ECONOMIC & SOCIAL REPORT

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Together, beyond animal health

CONTENT

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Marc Prikazsky

Chief Executive Officer & Chairman

2020 was like no other year any of us has ever experienced. The global pandemic has had a profound impact on the lives and wellbeing of every family, community and organisation on Earth. The Ceva group has been no exception and we have had to adapt to the 'new normal' along with everyone else.

I am very proud of the way Ceva's employees and partners have adapted and coped, and the way many have gone the extra mile to make important contributions in their communities.

Home working became the new normal for many of us, requiring the balancing of family and work commitments. In the process we have learned important lessons about how work can be

STRONGER TOGETHER

organised in the future. As we come back together in the office we will use these – lessons to refine plans for our exciting new state-of-the-art headquarters and other buildings, as we adjust to a hybrid form of working.

Throughout the world, there have been many inspiring examples of Ceva employees and resources responding to pressing needs arising from the pandemic. These included hungry and vulnerable families being provided with nutritious food; abandoned pets being taken into people's homes; and laboratory facilities being made available as Covid-19 testing centres. At Libourne, a new facility was rapidly erected in the grounds of our headquarters to accommodate an exciting new dog training and study centre to explore the use of sniffer dogs to detect samples taken from Covid-positive patients.

Some of the stories behind these initiatives are told in the following pages. But the past year has not solely been defined by the pandemic. Beyond our important 'day job' of developing, manufacturing, supplying and supporting the optimal use of animal health products and services, Ceva has continued to live up to its broad 'Together, beyond animal health' vision. So, we can also share stories about how Ceva and its partners have contributed to Healthy People, Healthy Animals, Healthy Food and a Healthy Planet.

As a company, we were early converts to the 'One Health' message. The past year has very clearly demonstrated that One Health isn't some sort of trendy aspiration – it's absolutely fundamental to the future health and wellbeing of us all.

*All the following articles can be found on our microsite: **www.togetherbeyondanimalhealth.com**, which is regularly updated with new blog posts to which you can subscribe.*

ONE HEALTH :

The health of animals, people and our planet is mutually dependent.

The Covid-19 pandemic reminds us that we share the same disease pool with both wild and domesticated animals. The better we protect them, the better we protect ourselves.

This crisis clearly brings home the interconnection between human, animal and environmental health. This is why, in 2010, looking ahead at future health megatrends we decided that Ceva should become a One Health company, recognizing that the health of humans, animals and ecosystems are interconnected.

This was the origin of our "Together, beyond animal health" slogan and since then we have moved our business from just over 25% vaccines to close to 50% today, focusing on preventative health that helps keep both animals and humans safe.

Ceva's commitment to **One Health**

In this section we share some thoughts on vaccination, the contribution that veterinary science can make to better understanding of the coronavirus pandemic, and Ceva's initiatives to safeguard the continuing effectiveness of antibiotics for both people and animals.

All these are examples of One Health in action. The idea that the health and wellbeing of people, animals and the planet is interlinked and mutually dependent - One Health for short - lies at the heart of everything Ceva does.

Vaccination: more than 220 years of innovation.
For perhaps the first time in the long history of plagues, we understand what we are facing and know that vaccination will be a key part of normal health and living being fully restored.

Thanks to its ambitious and extensive research programs Ceva has become a world leader in veterinary vaccines with almost 50% of its sales coming from this sector. As a result, the company now offers livestock farmers, and the veterinarians who support them, a very comprehensive range of innovative and effective vaccines that provide protection against many major infectious diseases. In most cases, these mass-produced, registered, standard products are effective on farms throughout the world, helping to ensure that billions of animals remain healthy.

Sometimes, however, a specific solution is needed in cases where a new strain of disease-causing bacteria or virus emerges or for a disease that is not covered by one of the registered and commercially-available products. To meet this need, over the past few years Ceva has emerged as a global

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Louis Pasteur - 1870s and 80s in France, Louis Pasteur developed the first vaccines for anthrax and rabies

leader in the rapidly growing field of custom-made vaccines, also known as autogenous or auto-vaccines.

This is not however a new field, the very first known vaccines were developed in a similar way in 1796, when an English doctor, Edward Jenner after finding a case of cow-pox in a dairy maid collected matter from her pustules and inoculated an 8-year-old boy. After a number of similar studies, he was able to convince a rather sceptical medical community of the value of his breakthrough and the concept of vaccination (which he named from Variolae vaccinae – smallpox of the cow) was born.

Later, in the 1870s and 80s in France, Louis Pasteur developed the first vaccines for anthrax and rabies. French-born Pasteur's contributions to public health, science and society were immense. He was a chemist, biochemist and biologist amongst other disciplines. His achievements included helping the Impressionist painters prepare better paint colours, to applying the concept of fermentation to the beer and wine industries and leading to the concept of milk pasteurisation. He is also credited with providing direct support for the germ theory of disease and its application in clinical medicine.

THE ROLE OF BESPOKE VACCINES

Autogenous vaccines are made specifically for a designated herd or flock on a particular farm. Having first determined that the disease present on the farm cannot be prevented using existing licenced and commercially available products, the farm's veterinarian obtains a sample from a sick or dead animal. The disease-causing microorganisms are cultured and characterised in the laboratory and the isolated pathogens then transformed by the vaccine manufacturer into custom vaccines. This process usually takes 4-6 weeks, after which the autogenous vaccines can be used on the farm, under veterinary supervision, to alleviate the original disease problem.

Ceva first began producing autogenous vaccines in the USA and later, in 2016, acquired Biovac, a leading manufacturer of autogenous vaccines, allergy treatments and associated reagents in France.

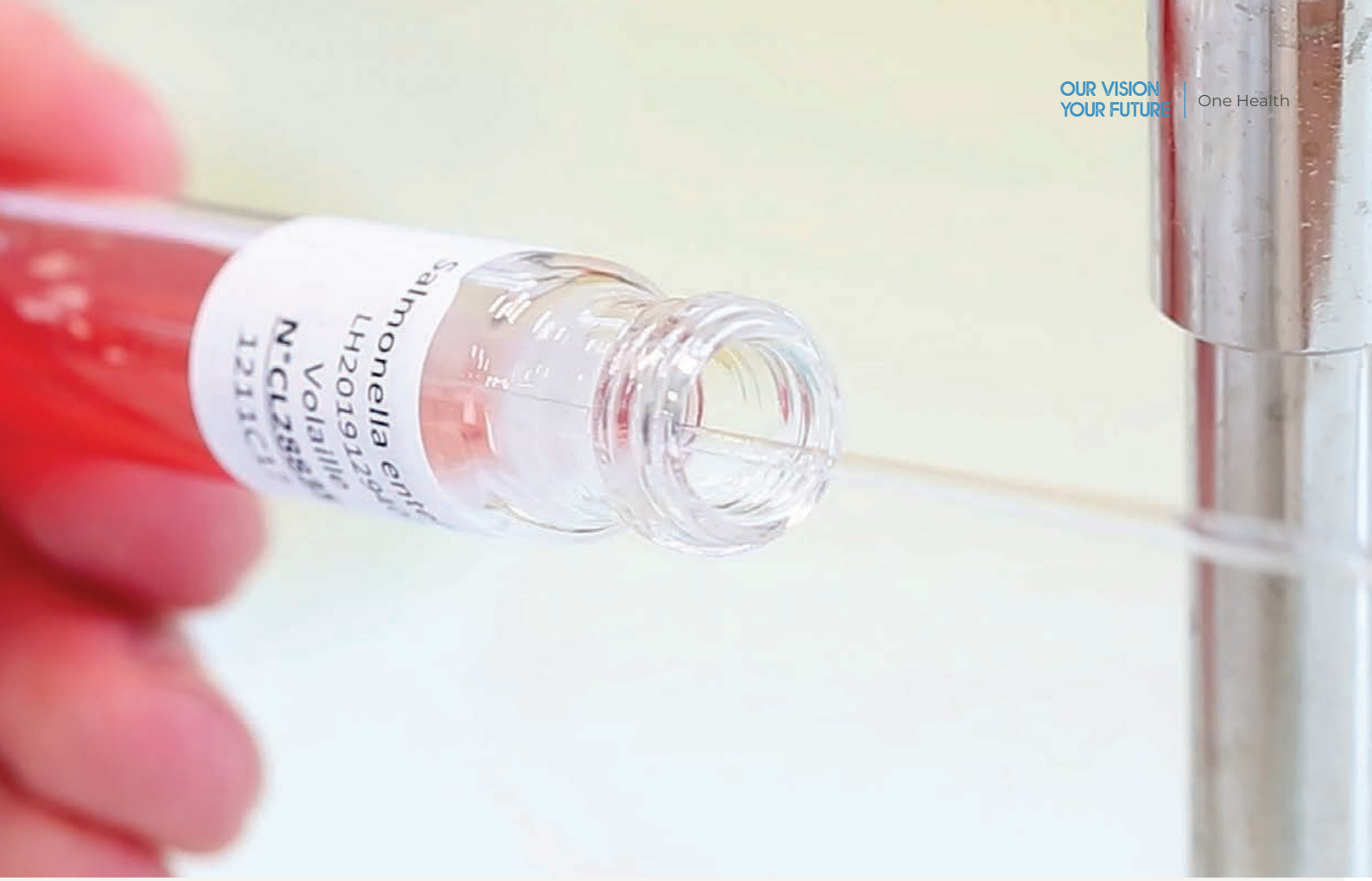
Ceva's autogenous vaccines expertise, which encompasses veterinary medicine, microbiology and vaccine production, can be used to produce custom vaccines for a wide range of animals. This includes minor farmed species, for which off-the-shelf vaccines are not available, and also companion animals. The company's autogenous vaccines have been produced to provide bespoke protection for pigs, poultry, horses, rabbits, fish and even wild animals.

