International
Veterinary Vaccinology
Network

Annual Report 2020

UKRI Medical Research Council

UKRI Biotechnology and Biological Sciences Research Council

GCRF Global Challenges Research Fund

Contents

Message from the Network Director

As for everyone, for the IVVN team this year has been dominated by the COVID-19 pandemic and the disruptions caused by this global scourge. After the disappointments of postponing our third annual conference in Vietnam, not once but twice, until a time in 2021, and suspending several proposed workshops, we have now begun to consider how the IVVN can best continue to support the global network that forms our community.

We are working on a number of new initiatives that we hope will benefit many of our members. Firstly, we are working hard to establish a new database that will integrate a wealth of diverse data to support veterinary vaccinology researchers. The database will contain information about specialised vaccine research resources and knowledge, highlight groups with pathogen-specific expertise, hold information about current research activities and also information about industrial and academic partners. It is quite an undertaking, but establishing a well-curated and comprehensive information resource has been a recurrent feature of discussions with several stakeholders and we think it will be worth the effort.

Secondly, we are starting an online IVVN webinar series that we hope will give our members across the globe the opportunity to hear from experts in a variety of areas of vaccine research. In addition, we are looking to initiate or expand on other activities that could continue to support IVVN members; recommendations of how we can do so in these difficult times will always be welcome. Adapting to the 'new normal' will be a challenge for a network like ours, where bringing people together is core to everything we do, but some of the innovations we are planning may well turn into long term activities that will complement those we have so enjoyed undertaking in the first two years.

In terms of our catalyst funding, we are delighted to have funded a total of 13 pump-priming awards and 13 laboratory exchange awards to date. Some of these projects have now finished, others are ongoing, and we are looking forward to seeing the outcomes of all of our funded research activities. Furthermore, we are excited about the female fellowship scheme we launched this year with our partners at the International Development Research Centre (IDRC), and we hope that we can continue to fund new and exciting projects through new opportunities over the coming years.

As ever, if you have any suggestions on how we can improve the network, then please get in touch with the IVVN team at IVVN@roslin.ed.ac.uk.

Stay safe and stay well
Tim

Dr Timothy Connelley
Network Director

Background

Animal diseases have significant impacts on societies in low-and-middle income countries (LMICs), through reduced animal health, impaired welfare, reduced livestock productivity and public health. Vaccines offer the most sustainable route to control and prevent many of the most devastating diseases of livestock. The IVVN provides the opportunity to establish multi-partnered, international collaborations that bring together the diverse skills that can accelerate the development of vaccines.

The IVVN offers a unique opportunity to establish a forum for specialists to focus on establishing new collaborations between partners with complementary expertise to address critical 'bottle-necks' in the development of veterinary vaccines for LMIC priority diseases. Many of these obstacles are relevant to human vaccinology and so much of the science conducted by the Network will have applications under the 'one-health' remit.

The IVVN launched in August 2017 after receiving £2.8M from the United Kingdom's Medical Research Council and Biotechnology and Biological Sciences Research Council, as part of the Global Challenges Research Fund. The activities of the Network will be achieved through:

- Hosting networking events.
- Providing catalyst funding.
- Hosting outreach activities.
- Being a central 'hub' for information dissemination.

Organisational structure

The IVVN is directed by Dr Timothy Connelley and Professor Bryan Charleston, and is advised by a network management board and an external advisory group comprising international experts from across the fields of human and veterinary vaccinology.

The Network is managed by Dr Carly Hamilton, with communications support by Dr Mabon Elis and administrative support by Anne Syrett. Please do not hesitate to contact the team at IVVN@roslin.ed.ac.uk if you have any questions or comments.

Network management team

- Network Director: **Dr Timothy Connelley**, Roslin Institute, UK.
- Network Co-Director: **Professor Bryan Charleston**, The Pirbright Institute, UK.
- Network Manager: **Dr Carly Hamilton**, Roslin Institute, UK.
- Network Administrative and Communications Assistant: **Dr Mabon Elis**, Roslin Institute, UK.
- Network Administrator: **Anne Syrett**, The Pirbright Institute, UK.

Network management board

- **Dr Pip Beard**, The Pirbright Institute, UK.
- **Dr Baptiste Dungu**, Onderstepoort Biological Products, South Africa.
- **Dr Michael Francis**, BioVacc Consulting Ltd, UK.
- **Professor Adrian Hill**, The Jenner Institute, University of Oxford, UK.
- **Dr Musa Mulongo**, International Livestock Research Institute, Kenya.
- **Dr Vish Nene**, International Livestock Research Institute, Kenya.
- **Professor Brian Perry**, Universities of Oxford and Edinburgh, UK.
- **Dr Jeremy Salt**, GALVmed, UK.
- **Professor Fiona Tomley**, Royal Veterinary College, UK.
- **Professor George Warimwe**, KEMRI-Wellcome Trust Research Programme, Kenya.

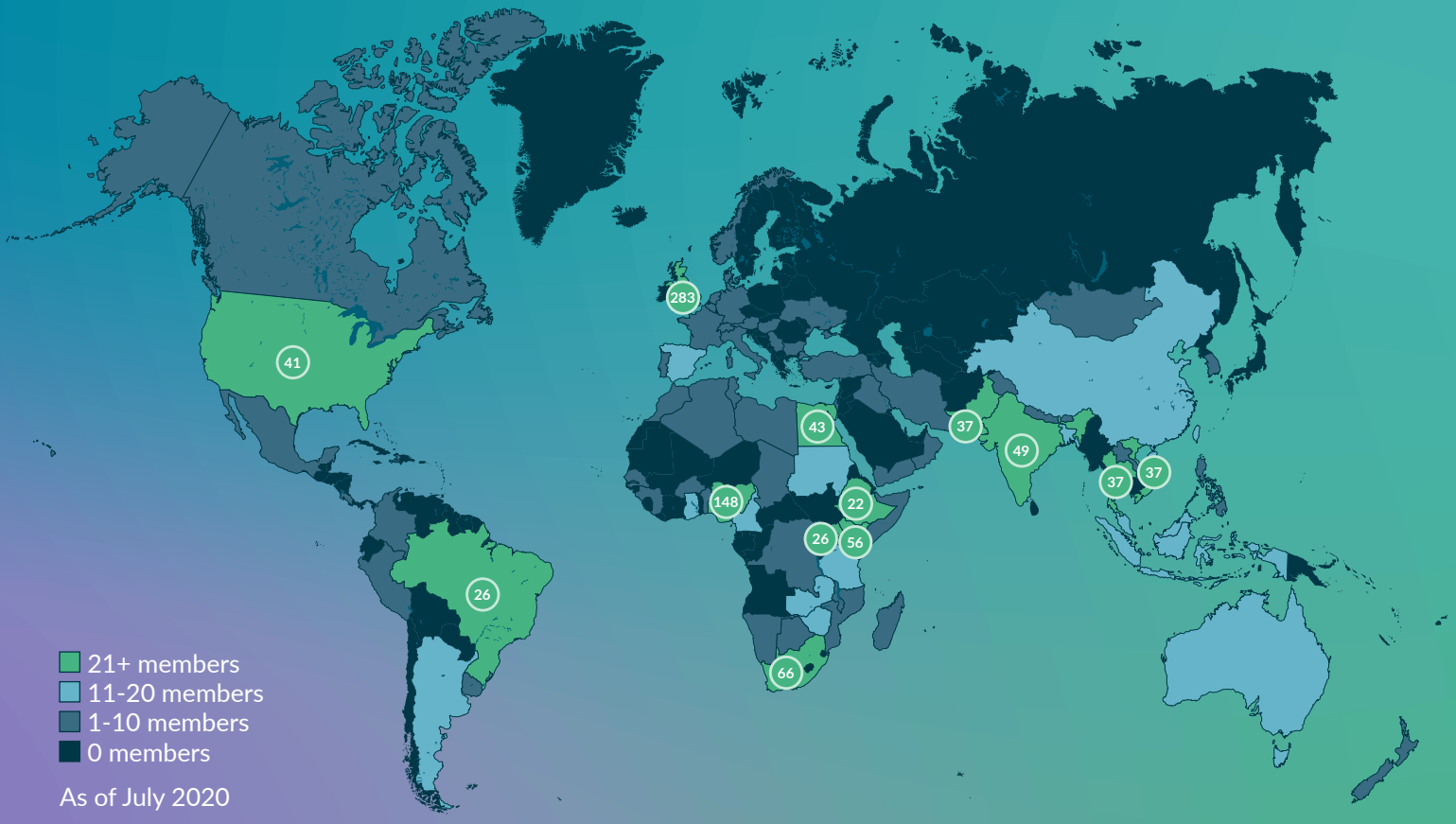
Many thanks to **Professor Alexandra Adams** (University of Stirling, United Kingdom), who retired from the network management board earlier this year.

External advisory group

- **Dr Keith Sumption**, Food and Agriculture Organisation of the United Nations (FAO)

Membership

Since welcoming our first IVVN members in August 2017, our membership has grown steadily month by month. The Network now has more than 1,250 members in 83 countries around the world, and we would like to thank all of you for your continued contribution to the community we are building.



Not yet a member of the Network?

Membership is free, and registering is quick and simple. Visit intvetvaccnet.co.uk/user/register to sign up.

Benefits of being an IVVN member include:

- Being part of an international community of researchers working to develop improved vaccines for major livestock and zoonotic diseases.
- Access to potential collaborators from across the fields of veterinary and human vaccinology through our members directory.
- Networking opportunities through attendance at our annual scientific meetings.
- Members are eligible to apply for scholarships to attend our annual scientific meetings.
- Members are eligible to apply for pump-priming grants of up to £100,000 and laboratory exchange awards of up to £10,000 to accelerate their vaccine research.
- Opportunities to host workshops on specific vaccine-related topics.
- Notification of news, events, training, funding and publications of interest in our monthly newsletters.

New search terms for the members directory

One of the most popular features of the IVVN website is the searchable directory of all our members. By searching for other IVVN members, you can find new collaborators to work with on future projects.

This year, we updated the directory to include key search terms to make it easier for IVVN members to find potential collaborators. As well as the previous options of searching by keyword and location, you can now browse members by **academic career stage**, **scientific discipline**, and by the **host species**, **pathogen species** and **vaccine development stage** they work on.

How do I search the directory?

You can access the IVVN members' directory at intvetvaccnet.co.uk/members. You will see six search fields, and you can use as many options as necessary in your search query.

Search bar

The first box allows you to search the database by name or keyword. This works with any word that shows up in a member's biography or research interests section.

Career stage

The career stage field allows you to view members who are group leaders, postdocs, postgraduate students or undergraduate students.

Discipline and stage of vaccine development

IVVN members work across many different scientific disciplines, from immunology and epidemiology to bioinformatics and ethics, and you can browse by any combination of these disciplines using the new search function. You can also view members by the stage of vaccine development they work on – eg field trials, antigen discovery or vaccine delivery.

Host and pathogen species

Another important way you can now filter the directory is by the species of host and pathogen/parasite members work on. You can browse members working on any host species, from pigs and poultry to wildlife, as well as zoonotic diseases. When searching for members by the pathogen they work on, you can select either the type of pathogen (viruses, bacteria and parasites) or specific pathogen.

