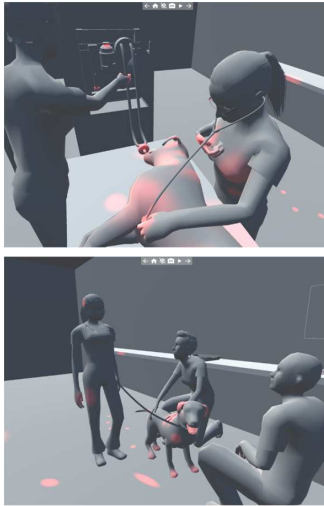
Mahmud M Hassan¹, Ahmad H M van Vliet¹, Owen Higgins¹, Lisa P Burke², Alexandra Choua³, Louise O'Connor⁴, Doreen Meehan⁵, Terry J Smith⁶, Roberto M La Ragione¹

Front. Microbiol. 2023 Jan;14:1074909. doi: 10.3389/fmicb.2023.1074909. Epub 2023 Jan 14.

Development of Loop-Mediated Isothermal Amplification Rapid Diagnostic Assays for the Detection of Klebsiella pneumoniae and Carbapenemase Genes in Clinical Samples

Yan Li¹, Yan Li², Yan Li³, Yan Li⁴, Yan Li⁵, Yan Li⁶, Yan Li⁷, Yan Li⁸, Yan Li⁹, Yan Li¹⁰, Yan Li¹¹, Yan Li¹², Yan Li¹³, Yan Li¹⁴, Yan Li¹⁵, Yan Li¹⁶, Yan Li¹⁷, Yan Li¹⁸, Yan Li¹⁹, Yan Li²⁰

MAKING THE INVISIBLE VISIBLE



Addressing Infection Risk in Veterinary Practice through the Innovative Application of Interactive 3D Animation Methods

Alastair S. Macdonald , Mark A. Chambers , Roberto La Ragione , Kayleigh Wyles ,
Matthieu Poyade , Andrew Wales , ...show all

Pages 51-72 | Received 18 Mar 2020, Accepted 14 Aug 2020, Published online: 03 Dec 2020

 Download citation

 <https://doi.org/10.1080/14606925.2020.1850225>

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Great British Taste



INOVENT
TECHNOLOGY



reboscientific



FarmSense:

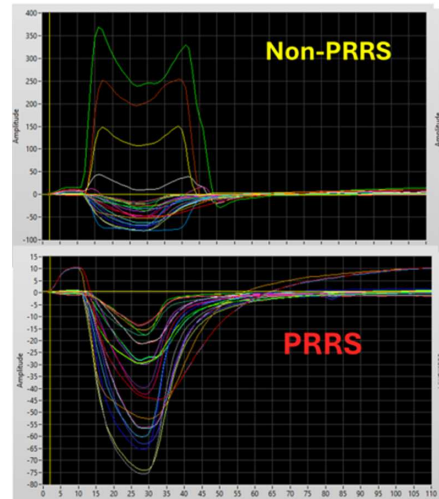
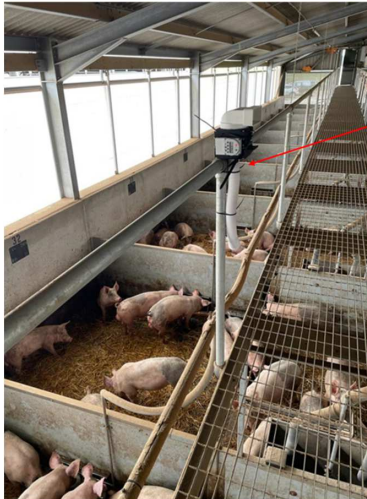
Ensuring sustainability of pig farming with automated machine vision and VOC monitoring





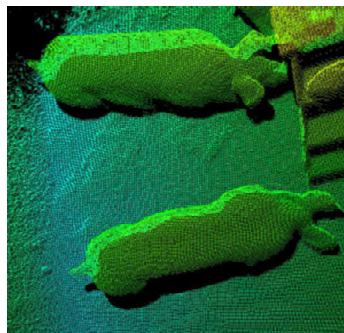
Air sampling

FarmSense



Behaviour and growth

FarmSense





	MEI	EVA	JOY
Data type	Behavioural data (Innovent)	VOC data (roboscientific)	Tracking data + VOC + environmental
Machine choice	Recurrent Neural Network (RNN)	Multilayer Perceptron (MLP)	Decision Tree
Input Data	Event-seconds (updated 5m)	13 features per VOC curve (updated 24h)	12 features (6 track, 3 VOC, 3 env) (updated 15m/24h/15m)
Results:	Intervention detection times: Bedding: 35-75 minutes Drinker off: 65-110 minutes	F1 score = 0.69	F1 score = 0.80 Disease: 45-120 minutes Bedding: 60-90 minutes



Goal: receive data from multiple modalities, use AI and statistical analysis to gain an understanding of pig behaviour in pens.