In a notable first, over recent years Ceva has worked with a number of partners to produce a custom vaccine to protect one of the world's most endangered species the Amsterdam island albatross with only 51 remaining nesting pairs (see page 61 - 63).

Autogenous vaccines play a much more important role than simply filling the gap where there are no commercial products currently available. They play a vital role in preventative health management programmes, allowing veterinarians to stay close to the farm, better understand the existing disease status and, as a result, reduce the need for emergency treatments.

This is particularly vital to ensure that antibiotics remain effective and available for use when they are needed to safeguard the lives of people and animals. Autogenous vaccines can also be used to fight against multi-drug resistant bacteria. Finally, they can help support public health programs, for example by helping to control food-borne pathogens such as Salmonella and *Escherichia coli* by preventing these infections in poultry and pigs.

Demand for autogenous vaccines has been growing so fast that it became clear that the Ceva Biovac facility in France was no longer big enough to cope with this. A second, much larger facility was therefore built on the existing site during 2019-20. The global coronavirus pandemic has



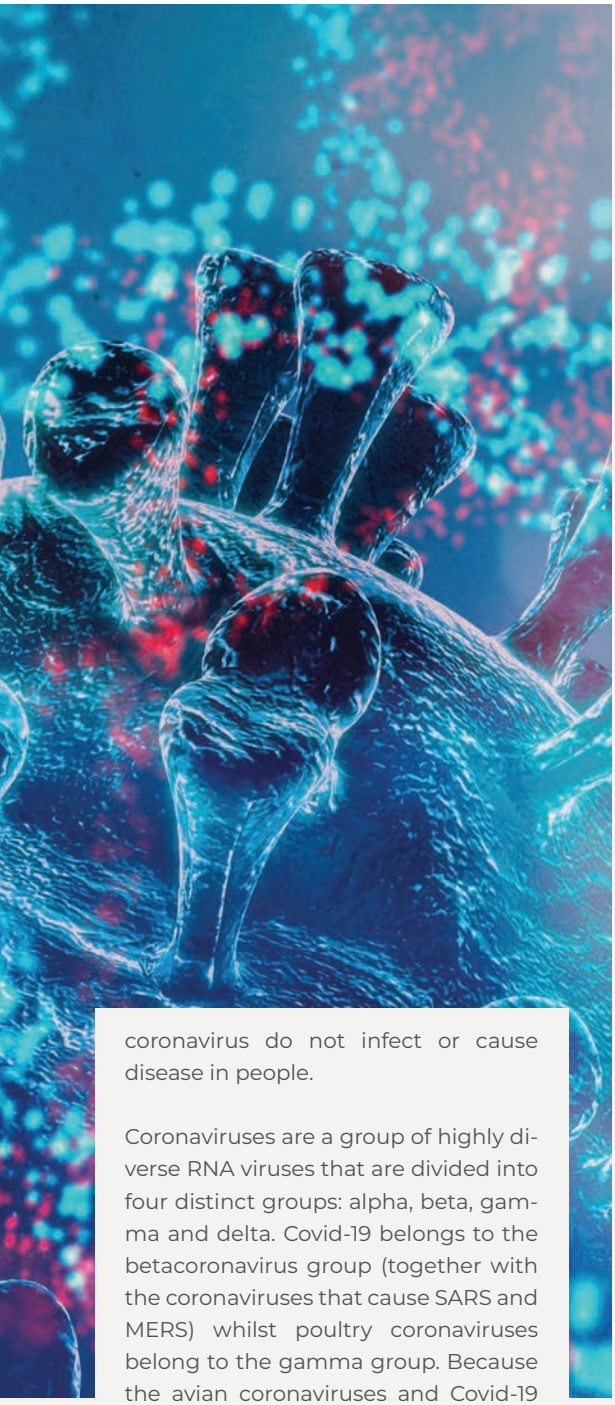
delayed the final official inspections needed before the new facility can start production. This new capacity will mean that Ceva can produce custom vaccines to complement its mainstream products, providing even more customers with a more complete set of tools to maintain the health, productivity and welfare of their animals and to help safeguard public health.

COVID-19 AND HOW OUR EXPERIENCES FROM VETERINARY SCIENCE CAN CONTRIBUTE TO IMPROVED KNOWLEDGE

While the whole world grapples with the immense threat to global health, well-being and prosperity from the ongoing Covid-19 pandemic, this seems like a good opportunity to consider the contribution that animal health professionals, including our own experts at Ceva, can make at this time.

Although many people have only heard about coronaviruses recently, this group of viruses and the diseases they can cause are very familiar to medical and veterinary researchers and clinicians.
Coronaviruses are amongst several viruses that cause the common cold in humans. In the early 2000s both severe acute respiratory syndrome (SARS), first reported in 2003, and Middle East Respiratory Syndrome (MERS), in 2012 were caused by coronaviruses. Although both have now been largely contained, they were different from the common cold with both causing significant numbers of deaths (774 and 858 reported deaths for SARS and MERS, respectively). The spread and total deaths associated with the above two diseases were, however obviously not at all comparable to the scale seen for Covid-19.

The avian coronavirus infectious bronchitis virus (IBV) is a respiratory pathogen of chickens that causes severe losses in poultry worldwide. Coronaviruses are also associated with a number of important respiratory and enteric diseases of pigs: transmissible gastroenteritis, haemagglutinating encephalomyelitis, porcine epidemic diarrhoea and porcine respiratory coronavirus. But importantly the Covid-19 virus is not found in chicken or pork products and avian and porcine



coronavirus do not infect or cause disease in people.

Coronaviruses are a group of highly diverse RNA viruses that are divided into four distinct groups: alpha, beta, gamma and delta. Covid-19 belongs to the betacoronavirus group (together with the coronaviruses that cause SARS and MERS) whilst poultry coronaviruses belong to the gamma group. Because the avian coronaviruses and Covid-19 belong to two different groups of coronaviruses, it is highly unlikely that avian coronaviruses will infect humans, or vice-versa.

The animal health industry has for over 50 years effectively used vaccines to prevent IBV in poultry. Ceva's poultry experts have worked extensively on these IBV vaccines. In 2013, Ceva launched Cevac IBird®. This vaccine provides effective protection against several variants of infectious bronchitis seen on multiple continents. When used in a vaccination programme combined with Cevac Mass L., a single vaccination in the hatchery protects meat-producing chickens throughout their life.
Ceva continues to utilize existing and newer technologies to protect the livestock industry from the populations of coronaviruses that infect these species. There are multiple ongoing projects (including molecular diagnostic, new genomic vaccines technologies, platform vaccines, bioinformatic, artificial intelligence, biologicals and vaccine administration) within Ceva that enhance the safety and efficacy of current and future vaccines.

It is likely, although not yet fully proven, that the Covid-19 virus originated in the wild bat population. The biology of bats is fascinating and has important implications for coronaviruses which cross the species barrier to people. When bats fly, they expend huge amounts of energy making their temperatures soar, in effect, mimicking a fever. In both humans and other animals, fever results from infections and is part of the body's defence mechanism, raising temperatures in an attempt to kill 'new invaders', such as viruses. In the case of coronaviruses that have evolved in bats, because they have to cope with the 'fevers' associated with flying, they are not so affected by higher body temperatures.
The coronavirus crisis clearly brings home the interconnection between human, animal and environmental health. This is why, in 2010, looking ahead at future health megatrends it was decided that Ceva should become a One Health company, recognizing that the health of humans, animals and ecosystems are interconnected.

This was the origin of the "Together, beyond animal health" slogan and since then Ceva has moved its business from just over 25% vaccines to close to 50% today, focusing on preventative health that helps keep both animals and humans safe.