Location

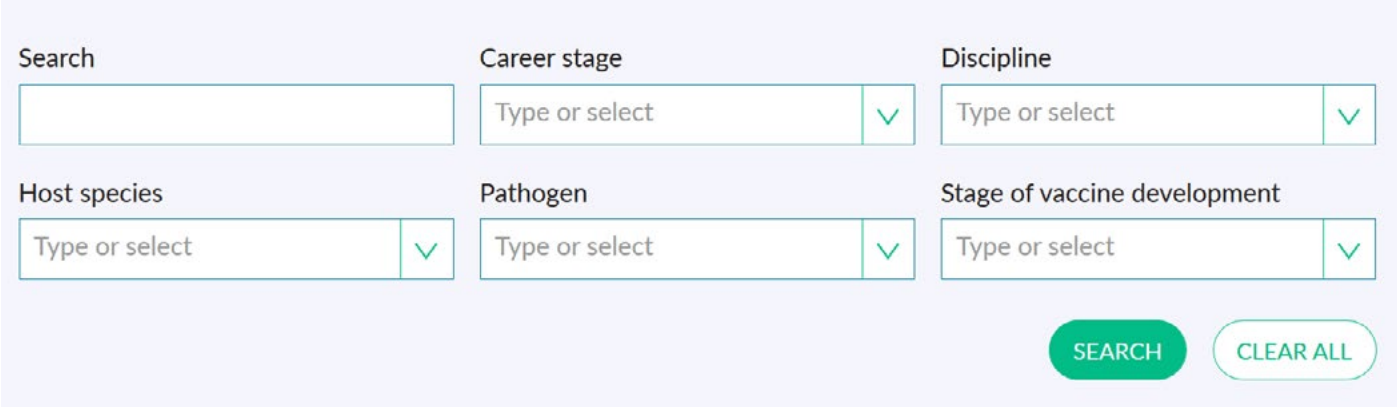
You can also continue to search the directory using the map of members' locations. Use the map to zoom in on a particular region. If you use the search terms to filter the directory, the map will also update to reflect these results.

Want to see your details in the directory?

Members can easily add the new search terms to their profiles by logging in to the website. If you are not yet a member, you can register for membership at intvetvaccnet.co.uk/user/register.

Are there any terms missing?

If you think any terms are missing – for example a pathogen species that is not listed – please let us know by emailing IVVN@roslin.ed.ac.uk.



Members' survey 2020

Earlier this year, we conducted a survey of IVVN members using an online questionnaire platform (Online Surveys by Jisc). Members were sent the link to the survey with the IVVN newsletter in February, March and April 2020, and twice in a direct email. A total of 241 members – around a fifth of the membership – filled out the questionnaire over the two months it remained open.

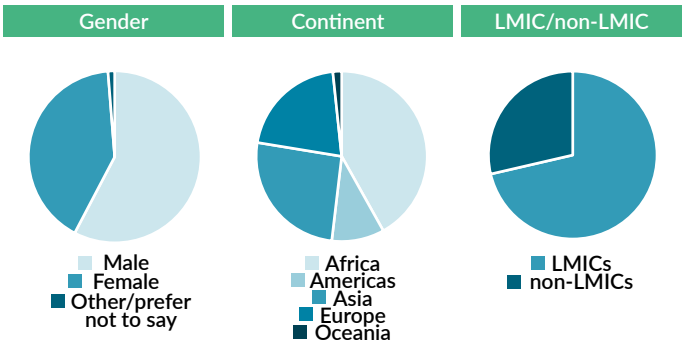


Figure 1 Survey respondents' gender, continent (United Nations geoscheme) and whether or not they work in a low- or middle-income country (according to the World Bank)

The survey's respondents worked in 57 countries, with the UK (39 respondents), Nigeria (27), South Africa (12), India (11) and Kenya (10) the five best-represented countries. 172 (71%) worked in a low- or middle-income country (LMIC; classed as least developed, other low-income, lower middle-income or higher middle-income by the World Bank), slightly higher than the IVVN membership as a whole (65%). 58% of respondents identified as male and 41% as female – similar to the estimated gender ratio of IVVN membership (61% male and 39% female). These demographic details are summarised in **Figure 1** above.

What are the greatest professional challenges and barriers that have negatively affected your scientific research?

When we last surveyed the IVVN membership, one of the questions that gave us the greatest insight into how members felt was one about the challenges and barriers they have faced in their research. We asked the same question this year, which confirmed 2018's results (**Figure 2**).

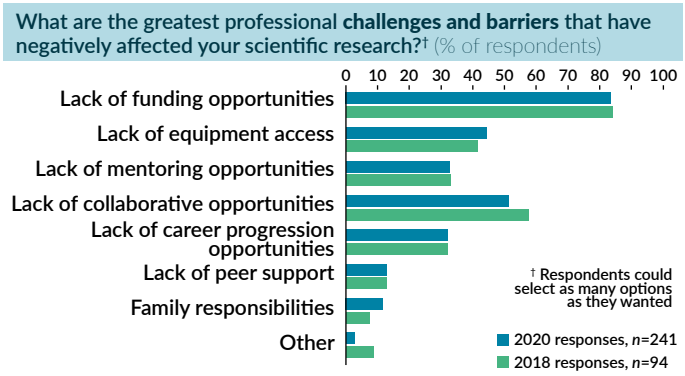


Figure 2 All responses to the question "What are the greatest professional challenges and barriers that have negatively affected your scientific research?" from the 2020 and 2018 members' surveys.

Many of these options reflect areas the IVVN is currently working to address, while others relate to possible future activities. Perhaps unsurprisingly, funding was the most commonly cited barrier and, although we continue to try to make as much funding as possible available for scientific research, this is likely to remain a barrier.

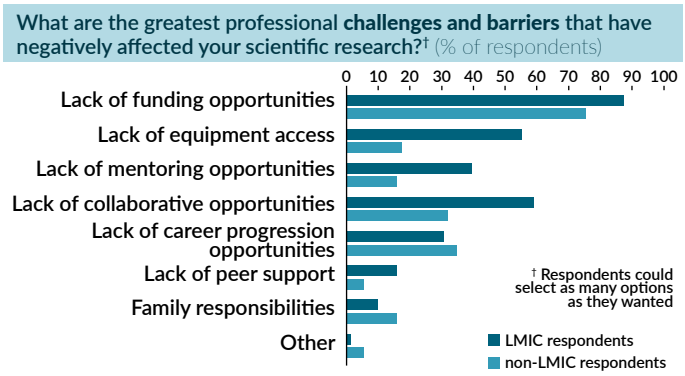


Figure 3 Responses to the question "What are the greatest professional challenges and barriers that have negatively affected your scientific research?" weighted according to whether or not respondents worked in an LMIC.

Many of the challenges were particularly felt by respondents from LMICs (**Figure 3**). 55% of LMIC-based respondents described a lack of access to scientific equipment as a professional barrier – much more than the 17% from high-income countries (HICs). This supports the case for the proposed IVVN equipment exchange programme, which will repurpose unused equipment for use in LMIC laboratories.

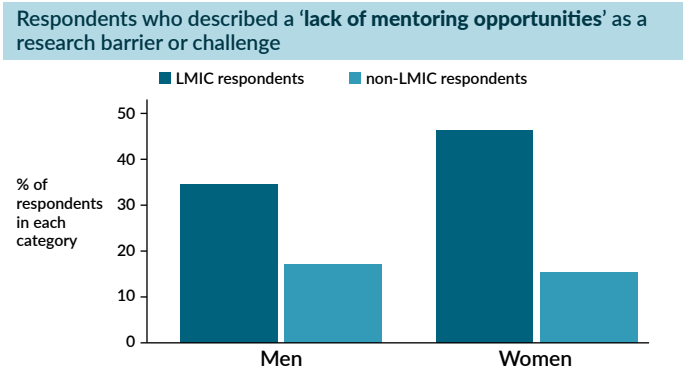


Figure 4 Respondents who selected 'lack of mentoring opportunities' in response to the question "What are the greatest professional challenges and barriers that have negatively affected your scientific research?" weighted by gender and by the World Bank income levels of the countries where respondents work (low- and middle income countries and high-income countries).

LMIC respondents also disproportionately identified a lack of mentoring opportunities and a lack of collaborative opportunities as barriers. The latter challenge is something the IVVN members' directory aims to address by improving the ease with which members' can find collaborators for their research. Recent and future improvements to how the directory works, such as the introduction of expertise- »

based filters, will hopefully address this further.

Women from LMICs were the most likely group to identify a lack of mentoring opportunities as a challenge, with 47% of the survey's 73 LMIC-based female respondents selecting this option (Figure 4). The new IVVN Fellowship programme, which aims to provide mentors for female postdoctoral researchers from LMICs, will hopefully begin to address this.

Female respondents from high income countries were more likely to identify a lack of career progression opportunities as a barrier, with 58% of the survey's 26 HIC-based female respondents selecting this option (Figure 5), compared with just 32% across all respondents. This reflects a widely-identified problem in science and suggests

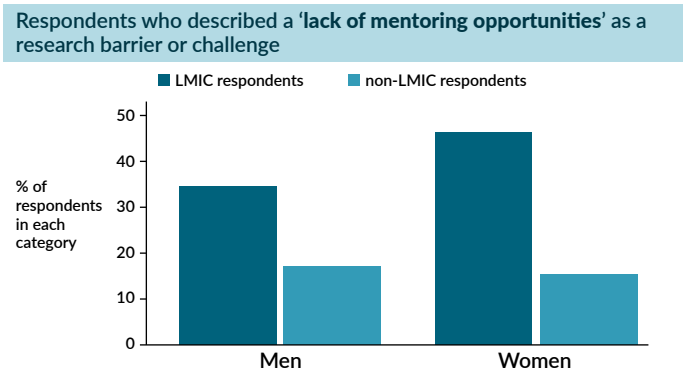


Figure 5 Respondents who selected 'lack of career progression opportunities' in response to the question "What are the greatest professional challenges and barriers that have negatively affected your scientific research?" weighted by gender and whether or not respondents worked in an LMIC.

that, although effort is being made to address this, female scientists' career progression remains an issue that needs to be addressed.

Satisfaction with IVVN funding application processes

The survey asked respondents whether or not they had applied for IVVN catalyst funding. 21% had applied – 6% successfully. Those who had applied were then asked about their satisfaction with the application process (Figure 6). Most were either completely or somewhat satisfied with each of the five aspects we asked about (finding collaborators, how easy it was to fill out the application, the communication they received from the IVVN team, the feedback they got on their applications and their overall experience). However, a third of unsuccessful applicants were dissatisfied with the process of finding suitable collaborators, which again highlights that this is a barrier to many scientists' research. 21% of unsuccessful applicants were also dissatisfied with the feedback they received, which is something the Network could consider for future funding rounds.

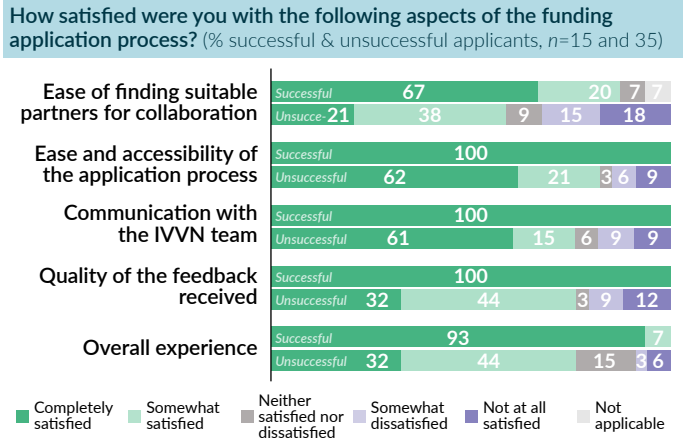


Figure 6 All responses to the question "How satisfied were you with the following aspects of the IVVN funding application process?" with percentages of successful and unsuccessful applicants who chose each option shown. Respondents could show their satisfaction on a five-point scale between 'completely satisfied' and 'not at all satisfied'.