EVA, MEI and JOY can receive data from the data sources in real time and continually update.

- o "Disease signs" detected within 6 hours of vaccinations.
- o Behavioural disruption (new bedding) detected within 8 hours

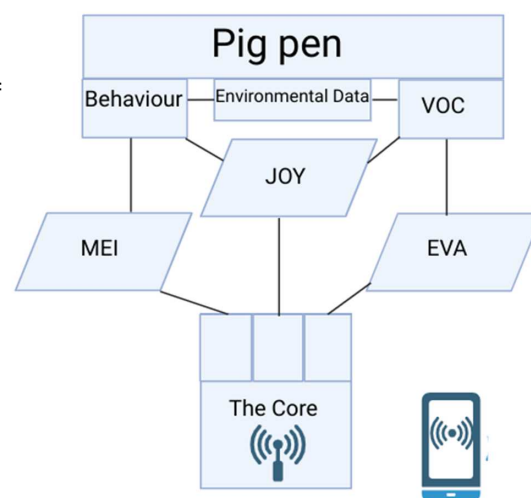
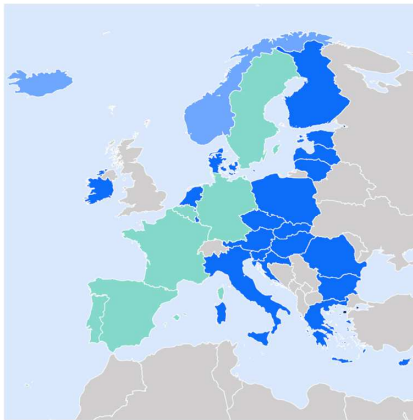




Diagram illustrating the DenseNet161 architecture for histopathological image classification. The input image (256 pixels by 256 pixels) is processed by the DenseNet161 Feature Extractor, which consists of dense blocks (purple boxes) and transition layers (yellow arrows). The output is a set of Bottleneck Features, which are then passed through a Classification Layer to produce the final classification results: Necrosis, OR, and Negative.



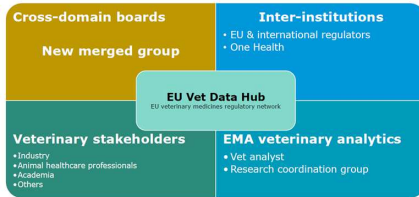
Application examples

Ewa Pacholewicz



Regulatory lifecycle	Pre-clinical phase (Use Case 1)	Clinical phase(s) I-III (Use Case 2)	Real World Evidence (Use Case 3)
Regulatory Areas	Innovation of medicines	Regulatory submission and evaluation	Pharmacovigilance
Business use case	Monitoring and facilitating relevant 36 methods by fostering cooperation of research and industry e.g. to identify alternative methods for animal trials.	Enabling a digital transformation to increase efficiency and reduce regulatory burden & Gaining efficiency and consistency in the regulatory assessment.	Signal evaluation: exploring the use of data from e.g. veterinary clinics, laboratories to evaluate the possibility of early signalling of a possible causal relationship between a product and an adverse effect.
	Setting study designs for drug testing before authorization	Faster authorization with real-world data (veterinary emergency)	Detecting side effects in animals

<https://www.camcar.astrazeneca.com/en/our-therapy-areas/medicines-life-cycle.html>



<https://www.ema.europa.eu/en/events/fourth-veterinary-big-data-stakeholder-forum>



From Data to Information to Actionable Insights & Solutions



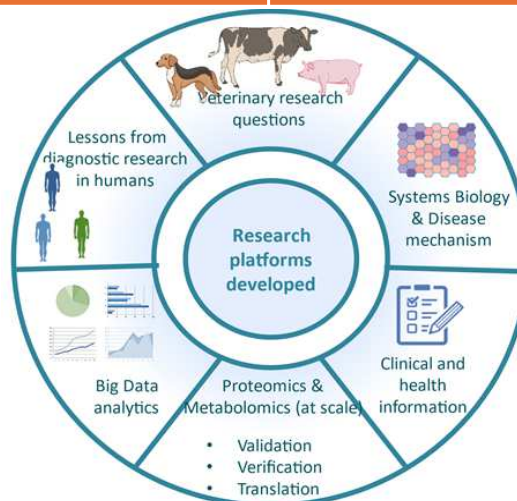
Improved Animal Health

Regional economic benefit

There are two key gaps in the translation of health research:

- ❖ translating ideas from basic and clinical research into the development of new products and approaches to treatment
- ❖ implementing those new products and approaches into clinical practice.