Ceva greatly values the mutual learning that can occur between professionals working in the fields of human and animal health. In the past, for example, it has organised a series of meetings bringing together veterinary and medical professionals to enable them to share experiences and learn from each other. Looking forward, it will continue to encourage and facilitate mutually beneficial collaboration between the two professions as part of our broader commitment to the One Health movement.

To better understand the challenges associated with the COVID-19 in humans, poultry health professionals can draw on their many years of experience attempting to control avian coronavirus infectious bronchitis virus in poultry.

Finding effective vaccines to control these devastating diseases in humans and animals will be one of the keys to protecting our future health. Ceva's experts are committed to sharing their knowledge to ensure we urgently achieve this goal.

MORE ACTION NEEDED ON ANTIMICROBIAL RESISTANCE SAYS LATEST OIE REPORT

A report published in October 2019 by the respected, independent policy institute Chatham House reviewed progress in the three years since the publication in 2016 of the authoritative Review on Antimicrobial Resistance that had been commissioned by the UK government. Although there was a "startling lack of progress on critical recommendations...[there] have been significant advances in reducing antibiotic use in agriculture, particularly in high-income countries, but there is a long way to go in low- and middle-income countries." An earlier February 2019 report from the World Animal Health organisation (OIE) acknowledged that, although there has been global progress in the regulation and monitoring of antimicrobial use in animals, there is still much more that can be done. In 2015, more than 180 OIE member countries officially committed to combat antimicrobial resistance (AMR), promote the prudent use of antimicrobials in animals and fully support the Global Action Plan on AMR, developed by the World Health Organisation in close collaboration with the OIE and the Food and Agriculture Organization of the United Nations.

Speaking at the launch of its third annual report on antimicrobial agents intended for use in animals, Dr Tedros Adhanom Ghebreyesus, OIE's Director-General, said:*"Many countries have already taken key actions, such as setting up surveillance systems and regulating the use of antimicrobials in human and animal health, but we still have a long way to go. Working together is the only way to avoid the huge human, social, economic and environmental costs of antimicrobial resistance."*

Poultry farmer in Portugal

Sylvain Comte, Ceva Poultry franchise director, explained: *"On farm trials and associated works from scientists and poultry producers has shown that consistent, correct application of new technology and vaccines allow producers to both control and reduce disease burden for present and future flocks: reducing the risk of clinical or subclinical sickness and therefore the likelihood that birds will need to be treated with antibiotics."*

'Working together' lies at the heart of Ceva's approach to all its endeavours. The actions of Ceva's management and its global network of animal health professionals clearly demonstrate that they are more than willing to play their part – living up to the company's **'Together, beyond animal health'** motto.

Since 2011, Ceva has taken a number of bold steps which have seen it transform itself from just another supplier of antibiotics towards becoming a global leader and the 'new reference' in the rational use of antibiotics. This includes the development and implementation of ambitious programs to address the problem of antimicrobial resistance and to promote rational prescribing of antibiotics across all its major business areas: poultry, ruminants, companion animals and pigs.

SUPPORTING ANTIBIOTIC-FREE POULTRY PRODUCTION

Over recent years Ceva has been at the forefront of the shift from controlling diseases through administration of antibiotics and other drugs to effective disease prevention through the strategic use of its growing range of innovative new-generation vaccines. Ceva has also invested significant resources in providing support services, such as its award-winning C.H.I.C.K. program, and equipment to enable automation of vaccination, especially at the hatchery, to ensure effective vaccination so that all birds are well protected against the major diseases.

A more recent focus of attention for Ceva is to support poultry farmers as they rise to the challenge of antibiotic-free production in response to rapidly increasing demand for such products from retailers and consumers. While vaccination plays a critical role in antibiotic-free production it is not on its own sufficient and needs to be complemented with excellent biosecurity and measures to reduce stress in birds, which may include reduced stocking rates and paying more attention to gut health and feed and water quality.

An important aspect of this new approach to rearing poultry is to balance the health needs of the flock and individual birds to avoid potential animal welfare issues.

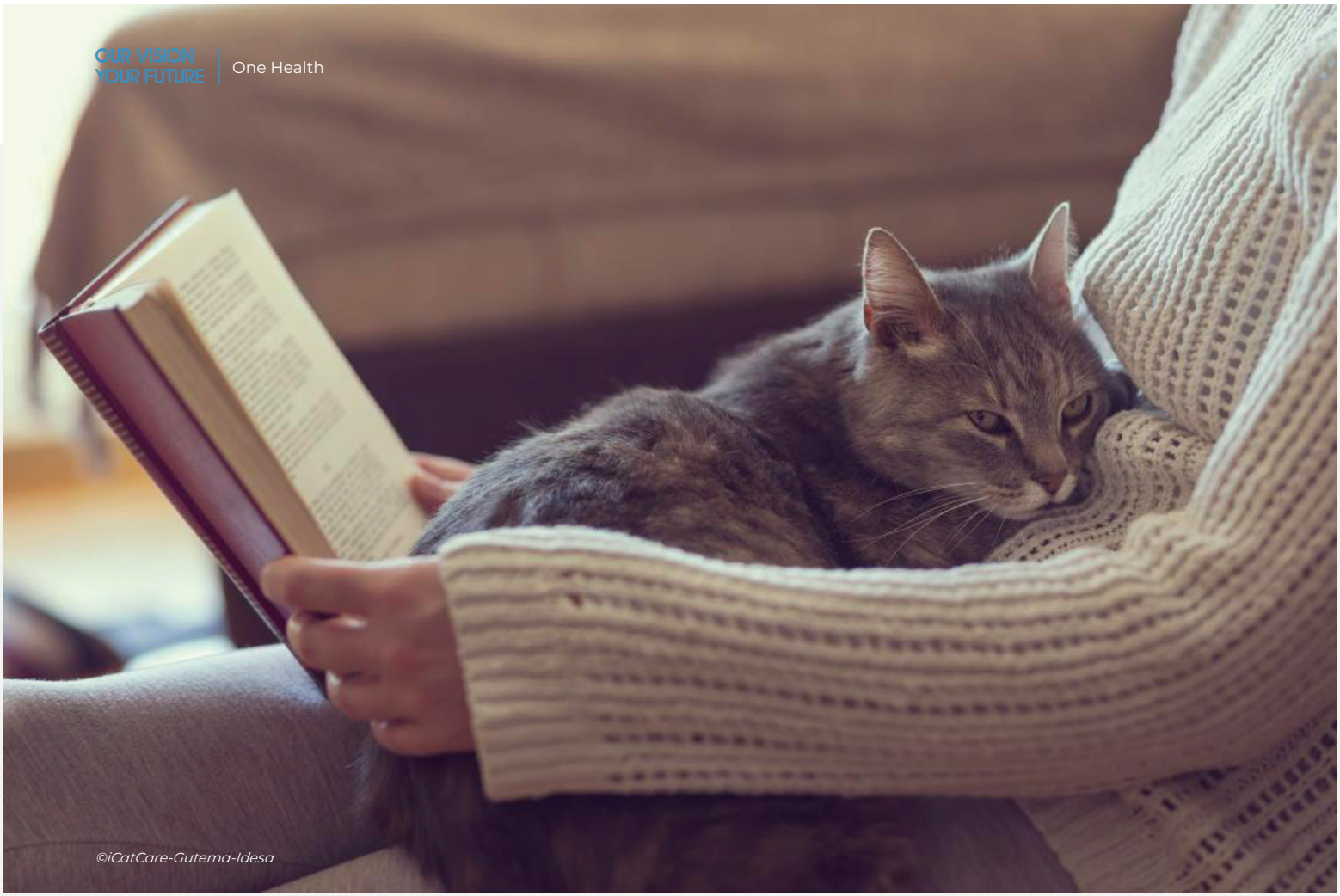
CEVOLUTION: RESPONSIBLE INNOVATION FOR RATIONAL ANTIBIOTIC PRESCRIBING IN LIVESTOCK

With increasing global concern about the impact of antibiotic resistance on the health and welfare of people, Ceva management decided a radical change was needed. Under the campaign name 'Cevolution', in 2011 Ceva set out to reposition itself as the 'new reference' in the rational use of antibiotics in cattle, sheep and goats. It does this by offering a wide range of differentiated antibiotic products, backed up by excellent up-to-date information, education and training to support rational antibiotic prescribing and use, address environmental concerns and enhance animal welfare.

Cevolution's focus is a wide portfolio of antibiotics and an approach that empowers veterinarians to make the right diagnosis, prescribe the right antibiotic (only when needed), at the right time and only for individual animals. It includes an extensive education and training program for vets and farmers. A comprehensive library of high-quality, authoritative print and on-line resources, produced in partnership with international opinion leaders and experts, and a regular newsletter are freely available to veterinary practitioners.

Compared to 10 years-ago, surveys confirm that Ceva is now widely regarded as a trusted partner in antibiotherapy.