We asked the rest of the applicants why they had not applied for IVVN funding and, again, a lack of collaborative opportunities was the biggest single issue (Figure 7). However, many respondents also said they lacked experience in writing funding applications (31%) or were unaware of the IVVN's funding opportunities (28%). A lack of grant writing experience is something the Network has previously tried to address with a workshop, but this is something we could consider re-running on a larger scale. This question also saw a considerable number (17%) selecting the 'other' option. This largely reflected respondents who did not work in research, and so a 'not applicable' option will be included should this question be asked in future surveys.

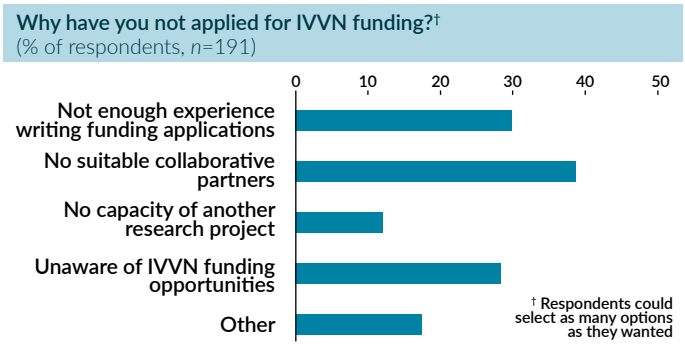


Figure 7 All responses to the question "How satisfied were you with the following aspects of the IVVN funding application process?" shown as percentages of those who were asked the question (the 191 respondents who had not applied for IVVN funding).

Which current Network activities do members value?

We were interested in finding out which of the Network's current activities and opportunities members liked and would like to see us continuing to offer (Figure 8). The most popular option among respondents was IVVN-organised meetings, highlighting the value of the 'networking' aspect of membership. Sadly, the 2020 IVVN annual conference has been postponed because of the COVID-19 pandemic, but it will hopefully return in 2021 to give members the opportunity to meet and discuss ideas. Catalyst funding was also popular, with 68% selecting this option, and 48% said they valued the monthly newsletter.

The newsletter was also the main way respondents said they found out about the IVVN's current activities, with

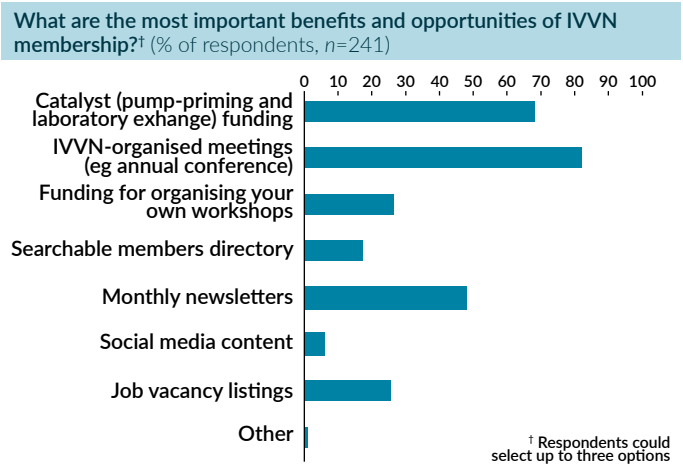


Figure 8 All responses to the question "What are the most important benefits and opportunities of IVVN membership?" shown as percentages of the total number of respondents (241).

72% selecting this option (**Figure 9**). This is reflected in the increase in website traffic we see each month in the hours and days after each edition of the newsletter is sent out.

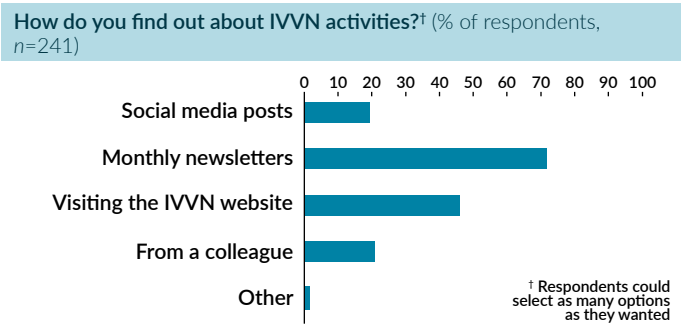


Figure 9 All responses to the question "How do you find out about IVVN activities?" shown as percentages of the total number of respondents (241).

Which additional opportunities should the IVVN offer?

Finally, survey respondents were asked about five possible future activities (**Figure 10**). 74% of respondents said

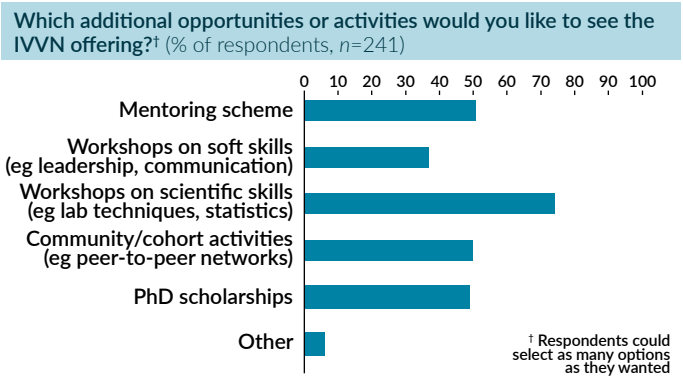


Figure 10 All responses to the question "Which additional opportunities or activities would you like to see the IVVN offering?" shown as percentages of the total number of respondents (241).

they would like to see workshops in scientific skills (such as laboratory techniques and experimental design) being offered. This was even higher in LMIC respondents, with 80% selecting this option (**Figure 11**). We have previously

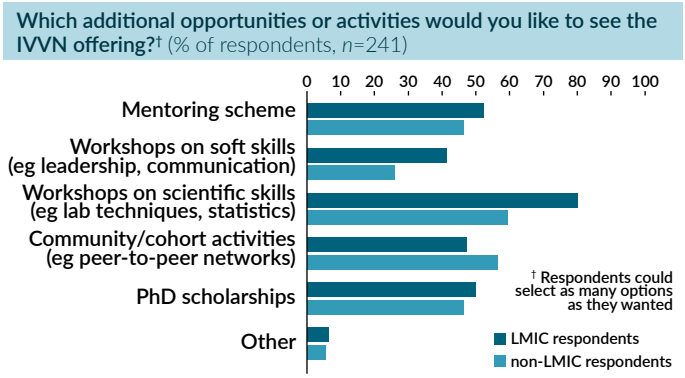


Figure 11 All responses to the question "Which additional opportunities or activities would you like to see the IVVN offering?" weighted according to whether or not respondents worked in an LMIC and shown as the percentage of respondents from each category who chose each option (n=172 in for LMICs, n=69 for non-LMICs).

discussed hosting webinars, either for training or research dissemination (or both), which could begin to address this need.

The four other responses were also popular with respondents, with 51% wanting a mentoring scheme and 50% wanting to see cohort-based activities, such as peer-to-peer networks, being offered. 49% of respondents also wanted to see PhD scholarships offered by the IVVN. Workshops on 'soft' skills, such as communication and leadership, were more popular among respondents based in LMICs than those in HICs, with 41% of LMIC respondents interested in seeing these workshops being offered.

Conclusions

The overwhelming majority of the feedback we received from respondents was positive, with many using the 'additional feedback' opportunity to thank the Network for its work and to say that they valued being a member. Additional comments and suggestions offered by members included:

- More opportunities (job vacancy listings, training and scholarships) offered.
- Listing members' achievements in the newsletter.
- Having regional or national representatives or coordinators for the Network.
- Better engagement in the United States and other countries outside Europe.
- Many members requested training opportunities and more funding for attending the IVVN annual conference.

Events

After hosting successful conferences in Kenya in 2018 and the UK in 2019, we were excited to host our third annual conference, in partnership with Cirad and the National Institute of Veterinary Research, in Vietnam in 2020.

However, due to the ongoing coronavirus pandemic, we have unfortunately decided to postpone this conference to 2021.

IVVN members will receive notification of the new conference dates by email – if you would like to be added to our mailing list then please sign up for free IVVN membership at intvetvaccnet.co.uk/user/register.

We hope to see many of you in Vietnam next year!

Workshops

BactiVac and IVVN workshop: Vaccines for tilapia

IVVN members **Dr Ngô Huỳnh Phương Thảo** (Biotechnology Center of Ho Chi Minh city, Vietnam), **Dr Rowena Hoare** (University of Stirling, UK) and **Dr Kim Thompson** (Moredun Research Institute, UK) hosted an IVVN and BactiVac-funded workshop on vaccines for tilapia at Biotechnology Center of Ho Chi Minh City on 23rd-25th September 2019.

The three-day workshop, was held as part of the BactiVac catalyst project 'Optimisation of novel mucosal vaccines to prevent bacterial diseases of tilapia (*Oreochromis niloticus*)' led by Dr Rowena Hoare. The workshop brought together 62 participants, including fish producers, vaccine manufacturers and academics specialising in vaccine development and fish health from the South East Asia region, UK and Europe.

You can read the full workshop report at intvetvaccnet.co.uk/blog/tilapia-workshop.

Attendees at the workshop in Ho Chi Minh City, Vietnam.

IVVN Workshop: Towards a vaccine for animal African trypanosomiasis

IVVN member **Professor Liam Morrison** (Roslin Institute, UK) hosted a workshop entitled 'Towards a vaccine for animal African trypanosomiasis (AAT)' on 12 November 2019 at the Roslin Institute, UK. The workshop brought together 20 delegates, representing a breadth of disciplines and expertise of relevance to trypanosomes and vaccinology, to discuss the development of a vaccine for AAT.

Various aspects were covered, including recent developments in trypanosome research, the bovine immune response and the ability to perform large-scale vaccination studies in cattle.

The outcome of this IVVN-funded workshop is submission of an application for funding which is currently under review.

You can read the full workshop report at intvetvaccnet.co.uk/blog/trypanosomes-workshop.

Professor Liam Morrison opening the discussions at the workshop.

Funding for researchers from LMICs to attend external conferences

The IVVN have provided funding for researchers from LMICs to attend the following meetings:

1 *12th International Veterinary Immunology Symposium, Seattle, 13-16 August 2019:*

- Dr Tshifhiwa Nefefe, Agricultural Research Council, South Africa.
- Dr Peera Jaru-Ampornpan, BIOTEC, Thailand.
- Dr Cecilia Langellotti, National Scientific and Technical Research Council (CONICET)/National Agricultural Technology Institute (INTA), Argentina).

2 *2019 International Society for Vaccines (ISV) Annual Congress, Ghent, 27-29 October 2019:*

- Neba Nebangwa Derrick, University of Buea, Cameroon.
- Dr José Manuel Jaramillo Ortiz, National Agricultural Technology Institute (INTA), Argentina.
- Emmaculate Ntang, University of Buea, Cameroon.

Catalyst funding

Pump-priming funding

Awards of up to £100,000 are available to support pump-priming projects from collaborative teams of IVVN members, which address a key bottleneck preventing the development of a vaccine for livestock and zoonotic diseases of importance in LMICs. The IVVN have awarded funding to 13 projects over four rounds of funding.

You can read about previously funded projects in previous annual reports and on our website.

Projects awarded in round three

The IVVN awarded pump-priming funding to three projects in our third round of grants, announced in October 2019.