Sir David Cooksey, Review on human health research funding



Bringing expertise from human medical research, health informatics, 'omics and diagnostics development.

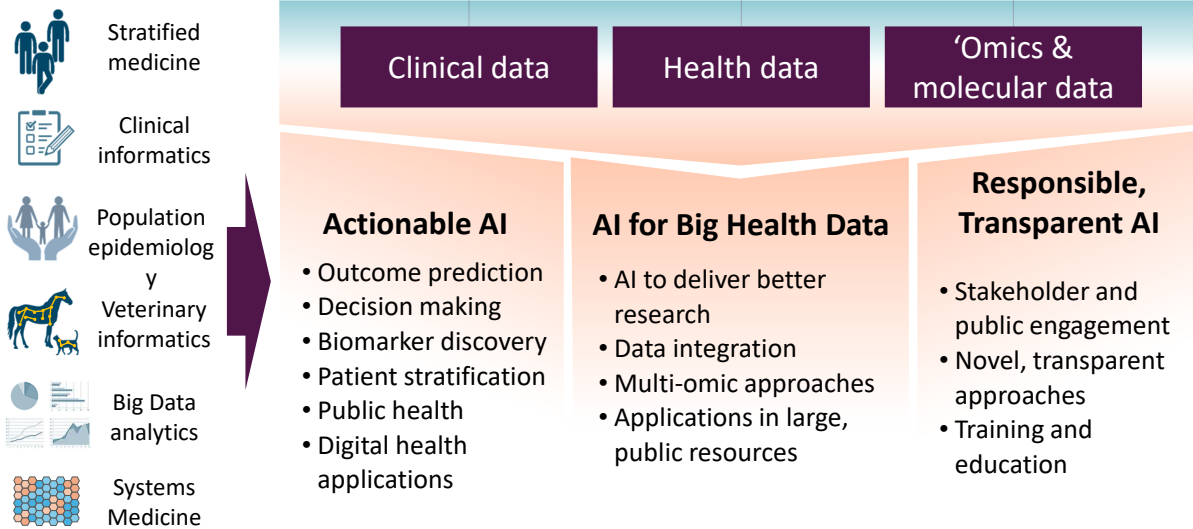
Our incubator enables (collaborative) commercialisation



Impact For Zoetis And The UK



vHive and Impact: AI and Informatics



Nophar Geifman

Challenges in the use of AI

1. **Halo Effect**- Outputs may appear to have an exaggerated value; blind trust can lead to overlooking errors or biases.
2. **Hallucination**- AI systems, especially generative models, can produce false or nonsensical information with high confidence.
3. **Bias**- AI models inherit biases present in training data, potentially reinforcing stereotypes or inequalities.
4. **Lack of Explainability** - Black Box.
5. **Data Quality and Quantity** - AI depends on large, high-quality datasets, but real-world data may be noisy, incomplete, or biased.
6. **Ethical Concerns** – Privacy, malicious purposes (e.g., fake news, bioweapons), lack of accountability and lack of societal trust
7. **Energy Consumption**
8. **Cybersecurity**
9. **Regulatory and Legal Challenges** - Rapid development outstrips policy and regulation
10. **Culture and education**



THE IMPOSSIBLE STREETS OF AI

The ability to build representations of our environment, called world models, helps humans to reason and plan. It is thought that AI systems will need this capacity, too, if they are to develop human-level intelligence. In the case of an AI system that was trained to predict routes taken by taxis in Manhattan, New York, its internal map did not resemble the real world. In later testing, this led to an inability to handle detours that were not present in the training data.



Conclusions



- Science is producing previously unimaginable amounts of data and advances in AI are essential to utilise this for new insights
 - Progress must be underpinned by a strong ethical framework and transparent governance
 - Research data should be **'findable, accessible, interoperable and reusable' (FAIR)**
 - The rapid rate of progress means mistakes will happen, too
 - Despite the apparent rush, adoption in veterinary research lags behind other fields
 - What are the implications for research funding models? Can we be nimble and agile in slow-moving bureaucratic systems & institutions?
 - AI is increasing the efficiency of administrative and management functions, freeing time and reducing costs
 - AI won't replace researchers – but researchers who don't use AI may be replaced!
- **"If we lose trust in primary scientific literature, we have lost the basis of humanity's corpus of common shared knowledge"** <https://www.nature.com/articles/d41586-023-02988-6>

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Zoetis

Casey Woodward
Oliver Boucher



AOB and conclusions of the meeting

Hein Imberechts

- Many thanks to Brid and Órlaith from the RefreSCAR project for the support!
- Next meeting: an option could be Poland: Warsaw or Cracow.
 - **Action:** please comment!