The wide Cevolution range of products enables vets to choose the right antibiotic for the diagnosed infection. Easy resuspension, improved syringability and shock-resistant and ergonomic vials enhance compliance and convenience, and reduce waste: the full dose can be administered rapidly with minimal discomfort to the animal. Extensive education, training and information ensures vets and farmers are aware of best practice and the latest developments and regulations.



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PROVIDING GUIDANCE FOR RATIONAL PRESCRIBING OF ANTIMICROBIALS IN PETS

Even ahead of the publication in 2016 of the landmark review on antimicrobial resistance, chaired by Jim O'Neill and commissioned by the UK prime minister, veterinarians in the UK, Germany and France had signalled a need for a pragmatic guide to rational prescribing that could be readily used under the time pressure of a consultation.

In 2014, Ceva began work to address the vets' need. This culminated in 2016 in the launch of Ceva's 'Guidance for the rational use of antimicrobials' – GRAM for short – a comprehensive practical and easy-to-use guide to promote rational prescribing of antibiotics. GRAM has since been rolled out across Europe and is freely available to vets in several languages. With over 500 pages, it was developed over a six-month period by an independent panel of 10 experts drawn from seven European countries, all recognised leaders in antibiotherapy.

National and transnational health authorities, such as OIE and WHO, have already published many guidelines. The idea behind GRAM was not to compete with these or create yet another guide, but rather to synthesise what already exists, reach a consensus and simplify the material so as to provide clear, practical answers to the questions that vets are likely to have in relation to rational use of antimicrobials in canine and feline surgery and medicine. The book includes 37 disease factsheets, 29 detailed recommendations and six synopses dealing with major topics such as 'key questions before initiating any antibiotherapy'.

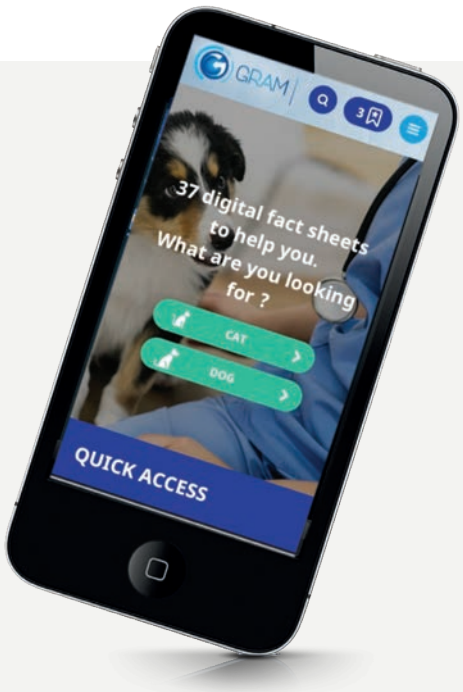
Ceva's work to protect the efficacy of antibiotics through GRAM has received favourable responses from health authorities, including from a recent European Commission fact-finding mission visiting UK vet practices.

GRAM emphasises proper diagnosis before treatment and the use of options other than antibiotics; e.g. use of suitable topical antiseptics as initial choices for the treatment of superficial dermatological conditions.

Where antibiotics are justified, to facilitate better compliance Ceva's DELICAMENTS® range of highly palatable antibiotic tablets are readily accepted by dogs and cats. Also, by introducing quarter-scored tablets, the DELICAMENTS® range enables vets to prescribe antibiotics with greater accuracy.

CEVA LUNG PROGRAM: EFFECTIVE PREVENTION OF PIG RESPIRATORY DISEASES FOR REDUCED ANTIBIOTIC USAGE

The Ceva Lung Program is a simple but effective methodology and guidelines used to generate lung scores from slaughtered pigs based on visual inspection of lung lesions.



The results, depicted in clear graphic displays, are used to monitor efficacy of vaccination against pig respiratory diseases.

In 2014, the Ceva Lung Program was launched in Asia. Since then, the award-winning Program has been rolled out worldwide. The Program, which runs as a user-friendly app on Android and i-Pad mobile devices, calculates the incidence, severity and impact of enzootic pneumonia and pleuropneumonia and even reveals the presence of subclinical infections. The results can be used to evaluate the efficacy of control measures, including vaccination protocols, flag-up changes in disease dynamics and benchmark effectiveness of respiratory disease management in comparison to other farms.

Use of the Program has grown rapidly; in 2018, data was collected and analysed from more than half a million lungs. In addition to being useful as a strategic tool on individual farms, this unique, 'big data' set is being used to identify factors associated with high or low prevalence of respiratory disease to help in the design of better preventive programs.
By providing vets and farmers with a simple but effective tool to help them improve the management of respiratory disease through more effective vaccination regimes, use of antibiotics can be reduced to a minimum while productivity and pig welfare is enhanced.

CEVA'S GROUP-WIDE APPROACH

Published in 2014, Ceva's overall position with regard to antibiotics is described in a position paper, the title of which clearly underscores the intent: *'Antibiotics: as little as possible and only as much as necessary.'*

The group's position is neatly summarised in the paper's opening sentence: *"The veterinarian alone is in the position to make the right diagnosis, to choose the best antibiotic to prescribe to the right patient, at the right time and only for animals that are infected."*

An important focus of the paper is for antibiotic use to be 'fewer and better'. The paper notes that "antibiotics are vital, irreplaceable drugs to treat human and animal infectious diseases...The only way to avoid or reduce resistance is to use fewer antibiotics. That is why, for Ceva, antibiotics should be used "as little as possible and only as much as necessary" to treat infected animals - and humans."

It is also clear that antibiotics should only be used when clinically justified. It states: *"Antibiotics should only be used for the treatment of infected individuals. Self-medication with antibiotics, without an accurate diagnosis made by a doctor or a veterinarian, is highly unadvisable in human and animal health.*
Under no circumstances may antibiotics be used to boost animal growth, or in healthy animals in the absence of any risk of infection."

Roadmap to reducing the need for antibiotics
Along with other leading global animal health companies, Ceva is a signatory to the 'Roadmap to reducing the need for antibiotics' published in August 2019 by Heath for Animals, which represents the global animal health industry. The roadmap includes five guiding principles which roadmap signatories have committed to follow.

These are:

- **Principle 1:** Protect animal health and welfare in a unified One Health approach.
- **Principle 2:** Use antibiotics judiciously and responsibly.
- **Principle 3:** Promote disease prevention and increased access to products and expertise.
- **Principle 4:** Invest in development of products for prevention and treatment.
- **Principle 5:** Increase knowledge, transparency and communication.


HEALTHY
ANIMALS

EUROPE AND BRAZIL BENEFIT FROM NEW INITIATIVES AGAINST LEISHMANIOSIS

Since 2016, starting in the United States, Ceva's DOUBLE DEFENSE™ protocol has been protecting dogs against the serious and potentially fatal disease heartworm. Prior to this, veterinarians focused on treating dogs with heartworm preventive products. Research supported by Ceva, however, demonstrated the benefit of combining a topical insecticide to repel and kill the blood-sucking mosquitoes that transmit the disease with a preventive drug against the heartworm parasite – an approach known as 'DOUBLE DEFENSE™. This approach, endorsed by the American Heartworm Society, especially in high risk areas, is now widely recognised as the 'gold standard' approach to controlling heartworm.

New initiatives by Ceva and partners are now extending the benefits of the DOUBLE DEFENSE™ approach to protect dogs in Europe and Brazil from another important vector-borne parasitic disease, leishmaniosis.

Like heartworm, leishmaniosis is transmitted by biting insects; sand flies in the case of leishmaniosis.

Both diseases are serious and potentially fatal for infected dogs in regions of the world where the right species of mosquito or sandfly occur – which is generally the warmer regions of the world, although climate change is affecting their distribution.

However, leishmaniosis has other complicating factors: it can be transmitted from breeding bitches to their pups, from infected male dogs to uninfected bitches during mating, or via blood transfusions from infected to uninfected dogs. It can be introduced into regions where the insect vectors do not occur and the disease is not endemic, for example when infected but asymptomatic dogs are moved long distances; this is a risk when rescue dogs from leishmaniosis endemic areas are rehomed in non-endemic areas.

Critically, leishmaniosis is a zoonotic disease: people as well as dogs can become infected with the leishmaniosis parasite and both humans and their canine companions can develop

a range of serious and potentially fatal conditions.

Cutaneous leishmaniasis is the most common form affecting people causing skin lesions, mainly ulcers, on exposed parts of the body, leaving lifelong scars, serious disability and also stigma impacting on quality of life and psychological well-being. Mucocutaneous leishmaniosis leads to partial or total destruction of mucous membranes of the nose, mouth and throat. Visceral leishmaniasis is characterized by fever, weight loss, enlargement of the spleen and liver, and anaemia; if left untreated more than 95% of patients die.