Construction of foot-and-mouth disease virus-specific phage-display libraries and epitope identification for improved vaccine generation

Dr Pamela Opperman (ARC-Onderstepoort Veterinary Research, South Africa), **Dr Alejandra Capozzo** (National Agricultural Technology Institute, Argentina), **Dr Anna Ludi** (The Pirbright Institute, UK) and **Dr Richard Reeve** (University of Glasgow, UK)

Project summary

Foot-and-mouth disease (FMD) ranks as one of the most economically important infectious diseases of cloven-hoofed animals and is endemic in large regions of Africa, Asia and the Northern part of South America. The majority of FMD virus (FMDV)-neutralizing antibodies are directed against epitopes located on the surface-exposed capsid proteins. However, the location of these antigenic sites and their antigenic features may vary between the different strains. Antigenic variation results from changes to the viral capsid because of the high mutation rate of the virus such that each FMDV isolate is antigenically unique in its fine epitopic composition. This process leads to the generation of new variants circulating in the field, which may be different from those included in the vaccines. Therefore, vaccine efficacy and effectiveness of vaccination programs may be dramatically affected. Knowledge of the amino acid residues that comprise the antigenic determinants of FMD viruses is essential for the rational design of vaccine virus seeds that antigenically match circulating emerging or re-emerging strains, as well as induce a broad immunological response. Monoclonal antibodies, traditionally used for mapping of viral epitopes, have several limitations such as low throughput and high cost, which renders this technology unappealing.

This project aims to identify critical antigenic determinants within the FMDV capsid from strains that circulate in different parts of the world, using newly developed assays. It will join the complementary expertise of four FMDV research institutes: ARC-OVR (South Africa), the Pirbright Institute (UK), INTA (Argentina) and the University of Glasgow (UK). We aim to use a library of recombinant "mini"-antibodies generated from FMDV-immune buffalos and cattle by making use of a phage-display library technology, which has been extensively and successfully used by ARC-OVR. This joint project will provide important information by identifying critical FMDV epitopes, unique or shared among different strains, which can be implemented to produce improved vaccines.

Photo: Alaina McLearnon/Unsplash

Isolation and purification of Nairobi sheep disease virus for development of a thermostable vaccine

Dr Caroline Wasonga (University of Nairobi, Keyna), **Dr Joel Lutomiah** (Kenya Medical Research Institute, Kenya), **Dr Jennifer Duncun** (University of Liverpool, UK), **Dr Michael Muthamia Kiraithe** (Kenya Agricultural and Livestock Research Organization, Kenya), **Dr Allan Ole Kwallah** (Kenya Medical Research Institute, Kenya) and **Edna M Ondari** (Kenya Medical Research Institute, Kenya)

Project summary

Nairobi sheep disease virus (NSDV) causes severe illness in sheep and goats, with fatalities reaching up to 90% in affected animals. This disease is widespread in Eastern Africa and in Indian subcontinent where it is known as Ganjam virus. It causes considerable losses, especially to small scale farmers. Sheep and goats are also an important source of proteins and provide income through sales. The control of NSDV will thus make a positive contribution to the rural poor. This project aims to contribute towards control and eradication of NSDV, by developing a vaccine that is effective against NSDV. Field studies will be done to obtain tick samples, NSDV isolated from the ticks, and grow in the laboratory. The purified NSDV isolates will be inactivated using formalin to generate an inactivated vaccine candidate and this vaccine will then be tested in sheep to confirm that the vaccine is indeed protective against NSDV.

Photo: Arthur Mazi/Unsplash

Immunisation of tilapia broodstock as a strategy to prevent vertical transmission of tilapia lake virus (TiLV)

Dr Pattanapon Kayansamruaj (Kasetsart University, Thailand), **Dr Ha Thanh Dong** (Suan Sunandha Rajabhat University, Thailand), **Dr Channarong Rodkhum** (Chulalongkorn University, Thailand), **Dr Saengchan Senapin** (National Center for Genetic Engineering and Biotechnology, Thailand), **Dr Jorge del-Pozo** (The Roslin Institute, UK), **Dr Janina Z Costa** (Moredun Research Institute, UK) and **Dr Kim Thompson** (Moredun Research Institute, UK)

Project summary

Aquaculture is the fastest growing food-production sector globally, with over 1 billion people relying on fish as their major protein source. Within low- and middle-income countries (LMICs), aquaculture has an important role in improving food security, as well as the economic and social development of the country. Tilapia (particularly *Oreochromis* spp) is the world's second most predominant aquaculture species after carp. Reaching harvest size in just six months, it provides an important source of revenue for many low income families. Disease in tilapia culture is associated with intensification of the farming system, and both bacterial and viral diseases are severely impacting on expansion of tilapia farming. Tilapia fry are actively traded for aquaculture purposes globally. There is a huge risk of widespread disease resulting from the movement of live fish without appropriate control measures in place, eg tilapia lake virus (TiLV) in tilapia, white spot virus in shrimp, etc. Thus, production of specific pathogen-free, immunised fry is considered an ideal approach for disease control and preventing the spread of disease worldwide. Maternal antibody transfer from female broodstock to offspring has been confirmed to occur in several finfish species, and has been shown to protect early embryos and fry from infection. However, little is known about maternal antibody transfer in tilapia. TiLV has recently emerged as a new viral disease problem in tilapia culture, and its rapid spread has raised global concern for the tilapia aquaculture industry. Vaccinating broodstock maybe a novel disease control strategy in tilapia, but it requires vaccinated tilapia broodstock to be able to pass specific antibodies to their embryos, and for these antibodies to prevent vertical transmission. We intend to test these hypotheses in this project using TiLV as our model pathogen.

Projects awarded in round four

We awarded pump-priming funding to a further three projects earlier this year. Applications for the fourth round of pump-priming grants closed in October 2019 and the successful projects were announced in April 2020.

Identification of virulence factors as novel vaccine targets for contagious bovine pleuropneumonia by whole genome saturated mutagenesis

Dr Elise Schieck (International Livestock Research Institute, Kenya), **Dr Musa Hassan** (The Roslin Institute, University of Edinburgh, UK) and **Dr Robert Kammerer** (Friedrich Loeffler Institute, Germany)

Project summary

There is an urgent need for improved vaccines for contagious bovine pleuropneumonia (CBPP). CBPP is one of the most infectious and highly contagious diseases of cattle in Africa accounting for more than $38.8 million annual loss in cattle productivity in 12 endemic countries in sub-Saharan Africa. Currently, control of CBPP relies on a live vaccine of limited efficacy and occasional severe side effects. Achieving breakthroughs in developing effective tools, including vaccines, for CBPP intervention requires deeper insights into host-bacteria interactions.

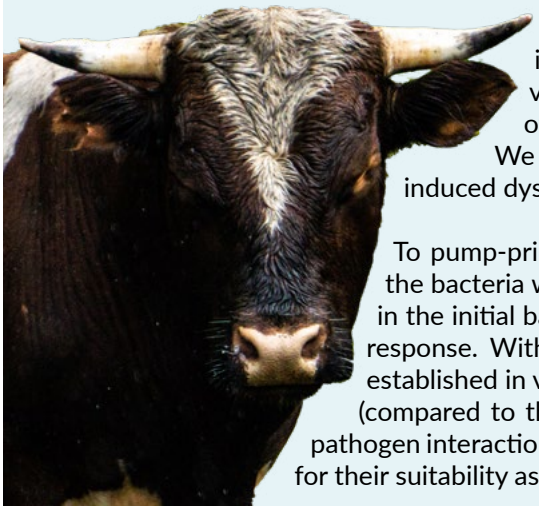


Photo: Mike Suarez C/Unsplash

Like other diseases caused by mycoplasma, CBPP is characterized by immunopathology, i.e. dysregulation of the host's immune response. In vitro data indicates that this dysregulation begins at the very early stages of infection, at the initial site of bacteria-host cell interaction in the lung. We aim towards identifying vaccine candidates that can disrupt the bacteria-induced dysregulation of the host's immune response.

To pump-prime this objective, we propose to generate a random mutant library of the bacteria which can be used to identify bacterial genes that play an important role in the initial bacteria-host cell encounters and the dysregulation of the host's immune response. Within the scope of the initial project, we will use the mutant library in established in vitro assays to screen for bacteria that fail to induce the typical response (compared to the wild type bacteria). This will allow a deeper understanding of host-pathogen interactions, and the identified antigens will be tested in future in vivo experiments for their suitability as vaccine candidates.

Discovery of T cell epitopes of the intracellular parasite *Babesia bovis* using immunoproteomic and immunoinformatic strategies

Dr Silvina Wilkowsky (National Agricultural Technology Institute, Argentina), **Dr Nicola Ternette** (University of Oxford, UK), **Magali Valenzano** (National Agricultural Technology Institute, Argentina) and **Professor Morten Nielsen** (University of San Martin, Argentina)

Project summary

Bovine babesiosis is a tick-borne disease caused by parasites *Babesia bovis* and *B. bigemina*. The disease affects cattle industry in tropical and subtropical regions of the world where bovine ticks are present. In bovines, *B. bovis* causes the most acute disease, characterized by anemia, neurological and renal damage and high mortality rates in adult animals.

Current control methods for babesiosis include vaccination with live attenuated strains of both parasites. Although these live vaccines are highly effective, they have some undesirable characteristics such as short shelf-life and the possibility of transmitting other diseases. For these reasons, there is an urgent need to produce new effective vaccines capable of inducing a strong protective immune response without these drawbacks.

Photo: Joshua Humpfer/Unsplash

Our proposal represents an important step towards addressing this need. We will identify some key protein fragments called T-cell epitopes of *B. bovis* that are specifically involved in the bovine immune response against the parasite. We will achieve this goal using cutting-edge mass spectrometry technologies combined with advanced immunoinformatics machine-learning to identify T-cell epitopes that remained unknown using previous techniques. This strategy will allow obtaining a set of novel vaccine candidates that could be included in new generation vaccines against bovine babesiosis.

Immunogenicity study of matrix 2 ectodomain proteins displayed on nodavirus-like particles as a universal avian influenza virus vaccine for chickens

Dr Mariatulqabtiah Abdul Razak, Professor Wen Siang Tan, Dr Kok Lian Ho and Professor Abdul Rahman Omar (Universiti Putra Malaysia, Malaysia) and Professor Munir Iqbal (The Pirbright Institute, UK)

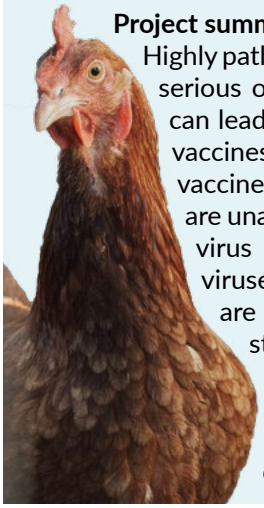


Photo: William Moreland/Unsplash

Project summary

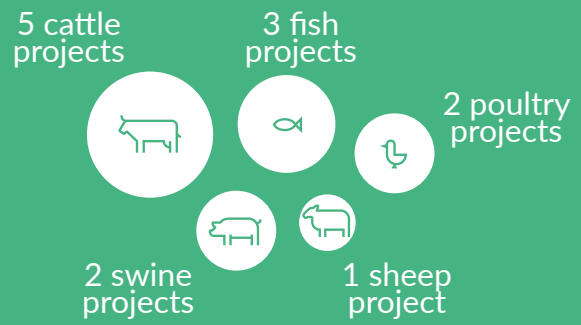
Highly pathogenic avian influenza (HPAI) H5N1 virus is highly contagious among birds and constantly causes serious outbreaks in parts of Asia and the Middle East. Failure to eradicate its spread and occurrence can lead to severe economic losses and potential health risks in humans. All the commercially available vaccines against H5N1 (inactivated H5N2 vaccine, reverse genetics vaccine, recombinant fowlpox virus vaccine and DNA vaccine), which express the antigenic glycoprotein of avian influenza, haemagglutinin, are unable to completely stop the virus from circulating. The inactivated vaccines against avian influenza virus (AIV) are commonly developed based on circulating low pathogenic avian influenza (LPAI) viruses, hence may not be efficacious against other types of HPAI or LPAI strains. These vaccines are strain-specific and require reconstitution to accommodate any new, mutated circulating viral strains. Development of a universal AIV vaccine targeting all AIV strains is urgently in demand. Our research team has shown a promising protective efficacy of nodavirus-like particles displaying three copies of M2e fragment against human influenza A virus in mice model. We hypothesise that expression of the matrix 2 ectodomain (M2e) proteins from avian influenza viruses of avian origin may confer a universal protection against avian influenza viruses in chickens.

At a glance: IVVN pump-priming funding

13 projects awarded over four funding rounds to

63 named scientists based in

13 countries



*As a condition of our funding from UKRI, all projects must involve at least one UK-based researcher.

Completed pump-priming grants

Five pump-priming grants from the first and second round of funding have now been completed.

Development of immunological tools for monitoring the immune response of Nile tilapia

Dr Kim Thompson (Moredun Research Institute, UK), **Professor Sachdev S Sidhu** (University of Toronto, Canada), **Professor Alexandra Adams** (University of Stirling, UK), **Dr Alasdair Nisbet** (Moredun Research Institute, UK), **Dr Hoang Nguyen** (Vietnam National University, Vietnam), **Dr Nguyen Ngoc Phuoc** (Hue University of Agriculture and Forestry, Vietnam), **Professor Ruth Zadoks** (University of Glasgow, UK)

Project outcomes

This project was a collaboration between scientists from Vietnam, Canada and the UK with the aim of developing a suite of synthetic antibodies (sAbs) for key immunological markers to study the response of different immune cell populations in tilapia. Synthetic antibodies are made in the laboratory unlike conventional antibodies, which are produced in animals, thus eliminating the need to use animals to make these reagents. The cell marker targets used for antibody production in this project included CD3Ɛ, CD4, CD8, CD172 (also known as SIRPα), CD45 and CD163. The DNA sequence of each target was successfully identified in the tilapia genome and Fc-fusion proteins produced for each target in HEK293 mammalian cells. As larger quantities of SIRPα, CD45 and CD3ε Fc-fusion proteins were produced compared to the other three targets, Fab-phage binding selection was initially performed for these markers, screening with an antibody phage-display library. Two unique binding phages were identified for tSIRPα, two for CD3 and 19 for CD45. So far five of the 19 phages for CD45 have been cloned into a human IgG vector and transfected into HEK293 mammalian cells to produce anti-CD45 sAbs. The other unique binding phages for SIRPα, CD3ε and CD45 remain to be cloned, and unique binding phages identified for CD4, CD8 and CD163. Three of the five anti-CD45 IgGs work in flow cytometry and indirect immunofluorescence (IIF), but not immunohistochemistry (IHC). These were subsequently used to analyse tilapia leukocyte populations sampled from a vaccination and challenge experiment performed by Vietnamese partners against Streptococcus agalactiae serotype III, sequence type 283, which gave a relative percent survival value of 62.5% in vaccinated fish. Interestingly, greater amounts of leukocytes were detected in the spleen of non-vaccinated fish compared to vaccinated fish with the CD45 sAbs by flow cytometry. Although further development and optimisation of the sAbs is continuing, it is clear that such tools are important for monitoring the development of adaptive immunity and establishing correlates of protection for the vaccine.

Low-cost thermostabilisation of a Rift Valley fever vaccine for veterinary use

Professor George Warimwe (KEMRI-Wellcome Trust Research Programme, Kenya), **Dr Alexander D Douglas** (Jenner Institute, UK), **Dr Michael J Francis** (Biovacc Consulting Ltd, UK)

Project outcomes

This vaccine stabilisation project has been successful in demonstrating two options suitable or distribution of ChAdOx1 RVF vaccine outside the cold chain. Based upon in vitro vaccine potency data, a liquid formulation is stable for a week at 30 °C or a month at 20°C, and a lyophilized formulation is stable for at least six months at 30°C. Additional in vivo data shows no loss of immunogenicity of the liquid-formulated vaccine after a month at 20°C.

These data suggest that it will be possible to distribute not only this vaccine, but also other adenovirus-vectored vaccines, in locations where reliable cold chain conditions cannot always be maintained. Depending on climatic conditions, the lyophilized formulation may possibly not require cold chain storage at all. These findings will greatly facilitate use and distribution on such vaccines within LMIC settings.

A single dose vectored Taenia solium vaccine

Professor Adrian Hill (Jenner Institute, UK), **Professor Marshall Lightowlers** (University of Melbourne, Australia), **Professor Bryan Charleston** (The Pirbright Institute, UK)

Project outcomes

Taenia solium causes neurocysticercosis in humans and is associated with a high frequency of epilepsy in endemic areas. Pigs are the almost exclusive natural animal intermediate host for *T. solium* and immunisation of pigs offers the opportunity for disease prevention. Despite the general difficulty of effective immunisation against complex parasites, Professor Lightowlers in Melbourne has developed a highly effective protein in adjuvant vaccine based on the TSOL18 antigen. Two doses of this vaccine lead to very high level protection of >98% in pigs in a variety of rural disease settings where the vaccine is most needed. However, deployment of two doses of vaccine in pigs in such settings is proving highly logistically problematic and a single dose of this vaccine has been found to be insufficiently protective.

This project sought to assess for the first time the potential of an adenovirus-vectored vaccine encoding the same

TSOL18 antigen. Adenoviral vectors are known to provide excellent antibody responses with a single dose in a range of animal species, including pigs, and in humans, as illustrated by their use as a single dose vaccine in the Ebola rapid response vaccine programme in 2014.

As expected, very high antibody titres were detected in pigs immunized with TSOL 18 protein-based vaccine as a prime boost. However, antibody titres below the levels consistent with protection were induced in pigs that received a single dose of 1010 infectious units of ChAdOx-1 TSOL 18. Therefore, adenovirus vectors expressing TSOL 18 are not suitable to immunise pigs against *Taenia solium*.

Creating a platform for developing novel vaccines against animal trypanosomiasis in Brazil

Professor Andrew Jackson (University of Liverpool, UK), **Professor Marta MG Teixeira** (University of São Paulo, Brazil), **Dr Gavin J Wright** (Sanger Institute, UK), **Professor Rosangela Zacharias** (São Paulo State University, Brazil)

Project outcomes

Our aim was to express antigens of one *T. vivax*-specific protein family and vaccinate mice and livestock, testing the protective effects against experimental *T. vivax* infection. Vaccination of mice with our recombinant antigens produced a mixed Th1/Th2-type immune response based on levels of proinflammatory cytokines IFN-γ and TNF-α and immunization with one of our antigens with a Quil-A adjuvant elicited a partially protective response, with a significant decrease in the parasite burden in vaccinated mice at 8dpi, indicating 60% efficacy. Our vaccination and challenge experiment in a goat model tested the protective effect of another member of the same *T. vivax*-specific protein family (AJ7), which confirmed the seroconversion of total IgG antibodies detected 6 weeks from the first immunization when animals were vaccinated with AJ7 co-administrated with a Freund's complete adjuvant. However, after challenge with *T. vivax* all vaccinated animals, regardless of the adjuvant applied, developed acute infection with peaks of parasitaemia typical of *T. vivax* infection. Therefore, vaccination with AJ7 did not confer protective immunity in the goat contrary to the protection seen against acute infection in a murine model. This suggests that AJ7 antigenicity is not sufficient to confer immunity and other immunological factors not identified must be involved in the process. Overall, while the project has shown that these *T. vivax*-specific proteins are immunogenic antigens capable of eliciting a favourable immune response post vaccination, they have not yet proven to be robustly protective against *T. vivax* infection.

Towards edible vaccines for chickens

Dr Kate Sutton (Roslin Institute, UK), **Professor Lonneke Verdelde** (Roslin Institute, UK), **Dr Roger New** (Proxima Concepts Ltd, UK), **Professor Damer Blake** (Royal Veterinary College, UK)

Project outcomes

In this project we tested a novel oil formulation as a vaccine vehicle that targets the mucosal immune system. We have shown the ability of the oil formulation to bind to intestinal epithelial cells and induce both a systemic and mucosal immune response to model antigens in chickens. This vaccine has the potential to be mixed into feed, making it suitable for routine administration to broilers and backyard poultry. This oil formulation is of particular relevance in low and middle income countries where poultry production is rapidly expanding but they have little or no access to cold-chain resources required for current chicken vaccines.

Celebrating female-led projects for International Women's Day

Sunday 8 March 2020 marked International Women's Day. To celebrate, we put together a video showcasing six IVVN-funded pump-priming projects that are led by women. The full video is available at intvetvaccnet.co.uk/IWD2020.

The video features projects led by:

Dr Caroline Wasonga
University of Nairobi, Kenya

Dr Kim Thompson
Moredun Research Institute, UK

Dr Pamela Opperman
ARC-Onderstepoort Veterinary Research, South Africa

Dr Thảo Ngô
Biotechnology Center of Ho Chi Minh City, Vietnam

Dr Anna Lacasta
International Livestock Research Institute, Kenya

Dr Kate Sutton
The Roslin Institute, University of Edinburgh, UK

Laboratory exchange funding

Awards of up to £10,000 are available to support transfer of expertise between laboratories within the Network, or to fund a proof-of-concept piece of work. The IVVN have funded 13 projects over three rounds of funding.

You can read about previously funded projects in previous annual reports and on our website.

Photo: ThisisEngineering/RAEng/Unsplash

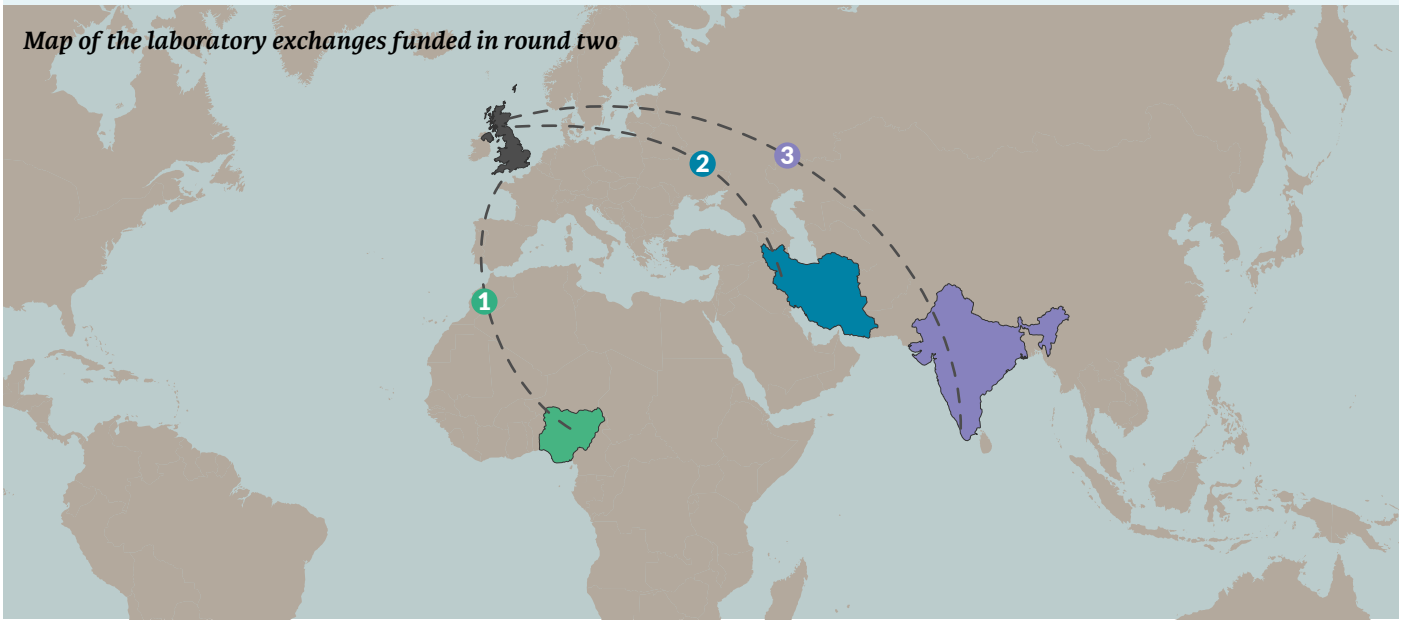
Projects awarded in round two

The IVVN awarded three laboratory exchanges in October 2019.