Leishmaniosis in people is a major problem in Brazil: in 2018, 276 deaths due to visceral leishmaniosis were recorded and 3,466 cases confirmed[1]. In Brazil and globally, the number of human cases has increased in recent decades: the WHO estimate there are up to 1 million new cases and as many as 30,000 deaths annually, especially in middle- and low-income countries.

1 : Source: LV-Casos.pdf (saude.gov.br)

As Professor Mary Marcondes, a member of the scientific board of the Brazilian Society of Veterinary Dermatology, explained during a recent Ceva TV interview:

> *The dog is the most important reservoir of leishmaniosis and it has a great susceptibility to the disease, and when you prevent the disease in dogs indirectly you decrease the incidence in human beings and you decrease the prevalence of the disease in other dogs.*

Over recent years, Ceva has been working with expert researchers and clinicians from all around the world to generate new knowledge about leishmaniosis, to develop detailed evidence-based and practical guidelines for veterinarians to help them improve the diagnosis, treatment and prevention of the disease, and to increase awareness amongst dog owners of the threat the disease represents and what they should do to prevent it.

GENERATING NEW KNOWLEDGE

Recently Ceva supported pioneering research in Italy which demonstrated that VECTRA 3D®, a Ceva parasiticide product that contains three active ingredients, effectively prevents sand flies from acquiring infections from dogs naturally infected with the visceral form of leishmaniosis. Up to a month after application of VECTRA 3D®, the product was more than 95% effective in preventing infections in previously uninfected sand flies that were exposed to the dogs.

VECTRA 3D® is an advanced topical product with a unique and innovative formulation: it adds a repellent effect to the classical parasites killing action. It acts against mosquitoes, sand flies, fleas and ticks before they bite, so before potential transmission of disease.

HELPING VETERINARIANS TO BETTER DIAGNOSE, TREAT AND PREVENT DISEASE

In 2019, Ceva invited a group of more than 20 of the world's leading experts on heartworm and leishmaniosis to gather in Sao Paulo, Brazil. During a facilitated workshop, the distinguished group – who came from France, Greece, Italy, Spain, USA and Brazil – reviewed the latest evidence and jointly developed and co-wrote a comprehensive, practical guide to the diagnosis, treatment and prevention of these two vector-borne, parasitic dog diseases. The resulting 40-page booklet, which is available on request to veterinarians, is a major update of an earlier version published by Ceva in 2018. The new edition benefited from the combined wisdom and experience of the expert group and also expands its coverage to include treatment options as well as diagnosis and prevention.

DOUBLE DEFENSE™' INTRODUCED TO DOG OWNERS AND VETS IN BRAZIL

When Ceva acquired the Brazilian animal health company Hertape Saude Animale Ltda in 2016, one of products the group gained was Hertape's recently developed vaccine for the prevention of leishmaniosis in dogs, LEISH-TEC. Not only did this provide an interesting additional tool for Ceva's commitment to counter the expanding global threat from zoonotic diseases, it also marked the company's entry into the companion animal vaccine market.

During 2019 and 2020, Ceva Brazil has introduced the DOUBLE DEFENSE™ approach to controlling leishmaniosis in the country with appropriate information targeted at dog owners and veterinarians, respectively. Uniquely in Brazil, this combines the use of VECTRA 3D® targeting sand flies together with vaccination using the LEISH-TEC vaccine to control the parasite.

LEISH-TEC is the only leishmaniosis vaccine approved for use in Brazil. It is a recombinant vaccine based on the A2 protein, which has been shown to generate a strong, specific and protective immune response against the leishmaniosis parasite. Because the vaccine is based on a purified protein it is also very safe.

The marketing campaign for the DOUBLE DEFENSE™ protocol in Brazil has been based on two pillars: use of social media targeted at dog owners to increase the awareness about the disease and the importance of its prevention and tools to increase the expertise of veterinarians (technical materials, website portal for veterinarians, and lectures with local key opinion leaders). For the first pillar, a particularly successful element has been the use of a short, animated film that explains how the combination of annual vaccination with LEISH-TEC with regular application of VECTRA 3D® can effectively prevent leishmaniosis in dogs.

Marie Varloud and Eve Pouzet, Ceva's Global Parasiticides Technical and Marketing Managers respectively, explained:

> ***"Our approach to the control of leishmaniosis is another example of how the Ceva companion animal parasiticides team work. 'The more we know, the better we can fight' is our motto. For leishmaniosis, and also heartworm and Lyme's disease, this includes supporting research to increase our understanding of the interactions between the host, vector and parasite; bringing together the top researchers and practitioners from all around the world to jointly develop evidence-based best-practice guidelines; producing appropriate materials and information tailored to meet the needs of both veterinarians and dog owners, helping them recognise the problem and make informed decisions about the best options for treatment and prevention. And, of course, we develop and supply innovative products and devise protocols for their use that provide real benefits over those that went before."***

CEVA'S POULTRY TRAINING PROGRAMS SPAN THE GLOBE

Even the best, most innovative animal health products will only be effective if they are used correctly. This is especially true for vaccines. That is why Ceva does far more than simply sell its vaccines. Instead, it aims to provide complete vaccination solutions that often include training targeted at both veterinarians and those engaged in poultry production, technical support, monitoring systems and specialist equipment. This approach is particularly advanced in Ceva's poultry business unit: a noteworthy example is the C.H.I.C.K. program. Operating in more than 40 countries worldwide, the C.H.I.C.K. program aims to ensure the highest hatchery vaccination quality for all chicks before they are sent to the farms.

More generally, Ceva places great importance in providing access to continuing professional development (CPD) both for its own staff and for those of its customers. Over the past 5 years, more than 6,500 poultry producers, veterinarians, hatchery staff and farm technicians have benefitted from Ceva's training programs which have been delivered across Africa, Asia, Europe and Latin America. Topics covered vary: some of the training events focus on a single poultry disease, such as avian influenza or infectious bursal disease (IBD), while others are more widely based, for example vaccines development, hatchery trends and data management. In the past, training has been delivered through live events with practical hands-on sessions and visits an important part of the curriculum. Responding to the coronavirus pandemic, recent events have been delivered online; for example, a recent highly topical webinar in Malaysia focused on the poultry industry and Covid-19.

In addition to providing training opportunities for its customers as part of its mainstream operations, Ceva is also committed to supporting all types and scales of livestock and poultry producers from all around the world.

In 2015, Ceva received a grant from the Bill & Melinda Gates Foundation (BMGF) to manage a 4-year long project to provide specialist training on poultry diseases and their control to a total of 180 vets in Bangladesh and Ethiopia. The objective was to increase the vet's individual and collective capacity so they could better support emerging commercial poultry farmers. The formal end of the project (2020) has been delayed by the coronavirus pandemic, but the project design included the creation of local capacity to enable continuing professional development opportunities, focused on providing support to the emerging commercial poultry sector, to continue to be offered to local vets on an ongoing basis.

The training program was provided through a partnership of local and French veterinary schools, Ceva and the BMGF, together with international poultry consultants.

60 vets in Ethiopia

have successfully completed the training course

Global demand for poultry meat and eggs has increased dramatically over recent decades with the rate of increase especially high in developing countries. In developed regions, very large-scale commercial poultry systems, often involving fully integrated operations that include all aspects of breeding, rearing, processing and marketing, dominate production. In contrast, in developing regions more than 80% of poultry are still kept in low input-low output backyard poultry systems.

To keep up with growing demand, which is driven by population growth, rising incomes and a shift from rural to urban areas, poultry production in developing countries needs to intensify and a major shift is needed from inefficient free-range backyard systems to emerging commercial systems. The latter are based on the use of improved genetics, feeds, housing and overall management, including effective disease control and biosecurity measures.

A major constraint to this shift occurring is the lack of vets in developing countries who have experience and knowledge of poultry diseases and their effective control in commercial systems. Without expert veterinary support it is extremely risky for farmers to embark on commercial poultry production. Developing country veterinary schools currently emphasize cattle rather than poultry in their curricula.

The problem is especially acute in small to medium-sized commercial poultry farms which are often owned by emerging farmers who lack experience and knowledge and also lack access to poultry experts and the knowledge, products and services they can bring. In contrast, the largest commercial poultry enterprises tend to have well established links to the same level of expertise, products and services as are enjoyed by their counterparts in more developed regions.

The project consisted of delivering

"Ceva partners with the Bill & Melinda Gates Foundation to train vets and boost dairy, poultry production and health in Ethiopia, Bangladesh and Burkina Faso."

four training modules to vets, each of which lasted a week. The modules were run at monthly intervals over a three-month period. Ahead of each module, participants – vets from the private and public sectors - received a reading list. This meant the week-long training sessions could primarily focus on practical activities, such as post-mortem examinations and farm visits. The overall focus was on preventive approaches.