1 Evaluation of antigenic and genomic methods to assess foot-and-mouth disease virus vaccine selection and performance in Nigeria
Dr David Ehizibolo (National Veterinary Research Institute, Nigeria), Dr Anna Ludi (The Pirbright Institute, UK) and Dr Donald King (The Pirbright Institute, UK)

2 Preparation of viral vaccines for Iranian aquaculture
Dr Nastaran Shahbazian (Iran Veterinary Organisation and Razi University, Iran) and Dr Kim Thompson (Moredun Research Institute, UK)

3 In vitro correlates of protective immunity in fish
Dr Preetham Elumalai (Kerala University of Fisheries and Ocean Studies, India) and Professor Samuel Martin (University of Aberdeen, UK)



Map of the laboratory exchanges funded in round two

Projects awarded in round three

The IVVN awarded five further laboratory exchanges in April 2020.

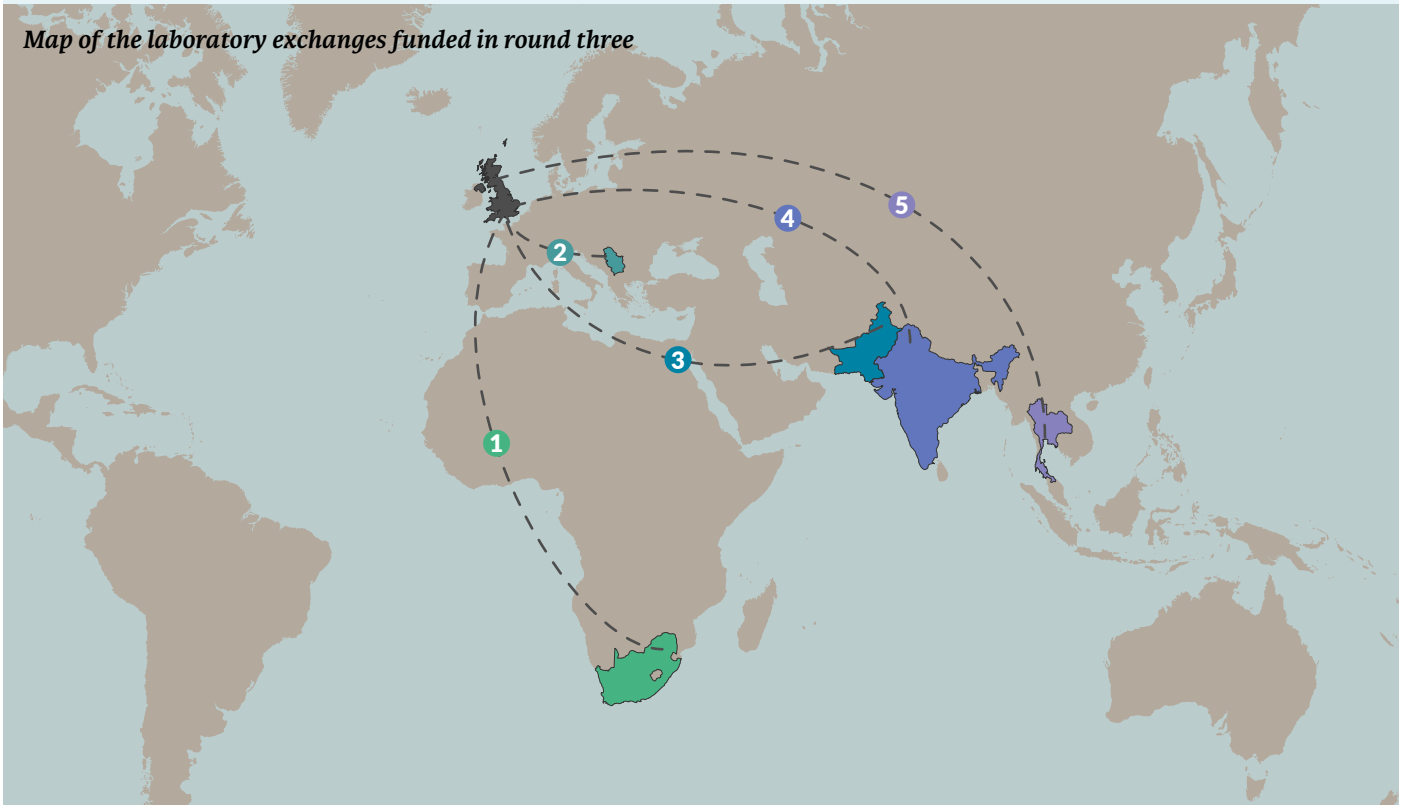
1 Using cell sorting and transcriptomics to monitor immune responses in livestock
Dr Tshifhiwa Nefefe (Agricultural Research Council, South Africa) and **Professor John Hammond** (The Pirbright Institute, UK)

2 Laboratory exchange to facilitate testing for nairovirus reactivity in Serbian livestock
Dr Tamara Saksida (University of Belgrade, Serbia) and **Professor Teresa Lambe** (The Jenner Institute, UK)

3 Population genomics of *Strongyloides papillosus* – a parasite of bovids in Pakistan
Dr Kiran Afshan (Quaid-i-Azam University, Pakistan) and **Professor Mark Viney** (University of Liverpool, UK)

4 The identification of Indian isolates of *Streptococcus equi* and *Streptococcus zooepidemicus* by whole genome sequencing
Dr Balvinder Kumar (ICAR-National Research Centre on Equines, India) and **Dr Andrew Waller** (Animal Health Trust, UK)

5 Evaluating the role of immunoglobulin IgT in vaccinated tilapia
Dr Wanna Sirimanapong (Mahidol University, Thailand) and **Dr Janina Costa** (Moredun Research Institute, UK)



Map of the laboratory exchanges funded in round three

IVVN Fellowship Programme

Using funding from the UK's Global Challenges Research Fund (GCRF) and Canada's International Development Research Centre (IDRC), the IVVN this year established a fellowship programme for women working in veterinary vaccinology in LMICs. The programme will provide awards up to £50,000 to support the professional development of female postdocs, and facilitate a partnership with international and local mentors, to work on a defined piece of research which will further the career of the mentee. Applications for the programme closed recently and we will announce details of the awarded projects later this year.

For more information about the IVVN Fellowship Programme, visit intvetvaccnet.co.uk/fellowships.


Photo: valentinrussanov/Getty Images

African Schools Outreach Programme

The IVVN African Schools Outreach Programme was established in March 2019 and aims to provide women working in veterinary vaccinology in Africa with training and resources to host outreach workshops in their local schools to inspire the next generation of scientists. Working with Easter Bush Science Outreach Centre (EBSOC), African Women in Agricultural Research and Development (AWARD), the African Vaccinology Network (AfVANET), the International Livestock Research Institute (ILRI), the University of Ibadan and the University of Zambia, the first phase of the programme has been delivered to 223 students across six schools in Kenya, Nigeria and Zambia.

Celebrating the programme at the Scottish Parliament

A reception at the Scottish Parliament in October 2019 celebrated the IVVN African Schools Outreach Programme and other University of Edinburgh-based work on tackling gender inequality in science in Scotland and internationally.

AWARD's deputy director for programmes, Michèle Mbo'o-Tchouawou, spoke at the reception, where she praised the programme and the AWARD country chapters involved in its delivery.

"This is not just another initiative," she said. "It is also an opportunity to see how interested young girls are in doing science. All they need is people to motivate them to really think that it is something they can do, and they can succeed."

Read the full story at intvetvaccnet.co.uk/news.

January 2019

First meeting of the project partners in London.

March 2019

The programme is formally launched on International Women's Day 2019. Later in the month, EBSOC host a two day training session for six scientists (from Cameroon, Kenya, Nigeria and Zambia) at ILRI, Kenya, and deliver a pilot activity to 40 school students at Precious Blood High School in Nairobi. This includes a mentorship event led by AWARD.

May 2019

First Nigerian workshops take place at Abadina Grammar School and Abadina College. The workshops are delivered by two of the scientists trained during the visit to Kenya in March.

March 2020

First Zambian workshop takes place at Lusaka Girls Secondary School. The workshop is delivered by six scientists from the University of Zambia and the Central Veterinary Research Institute.

February 2019

'Rabies lab' workshop is designed by EBSOC and the first mobile laboratory is shipped to Kenya.

April 2019

Two more mobile laboratories shipped – one to the University of Ibadan, Nigeria, and the other to the University of Zambia.

June 2019

Workshop at Ole Tipis Girls High School, Narok, Kenya, delivered by three of the scientists trained during the March visit.

October 2019

Phase 2: The programme launches in South Africa, Uganda and Ethiopia. The IVVN and EBSOC teams train seven scientists from the University of Pretoria, University of Addis Ababa and Makerere University to deliver the Rabies Lab workshop.

Following successful implementation of the first phase of the programme, the second phase to deliver workshops in South Africa, Ethiopia and Uganda began in October 2019.

For more information about the African Schools Outreach Programme, please visit intvetvaccnet.co.uk/outreach. Follow the progress of the project on our Twitter account (@IntVetVaccNet) and using the hashtag #InspiringFutureScientists.

News from our community

Launch of the UK Immunological Toolbox website

9 September 2019

Image: National Institute of Allergy and Infectious Diseases

The UK Immunological Toolbox website collates and hosts information on reagents and resources to promote veterinary immunology and vaccinology research. Its aim is to remove barriers to veterinary vaccine development by facilitating accurate information exchange and collaboration through a central curated platform.

The initial focus has been on providing a centralised information repository for antibodies and recombinant proteins, available from commercial companies and through academic institutes. This basic information is displayed alongside descriptive data, species cross-reactivity, references, images and any other useful evidence that promotes their use. This website is now the most up-to-date and comprehensive repository available. It details over 1600 hybridomas producing well-characterised monoclonal antibodies (mAbs) and some polyclonal antibodies against cattle, chicken, pig, sheep, goat, horse and fish molecules. Both the number of reagents and species included will continue to increase as further information on unique institutional collections is received from around the world.

The UK Immunological Toolbox website is based around the antigenic molecules and is searchable using molecule name, species name or specific antibody name. A detailed but simple application table is displayed for each reagent which enables researchers to easily establish the utility of each reagent and rate them via an independent feedback system. Registered users can easily comment and submit supporting data, references and any other evidence that allows the community to better understand the utility of any reagent listed. Community engagement is a key component to maximising the utility of this website.

To make it easier for the research community to find the reagents, owner and/or supplier information is also prominently displayed on each reagent page and users are guided on whether the antibody is commercially available, available on request or in development. The next phase of Toolbox development will include specific details from genome variation through to isoforms, assays and expression patterns of target molecules.

The development of this website was supported by the UK's Biotechnology and Biological Sciences Research Council (BBSRC) through the Global Challenges Research Fund (GCRF) grant BBS/OS/GC/000015. It is an output from the activities of the UK Immunological Toolbox initiative; the Immunological Toolbox project at The Pirbright Institute and the Roslin Institute is supported by BBSRC strategic funding.

For any queries on the Immunological Toolbox Database and Website or the UK Immunological Toolbox project, please contact: immunological.toolbox@pirbright.ac.uk. ▪

Launch of the One Health Poultry Hub website

24 September 2019

The GCRF One Heath Poultry Hub, headed by IVVN Network Management Board member Professor Fiona Tomley of the Royal Veterinary College, has launched its website.

The Hub, which is co-hosting the 'Vaccines for Poultry' session at the IVVN Conference in 2020 in Hanoi, is an interdisciplinary impact-driven programme exploring how rapid expansion of poultry production can increase the risk of infectious disease and why certain processes and behaviours are risky.

One of 12 UKRI GCRF interdisciplinary research Hubs announced in January this year, it is working in Bangladesh, India, Sri Lanka and Vietnam. Two of the Hub's Vietnam partners, CIRAD and the National Institute of Veterinary Research are local organisers for next year's IVVN conference.

The Hub welcomes collaboration with other research organisations and projects as well as with the private sector, industry bodies, regulators, development organisations and others.

Professor Fiona Tomley said: "We hope the website will be useful to IVVN members as it is where you can find research updates on this exciting initiative, and also where, in time, you will find information about opportunities for collaborating with the Hub in our research- and impact-related work."

Find out more at the Hub's new website at onehealthpoultry.org.

You can also follow @PoultryHub on Twitter or email info@onehealthpoultry.org for more information. ▪

Photo: Nguyen Van Dai

Africa Week at the University of Edinburgh: agri-food transformations for Africa

28 October 2019

Photo: The Roslin Institute/University of Edinburgh

In October 2019, the University of Edinburgh's Easter Bush campus hosted a morning of lively discussions on agricultural research in Africa. The event, called 'Agri-food Transformations for Africa', formed part of Africa Week, which celebrates the university's connections across the African continent.

The event was jointly organised by Supporting Evidence-Based Interactions (SEBI), the Centre for Tropical Livestock Genetics and Health (CTLGH), the Global Academy of Agriculture and Food Security (GAAFS) and scientists at the Roslin Institute.

A panel discussion highlighted the challenges facing livestock research in Africa and its implementation. The four panellists – Dr Liam Morrison (Roslin Institute), Professor Andy Peters (SEBI), Dr Thumbi Mwangi (Washington State University) and Dr Rebecca Callaby (CTLGH) – agreed that long-term multidisciplinary projects are needed to bring together research on animal nutrition, genetics, diseases and responses to the environment.

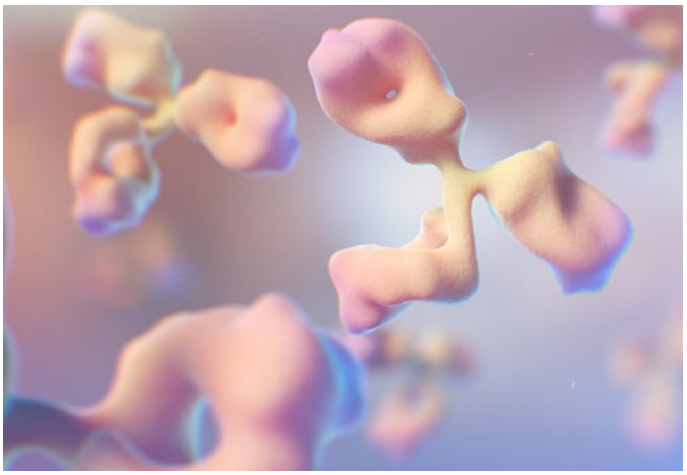
The discussion followed a series of flash talks, which started with Dr Oluyinka Opoola from CTLGH, who spoke about her work on dairy farming in Rwanda and strategies for improving productivity.

IVVN member Professor Ross Houston spoke about genomic tools for improving Nile tilapia, an important fish species in commercial aquaculture in Africa. Other speakers at the event included CTLGH's Dr Emily Clarke, Professor Alan Duncan from GAAFS, and Dr Theodora Tsouloufi from SEBI.

The event was also an opportunity to share news about the IVVN African Schools Outreach Programme with researchers from across the campus. ▪

New $5.5m Livestock Antibody Hub at the Pirbright Institute

27 November 2019



Scientists at the Pirbright Institute in the UK have been awarded $5.5 million by the Bill and Melinda Gates Foundation to launch a new Livestock Antibody Hub. The Hub's work will aim to improve animal and human health globally and help drive vaccine design and development.

Pirbright's research is focused on viral diseases in animals, and the Hub will use the institute's expertise and facilities to improve antibody discovery, manipulation and testing in livestock. The project will see six research groups at the institute working together to study antibody responses at high resolution in pigs, poultry and cattle.

"New tools have given us the opportunity to utilise these detailed antibody responses to make the next generation of vaccines and therapies" said Pirbright's Professor John Hammond, who will lead the project, working alongside Professor Venugopal Nair, Dr Elma Tchilian, Dr Erica Bickerton, Prof Munir Iqbal and Dr Simon Graham.

The Hub will help the wider research community by providing methods, access to animal models and expertise to drive antibody research. The work will form part of the 'One Health' agenda – using research outcomes in livestock to inform and support work on human diseases. "[Our findings] will improve animal health and ultimately human health, as well as ensuring the security of our food supply", Professor Hammond said.

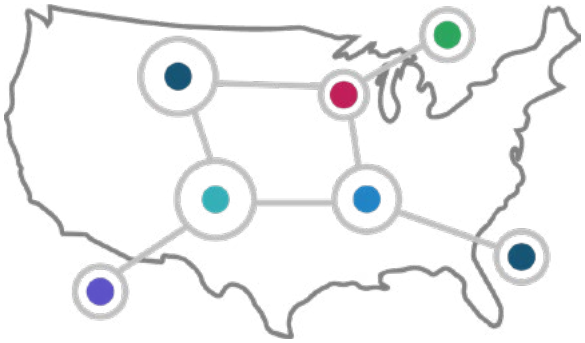
Dr Doug Brown, chief executive of the British Society for Immunology, welcomed the announcement. "This is the single biggest investment in the immunology of livestock in the UK from an international funder," he said. ▪

Launch of US Animal Vaccinology Research Coordination Network

14 January 2020

The Center of Excellence for Vaccine Research (CEVR) at the University of Connecticut's Department of Pathobiology and Veterinary Science has been designated by the US Department of Agriculture (USDA) as the National Center for animal vaccine coordination under the title 'US Animal Vaccinology Research Coordination Network' (USAVRCN).

The USAVRCN is modeled broadly on the UK Vaccinology Network and the International Veterinary Vaccinology Network (IVVN), and looks forward to interacting closely with them for the benefit of US members and the international community.



The USAVRCN comprises academic, government, and corporate vaccine researchers brought together on a formal basis to identify current and future vaccine needs and opportunities in the US, and to collaboratively set broad goals and priorities for addressing them.

Network policy and programmatic recommendations will be communicated annually to the USDA leadership to assist them with the development of future research initiatives and program funding at a national level.

USAVRCN organization is structured around working groups focused on target-species and topically-relevant themes. Network leadership is provided by the Chairman, Dr Steven Geary, and the Network Coordinator, Edan Tulman, with guidance from a Board of Directors.

The inaugural meeting of the USAVRCN was held on 2 November 2019 in Chicago, Illinois, where approximately 100 attendees gathered to learn more about the network's vision and to comment on priorities and future directions. Keynote lectures were presented by Dr Roy Curtis from the University of Florida, who spoke about 'Animal vaccines – current availability, future needs and technologies to deliver', and Dr Dan Rock from the University of Illinois Urbana Champagne who spoke about 'Challenges for African swine fever vaccine development'.

For more information, visit the USAVRCN website. ▪

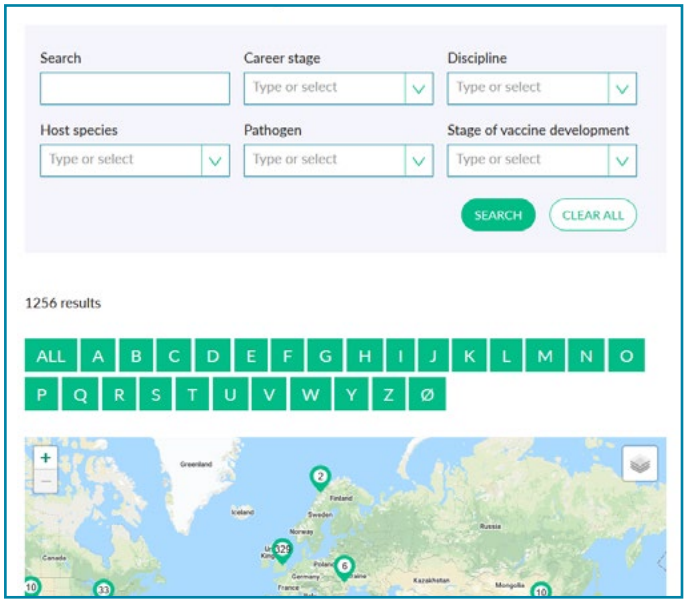
Information dissemination

One of the IVVN's core components is its role as a central hub for disseminating relevant information to the veterinary vaccinology community worldwide. We do this through our website, on social media and in our monthly newsletters.