To date, 90 vets in Bangladesh and 60 in Ethiopia have successfully completed the training course. Facebook discussion groups have been formed to enable the vets to keep in touch and continue to support each other as a community of practice. In addition, the most able vets have been selected for further training and mentoring by the international experts so they can now serve as trainers to future cohorts of vets wishing to gain the knowledge and expertise needed to enable them to support commercial poultry farmers in their respective countries.

The existence of a cadre of trained poultry vets will enable the development of small and medium-sized commercial egg and meat producing poultry farms in ways that support safer and more efficient production. This will enable the poultry sectors in Bangladesh and Ethiopia to grow in a more sustainable way, enabling domestic production to meet more of the rapidly increasing local demand for eggs and meat as part of more diverse and nutrition diets. In turn this will support a greater number of more sustainable jobs in the sector.

The creation of a pool of local poultry vets who have the expertise and knowledge to teach future cohorts of vets so they too can better support commercial poultry farmers means that specialist poultry vets will be available to support the growing commercial poultry sector on an ongoing basis.


JUGUETES PARA BEBE
HEALTHY
FOOD

HEALTHY LIVESTOCK'S ROLE IN PROVIDING SAFE, NUTRITIOUS FOOD FOR ALL

A major thrust of Ceva's work is to support livestock farmers, enabling them to keep their animals healthy while respecting their welfare. The company's primary focus is disease prevention: healthy animals enjoy a better quality of life and are more productive – a triple win for farmers, their flocks and herds, and consumers. And because healthy animals are more efficient at converting feed into food for people, health animals are also good for the environment.

Beyond its primary role of developing, manufacturing, supplying and ensuring the effective use of innovative vaccines and other animal health products and services, Ceva is committed to helping to increase access to safe, nutritious meat, milk and eggs – including by the poor and vulnerable.

It is impossible to ignore the fact that today the voices of those who oppose the livestock industry and choose not to eat the products it supplies are being heard loud and clear. It is undoubtedly true that overconsumption of food, including meat, milk and eggs, is a huge global problem: according to WHO, almost 40% of adults over 18 are overweight and the worldwide prevalence of obesity has tripled since 1975.

But equally for hundreds of millions of the world's poorest citizens and their children, the addition to their nutrient-poor diets of even small amounts of meat, milk or eggs would make a huge difference to their health, wellbeing and life chances, and even to their survival.

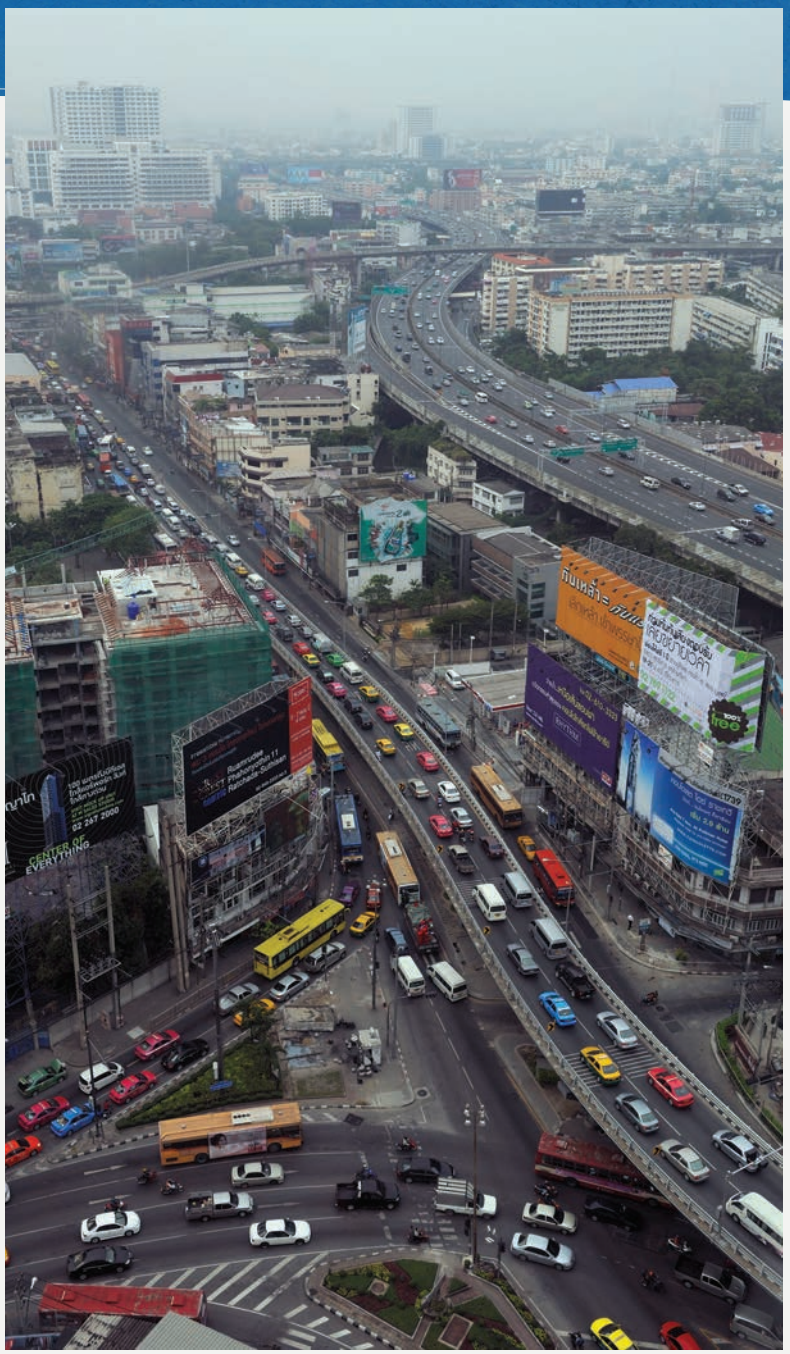
The 2020 edition of the UN's State of Food Security and Nutrition[1] reveals that ***"a staggering 3 billion people or more cannot afford a healthy diet… [and] in 2019, between a quarter and a third of [the world's] children under five (191 million) were stunted or wasted – too short or too thin."***

The press release accompanying the publication of the report goes on: ***"Tens of millions have joined the ranks of the chronically undernourished over the past five years, and countries around the world continue to struggle with multiple forms of malnutrition… almost 690 million people went hungry in 2019 – up by 10 million from 2018, and by nearly 60 million in five years. High costs and low affordability also mean billions cannot eat healthily or nutritiously. The hungry are most numerous in Asia but expanding fastest in Africa. Across the planet, the report forecasts, the Covid-19 pandemic could tip over 130 million more people into chronic hunger by the end of 2020."***

Against this worrying background, Ceva is committed to playing its part to ensure that the role that the global livestock industry plays in providing humanity with nutritious and safe food is not overlooked, played down or threatened. Below we explore some of the work Ceva is doing to that end, which includes contributing to the debate and also practical initiatives on the ground.

1 : As more gwwwo hungry and malnutrition persists, achieving Zero Hunger by 2030 in doubt, UN report warns (who.int)

HELPING TO BALANCE THE RISKS OF UNDERNUTRITION AND FOOD SAFETY



In late November 2019, the Asia-Pacific Agri-Food Innovation Week was held in Singapore. This annual event focused on the latest innovations and opportunities in Asia's agri-food supply chain, and considered new models for technology investment, incubation and commercialisation. To accompany the event, The Asia Food Challenge report[1] was launched.

The report paints a vivid picture of the challenges and opportunities that Asia will face by 2030. By then the Asian population will have increased by over 250 million people[2] – equivalent to another Indonesia. Increasingly, these people will live in cities, including huge megacities. In 2030, two-thirds of the world's middle class will live in Asia[3] and these more affluent and better-connected people will demand better quality food that is more nutritious, fresh, safe and convenient. Between 2019 and 2030, the annual Asian food market will double in value to USD 8 trillion[4].

However, already the continent is struggling to feed itself: net imports of food have tripled since the year 2000[5]. Asia will be especially hard hit by the impacts of climate change: the amount of land available for farming will reduce as sea-levels rise, extreme weather events will occur more frequently, pest and disease burdens will increase – witness the devastating impact on food supplies caused by the ongoing African swine fever outbreak. Although Asia is home to some of the

largest livestock farms on the planet, perhaps surprisingly, still today 80% of all the food consumed in the continent comes from smallholder farms[6].

Just before the event in Singapore, a special edition of the academic journal Animal Frontiers was published. It was subtitled 'Foods of Animal Origin: a prescription for global health'[7]. The special edition reviewed the evidence that demonstrates how nutrient-rich meat, milk, and eggs can efficiently boost nutrient-poor diets, either as part of the normal diet or if access is increased through interventions. It specifically reviewed the evidence for the role of livestock products in the critical first 1,000 days of life, from conception to the second birth day, in low- and middle-income countries. Finally, it dispassionately considered these benefits in the context of additional positive and negative impacts on human health, the environment, societies and economies.

During the Agri-Food Innovation event, 'Developing a safer food system farm to fork in Asia', Ceva CEO and chairman Marc Prikazsky highlighted an exciting initiative by a group of Ceva's 'Millennial Managers' from Asia. Challenged to come up with a new corporate social responsibility project, they did their research and settled on tackling the enormous problem of child malnutrition. The facts are shocking: of the 5.3 million children under 5 years old who die globally each year, nearly half of these deaths are due to undernutrition[8]. Stunting – caused by undernutrition that impairs normal growth and development – affects 149 million children globally; 2 in every 5 children in S.E. Asia are stunted[9].

The Ceva manager's response was to launch the C our Future campaign to draw attention to the problem of malnutrition of children in the region. They also implemented a simple solution: promoting the benefits of consuming eggs and chicken meat to disadvantaged families, and also providing an egg a day directly to poor families with young children. Eggs are a near perfect source of high-quality protein and other micronutrients critical to support normal development.

The Animal Frontiers journal reported that the scientific evidence for the role of livestock products in improving nutrition is actually rather limited, especially during the first 1,000 days of life in low- and middle-income countries. This is largely because it is very difficult to conduct rigorously controlled but ethical with and without trials. But they did report on a recent study in Ecuador which showed that supplementing nutrient-scarce diets of children 3 to 9 months of age with one egg per day for 6 months increased child height and the prevalence of stunting was nearly halved compared with children on the traditional diet[10]. That's why the C our Future campaign is so important.

Unfortunately, the already complex and challenging food and nutritional situation is further complicated by the issue of food safety. WHO inform us that globally, 1 in 10 people fall ill every year from contaminated food and 420,000 people a year die as a result of food-borne diseases, a third of whom are children[11]. A recent report estimates that 35% of all food-borne disease is caused by livestock products[12].

The Asia Food Challenge report highlights the huge investment opportunities as an enormous and largely urban middle-class demand better quality food. As businesses rush to take advantage of these opportunities and the regulatory environment around food is tightened, there is a danger that the middle classes' demand for safe, nutritious,

convenient food will take attention away from the more basic needs of the poor. For them the imperative is access to even small amounts of meat, milk and eggs to supplement nutrient-poor diets.

Poor people mostly obtain the little meat, meat and eggs they can afford from informal markets which lack facilities such as refrigeration, clean safe packing materials, health and veterinary inspection - and in some cases, even clean, running water. Although the meat, milk and eggs that are sold are usually much less expensive than those sold in formal markets, food safety and hygiene standards are often much lower, enhancing the risks associated with consuming these nutrient-rich foods.

Fortunately, there are things that can be done. Firstly, diseases can be prevented on the farm – whether production is large-scale commercial or backyard – by routinely using vaccines and observing good biosecurity practices. Of course, Ceva produces a very wide range of highly effective and innovative vaccines and strives to support farming at all scales and all across the globe.

Secondly, it has been demonstrated that it is possible to work with traders in informal livestock product markets to drive up food safety and hygiene standards, while still offering consumers affordable livestock products. The long-running Smallholder Dairy Project in Kenya was jointly implemented by the Ministry of Livestock and Fisheries Development, the Kenya Agricultural Research Institute and the International Livestock Research Institute. An important focus of this project was the training provided to small-scale traders who sold raw milk. The authorities were initially hostile to these traders but came to appreciate the important role they played in selling affordable milk to poor families. Agreement was reached that, once the traders were trained, they could be officially licensed to sell raw milk, as long as they followed simple but effective hygiene guidelines. Although the initial work was done in Africa, the combination of 'carrot and stick' – if you undergo training and observe basic hygiene standards, you can be officially licensed to sell meat, milk or eggs – can and has been applied to informal food markets globally.

So, we do not have to make the impossible choice between food and nutritional security on the one hand and food safety on the other. We can work together with others to achieve the win-win – we can 'meat in the middle'.

1 : Skinner, R., Chew, P. and Maheshwari, A. (2019) The Asia Food Challenge report: Harvesting the future. PwC, Rabobank, Tamasek.

2 : UN Department of Economic and Social Affairs. World Population Prospects 2019. Data Booklet. Annex Table: Key Indicators, p.13 It states: 2019 population Asia = 4,601,371,000; 2030 = 4,974,092,000. Difference = 273 million

3 : Global Economic Development at Brookings: The Unprecedented Expansion of the Global Middle Class, https://www.brookings.edu/wpcontent/uploads/2017/02/global_20170228_global-middle-class.pdf

4 : Skinner, R., Chew, P. and Maheshwari, A. (2019) The Asia Food Challenge report: Harvesting the future. PwC, Rabobank, Tamasek – based on PcW analysis of data from World Bank, IMF, OECD-FAO, USDA, Capital IQ

5 : Skinner, R., Chew, P. and Maheshwari, A. (2019) The Asia Food Challenge report: Harvesting the future. PwC, Rabobank, Tamasek. Quoting unspecified FAO data. Note: data from https://wits.worldbank.org/CountryProfile/en/Country/CHN/Year/2000/TradeFlow/EXPIMP/Partner/all/Product/16-24_FoodProd for China show net imports increased 2.4 fold between 2000 and 2017 (Keith Sones' calculations)

6 : Skinner, R., Chew, P. and Maheshwari, A. (2019) The Asia Food Challenge report: Harvesting the future. PwC, Rabobank, Tamasek – direct quote attributed to President, Asia-Pacific, Corteva (https://www.corteva.com/)

7 : https://academic.oup.com/af/issue/9/4

8 : https://data.unicef.org/topic/nutrition/malnutrition/ Malnutrition. April 2019. It states:"Nearly half of all deaths in children under 5 are attributable to undernutrition; undernutrition puts children at greater risk of dying from common infections, increases the frequency and severity of such infections, and delays recovery."

9 : https://data.unicef.org/topic/nutrition/malnutrition/ Malnutrition. April 2019. It states:"Between 2000 and 2018, stunting prevalence globally declined from 32.5 per cent to 21.9 per cent, and the number of children affected fell from 198.2 million to 149.0 million. In 2018, nearly two out of five stunted children lived in South Asia while another two out of five lived in sub-Saharan Africa."

10 : Iannotti LL et al. (2017) Eggs in Early Complementary Feeding and Child Growth: A Randomized Controlled Trial. Pediatrics. 2017 Jul;140(1) https://pediatrics.aappublications.org/content/140/1/e20163459.long It states: "This randomized controlled trial showed that eggs introduced during infancy increased length-for-age z score by 0.63 and reduced stunting by 47%. There was no evidence of egg allergies. Eggs, generally affordable and accessible, have the potential to contribute to global stunting targets."

11 : https://www.who.int/health-topics/food-safety/

12 : Li M, Havelaar AH, Hoffmann S, Hald T, Kirk MD, Torgerson PR, et al. (2019) Global disease burden of pathogens in animal source foods, 2010. PLoS ONE 14(6): e0216545. https://doi.org/10.1371/journal.pone.0216545 It states: "We present the human disease burden associated with 13 pathogens (bacteria and parasites) in ASF, based on an analysis of global burden of foodborne disease (FBD) estimates of the WHO Foodborne Disease Burden Epidemiology Reference Group. In 2010, the global burden of ASF was 168 (95% uncertainty interval (UI 137–219) Disability Adjusted Life Years (DALYs) per 100,000 population, which is approximately 35% of the estimated total burden of FBD."

13 : Blackmore, E. et al (2015) Legitimising informal markets: a case study of the dairy sector in Kenya. IIED Briefing, London, UK. https://pubs.iied.org/pdfs/17316IIED.pdf It states: "Training and certifying informal market traders in Kenya has had sustained benefits: helping the government to protect public health, supporting the livelihoods of producers and traders and increasing the availability of milk to nutritionally insecure households."

CRACKING CHILD MALNUTRITION WITH 'ONE EGG PER DAY'

Initially, in 2012, the Ceva program provided 1,000 eggs a month but this has now grown to 10,000 a month. The whole Ceva Argentina team was given the chance to become involved as were customers; for example, for every vaccine order received, Ceva donates an additional 50 eggs to CONIN.

Maria Farina, Ceva Argentina

In October 2018, a special edition of the respected academic journal Maternal & Child Nutrition was devoted to a single issue – ***'eggs: a high potential food for improving maternal and child health'***[1]. Unless mothers and children have access to adequate amounts of nutrient-rich foods during pregnancy and early childhood, normal development and growth is not possible. In addition to physical stunting of children, inadequate nutrition does not enable normal cognitive development and brain functioning. Malnutrition during pregnancy and in the first few years of life therefore has lifelong impacts which prevent children from going on to fulfil their full potential - which does enormous harm to individuals and families and imposes huge costs on society.