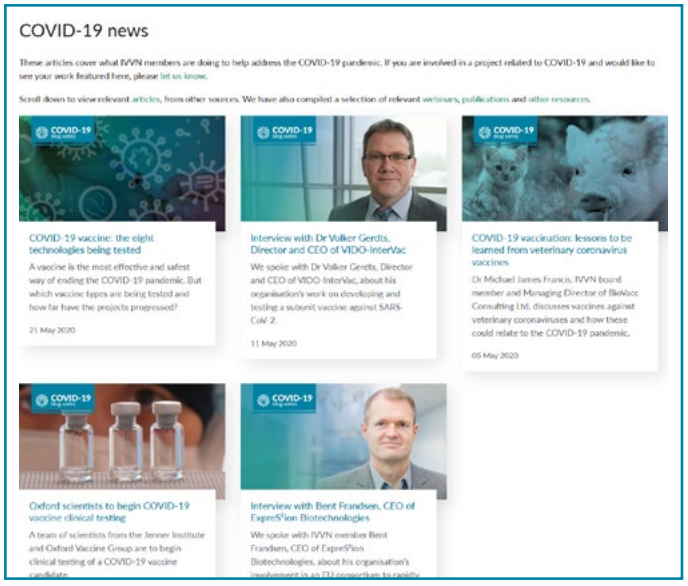
Website

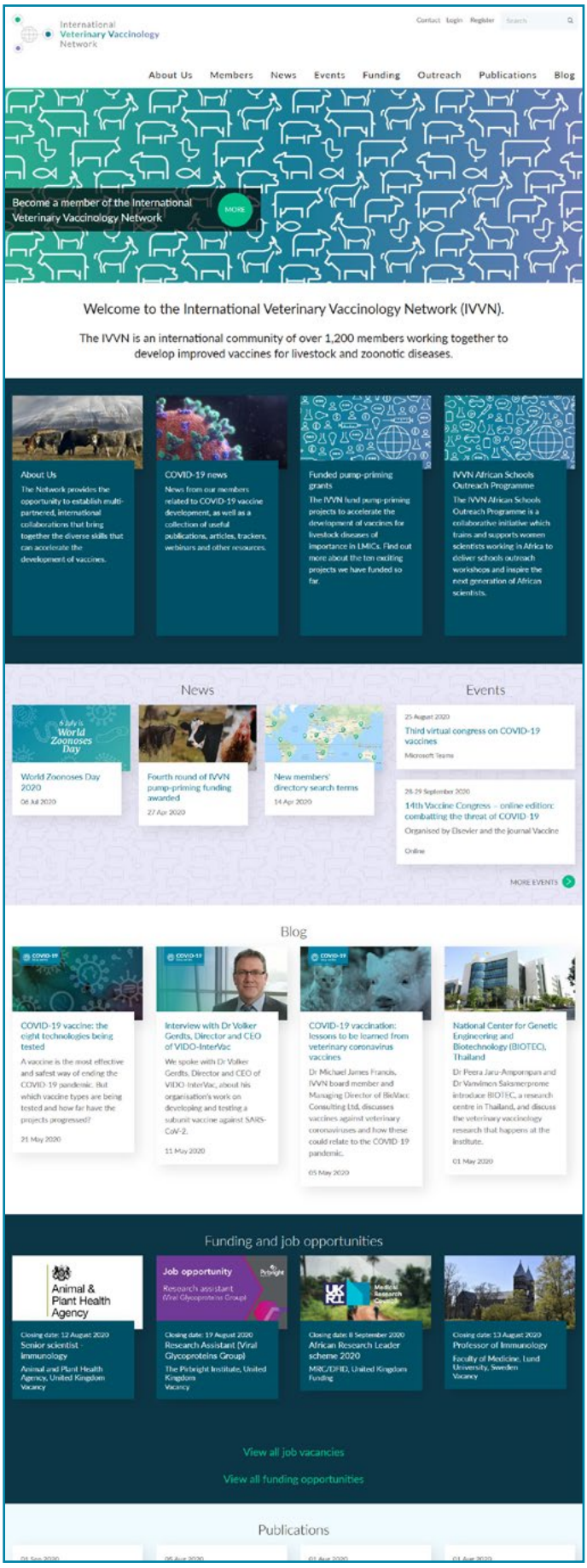
Our website (intvetvaccnet.co.uk) provides a searchable directory of IVVN members, links to scientific publications from members, events listings, and the latest jobs and funding opportunities in veterinary vaccinology and related fields.

This year, we have made some improvements to the directory to make it easier to find members by their scientific interests.



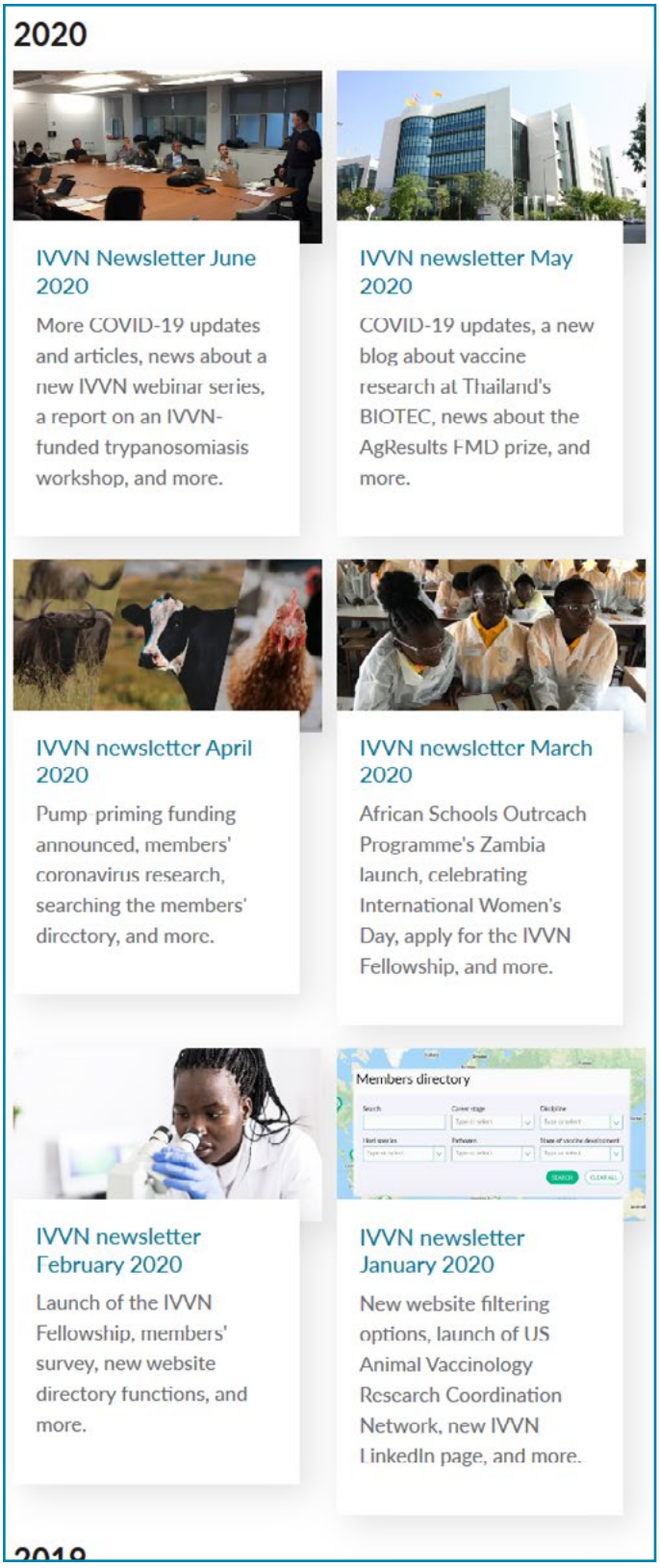
We have also added a new section to help keep members informed on the coronavirus pandemic and efforts to develop a COVID-19 vaccine.





Newsletter

The IVVN newsletter is sent to all members at the end of each month. These newsletters provide a comprehensive update of all our activities over the past month, as well as the latest from the community, veterinary vaccinology in the news, publications, and upcoming latest opportunities. An archive of all previous newsletter editions is available on our website.

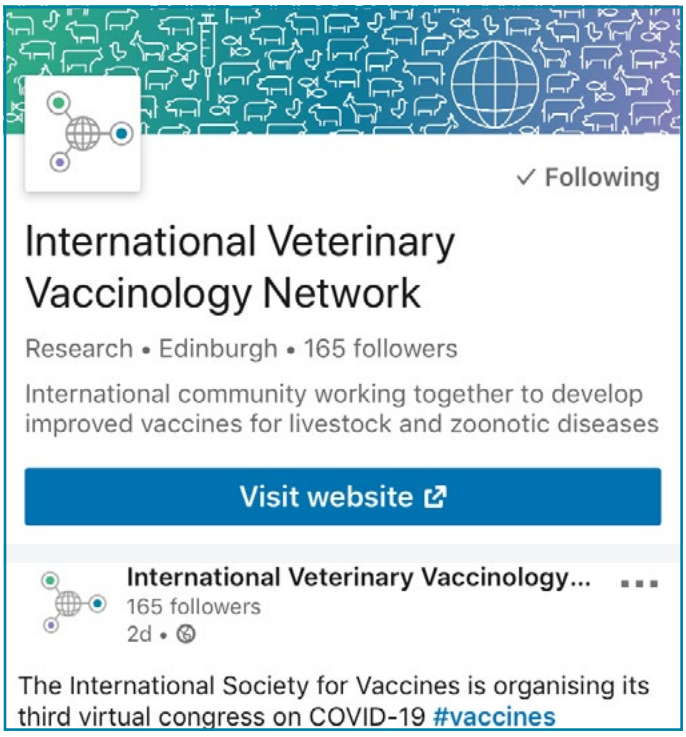


Twitter

Follow the IVVN on Twitter (@IntVetVaccNet) for regular updates from the Network and the veterinary vaccinology community.

LinkedIn

This year, we also launched a LinkedIn page, where you can also get updates about our work and news from the community.



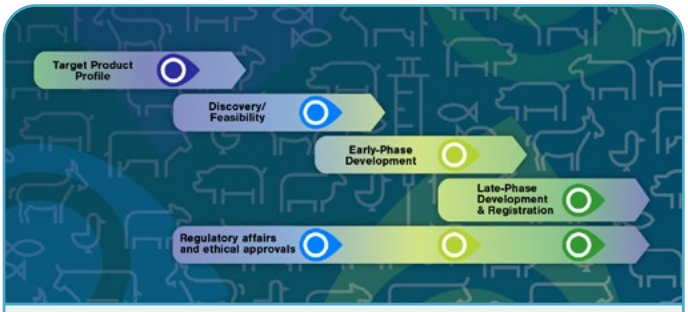
Blog

The IVVN blog aims to highlight projects, institutes and resources that may be of interest to members. If you would like to contribute a blog post about your work, please contact us to discuss. You can read all our previous posts at intvetvaccnet.co.uk/blog.

DISCONTOOLS – Identifying research gaps in animal disease control

DISCONTOOLS (Disease Control Tools) is an open-access database of animal health information and resources. The database aims to assist researchers and research funders in identifying research gaps and planning future work. Project manager **Johannes Charlier** wrote a post introducing the resource and how it works.

intvetvaccnet.co.uk/blog/discontools



Launch of the Veterinary Vaccine Development Process Map

Last year, the UK government's UK Vaccine Network launched a Veterinary Vaccine Development Process Map, which highlights the different stages that go into developing a veterinary vaccine, as well as some of the bottlenecks. This blog post by **Dr Michael Francis** explains how the map works.

intvetvaccnet.co.uk/blog/process-map

National Veterinary Research Institute (NVRI), Vom, Nigeria

Dr David Shamaki and **Dr Reuben A Ocholi** introduce Nigeria's NVRI and the various animal vaccines currently undergoing research, development and manufacture at the institute.

intvetvaccnet.co.uk/blog/nvri

National Center for Genetic Engineering and Biotechnology (BIOTEC), Thailand

Dr Peera Jaru-Ampornpan and **Dr Vanvimon Saksmerprome** introduce BIOTEC, a research centre in Thailand, and discuss the veterinary vaccinology research that happens at the institute.

intvetvaccnet.co.uk/blog/biotec

COVID-19 blog series

This spring, we launched a series of blog posts to highlight our members' efforts in addressing the COVID-19 pandemic and to keep members informed. To read these posts in full, and to access additional resources, including webinars, trackers and publications, please visit our COVID-19 page at intvetvaccnet.co.uk/blog/covid-19.

We spoke with IVVN member **Bent Frandsen** about his organisation's involvement in an European Union consortium to rapidly develop a COVID-19 vaccine.

intvetvaccnet.co.uk/blog/covid-19/interview-with-bent-frandsen

The team behind the University of Oxford adenovirus-vectored COVID-19 vaccine discuss the early phases of its development in April.

intvetvaccnet.co.uk/blog/covid-19/oxford-vaccine-clinical-testing

Dr Michael Francis discusses vaccines against animal coronaviruses and how these could relate to the COVID-19 pandemic.

intvetvaccnet.co.uk/blog/covid-19/lessons-veterinary-coronaviruses

We spoke with **Dr Volker Gerdts** about VIDO-InterVac's work on developing and testing a subunit vaccine against SARS-CoV-2.

intvetvaccnet.co.uk/blog/covid-19/interview-with-dr-volker-gerdts

A vaccine is the most effective and safest way of brining and end to the COVID-19 pandemic. But which vaccine types are in development?

intvetvaccnet.co.uk/blog/covid-19/vaccine-eight-types-being-tested

Get in touch

International Veterinary Vaccinology Network
The Roslin Institute
University of Edinburgh
Edinburgh, Scotland,
EH25 9RG

IVVN@roslin.ed.ac.uk

www.intvetvaccnet.co.uk

@IntVetVaccNet

linkedin.com/company/intvetvaccnet

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