The special edition highlighted a simple solution: providing children from poor families in low and middle-income countries with just one egg a day was an effective way of helping to meet their nutritional needs at this critical stage of their development. Ceva, however, was ahead of the curve having already implemented a program to supply poor children with an egg a day in Argentina and has also launched a major campaign in Asia to combat stunting in children.

Eggs are nutrient-dense foodstuffs that are consumed in a wide variety of forms throughout the world. As well as providing high-quality protein with a near perfect combination of amino acids that closely matches the dietary needs of children, eggs also contain a number of essential micronutrients including vitamins, minerals, fatty acids and other compounds, such as choline, that plays unique roles in the brain's development. Compared to supplements that provide one nutrient at a time, eggs deliver these nutrients together in forms that are readily absorbed and utilized by the body.

According to World Bank data, there are 127 countries in the world that are poorer than Argentina. Staff and management at Ceva Argentina were therefore shocked to learn that, even in their relatively wealthy country, in 2012 the mortality rate for children up to 5 years old was nearly 14% (more than triple the rate in France) and malnutrition all too common. This prompted them to begin supplying eggs to Centres for Child Nutrition (CONIN), a not-for-profit foundation which aims to prevent and cure malnutrition, especially amongst poor families with young children. Inspired by what Ceva was doing, in 2015 CAPIA, the Argentine Chamber of Poultry

Producers, joined the 'One egg per day' campaign. The CAPIA president, Javier Prida, signed an agreement with CONIN to deliver 180,000 eggs, spread over the year, to the 23 sites that CONIN has in Argentina. In 2016, a Ceva client, egg producer Proavinar, also joined and supplies 2,000 eggs per month to the CONIN initiative in Pilar, Buenos Aires. And in early 2018, the biggest distributor started to donate eggs to its local CONIN branch.

The one egg per day campaign goes beyond simply donating eggs. It also aims to use social networks to educate people on the importance of eggs in the daily diet and also carries out face-to-face training about the benefits of eating eggs and recipe ideas for mothers who take their children to CONIN centres. In addition, once a year, Ceva volunteers visit the CONIN centres to help out with practical maintenance tasks.

In 2018 Ceva's Zone Manger in Asia, Ruud Aerdts, challenged a group of young millennial managers from its businesses in nine Asian countries to design a corporate social responsibility project. After doing their research, the group focused on stunting in children. They were surprised to learn that, despite rapid economic development in the region, one in five children in Asia suffered from stunting (that is children who are too short for their age caused by chronic or recurrent malnutrition) and globally more than half of all stunted children live in Asia.

As well as being short for their age, stunted children fail to develop both physically and mentally. The young managers learnt that low protein consumption in daily diets was a major cause of stunting and they realised that chicken meat and eggs are ideal foodstuffs to provide these vital missing nutrients.

Since a major focus of Ceva's work in the region is supporting poultry farmers there was clearly a good fit between their 'day job' and the goal of tackling stunting in children. The group therefore launched a major campaign under the name 'C our Future'. The campaign has its own website with hard-hitting and eye-catching content, specially-made videos and graphics, and links to authoritative sources of information, and also country-specific pages for nine Asian countries. The campaign explains that "Child stunting is an endless cycle. Let us break the cycle and make a difference together!" It goes on to urge: "Let's embrace chickens and eggs together! They are affordable yet empowering high-quality protein to build a better future for our children!"

The programme has also been launched in China, Indonesia, Malaysia and Thailand, and will be extended to all Asian countries where Ceva is present. Several donations of food have been made to local organisations specialised in child nutrition and, as importantly, the accompanying social media and educational campaigns designed to bring awareness of the problem (particularly to mothers) is in full swing.

1 : https://onlinelibrary.wiley.com/toc/17408709/2018/14/S3

CEVA MALAYSIA AND THEIR CUSTOMERS RESPOND TO IMPACT OF COVID-19 CRISIS ON COUNTRY'S MOST NEEDY COMMUNITIES

Since 2019, as part of the C our Future initiative, Ceva Malaysia has been running a social media campaign to raise awareness about the nutritional value of eggs and chicken meat, and their potential to tackle child malnutrition. In addition, in partnership with local poultry producers, they have been providing eggs to vulnerable children who are at risk of stunting and other impacts of inadequate nutrition.

In 2020, Malaysia, like the rest of the world, was hit by the coronavirus pandemic. The government's response included lockdowns, known locally as movement control orders (MCOs). The impact of these orders, which forced businesses to close and restricted movement of people, was felt particularly by the most underprivileged Malaysians. This includes those with little or no assets or savings to fall back on, informal workers and those who have lost their jobs, been placed on unpaid leave, or experienced pay cuts because of the MCO. Many of these categories have fallen between the cracks of Malaysia's social protection network.

When the first MCO was announced in March 2020, initially there was very strong local demand for eggs as panic buying led to empty shelves in supermarkets. However later, when neighbouring Singapore went into a 'circuit breaker' in April 2020, the market for Malaysian eggs collapsed. Singapore usually imports around three-quarters of its eggs from Malaysia, worth around USD 100 million annually to the Malay economy. The enforced closure of local restaurants and hotels in Malaysia also severely impacted on demand for eggs.

Responding to this situation, The Lost Food Project (TLFP), together with Ceva Animal Health Malaysia and local poultry producers, stepped up resulting in the contribution of 100,000 eggs.

The local poultry producers involved in the initiative include some of the leading companies in the sector including CP Malaysia, Heap Soon Farming Sdn Bhd, Liang Kee Farming Sdn Bhd, Teo Seng Capital Bhd and Zenxin Agriculture Sdn Bhd.

TLFP's general manager, Mohd Syazwan, commented: ***"We are pleased to see our local poultry farmers pull together to not only help communities struggling with food insecurity but also to tackle food waste amid the slump in demand for eggs, caused by lockdowns and border closures in light of Covid-19. We are very grateful for this generous donation of nutritious eggs, which will keep more than 17,000 beneficiaries nourished during this difficult time."***

CP Malaysia senior vice-president Dr. Sakda Aunsiam added: ***"We want to remind people about this fundamental source of protein and extend access to as many people in our community while helping our local poultry industry."*** So, to safeguard the livelihoods of farmers while confronting Covid-19, Malaysians are being encouraged to consume more eggs as an affordable source of protein, including through Ceva's ongoing social media campaign.

"It is important to band together as a company or individual to successfully emerge on the other side of this pandemic. We are pleased to work hand in hand with TLFP, Ceva Animal Health Malaysia and other local poultry farmers to ensure vulnerable groups are getting adequate nutrition and are not left behind during these challenging times" said Heap Soon Farming executive director Ong Soon Ping.


Texas Chicken
Embrace Chicken and Eggs.
To break the cycle of child stunting.

HEALTHY PEOPLE

DOGS CAN BE FAR MORE THAN 'WOMAN'S BEST FRIEND'

A research paper published in the Journal of Ethnobiology[1] in December 2020 suggests that the evolution of the partnership between people and dogs was "disproportionately influenced by dogs' relationships with women." Women, it seems, were more likely to regard dogs as a type of person, include them in family life and treat them with affection. Stories in the popular press inevitably simplified this to dogs being 'woman's best friend'.

Ceva has long been a passionate advocate of the bond that links animals, especially dogs, with all people – men or women, young or old.

The company supports and champions a wide range of initiatives all around the world focused on the diverse roles that dogs can play in society. Thanks to the commitment of specialist charities and organisations, and their dedicated staff and volunteers, especially trained dogs are bringing benefits to families, young people, the elderly, people living with various health conditions and challenges, even helping endangered wildlife.

And through partnerships with multi-disciplinary teams of scientists, Ceva is helping to generate sound evidence that demonstrates the economic as well as health and social value dogs can provide. Such research also provides the basis for sound best-practice that recognises the health and wellbeing of both dogs and the people they support.

Below, we describe three contrasting examples of the type of work Ceva supports all based on the unique bond that exists between people and dogs.

1 : Jaime Chambers, Marsha B. Quinlan, Alexis Evans, and Robert J. Quinlan "Dog-Human Coevolution: Cross-Cultural Analysis of Multiple Hypotheses," Journal of Ethnobiology 40(4), 414-433, (18 December 2020). https://doi.org/10.2993/0278-0771-40.4.414

CEVA SUPPORT HELPS TO ENSURE ANIMAL ASSISTED INTERVENTIONS ARE GOOD FOR ANIMALS AS WELL AS PEOPLE.

"If you get it right for the dog and if you get people to understand how the dog can really interact and fit together with them, then you really do have something very special that takes it on to a whole different level."

Peter Gorbing, CEO of the UK charity Dogs for Good, which is supported by Ceva.

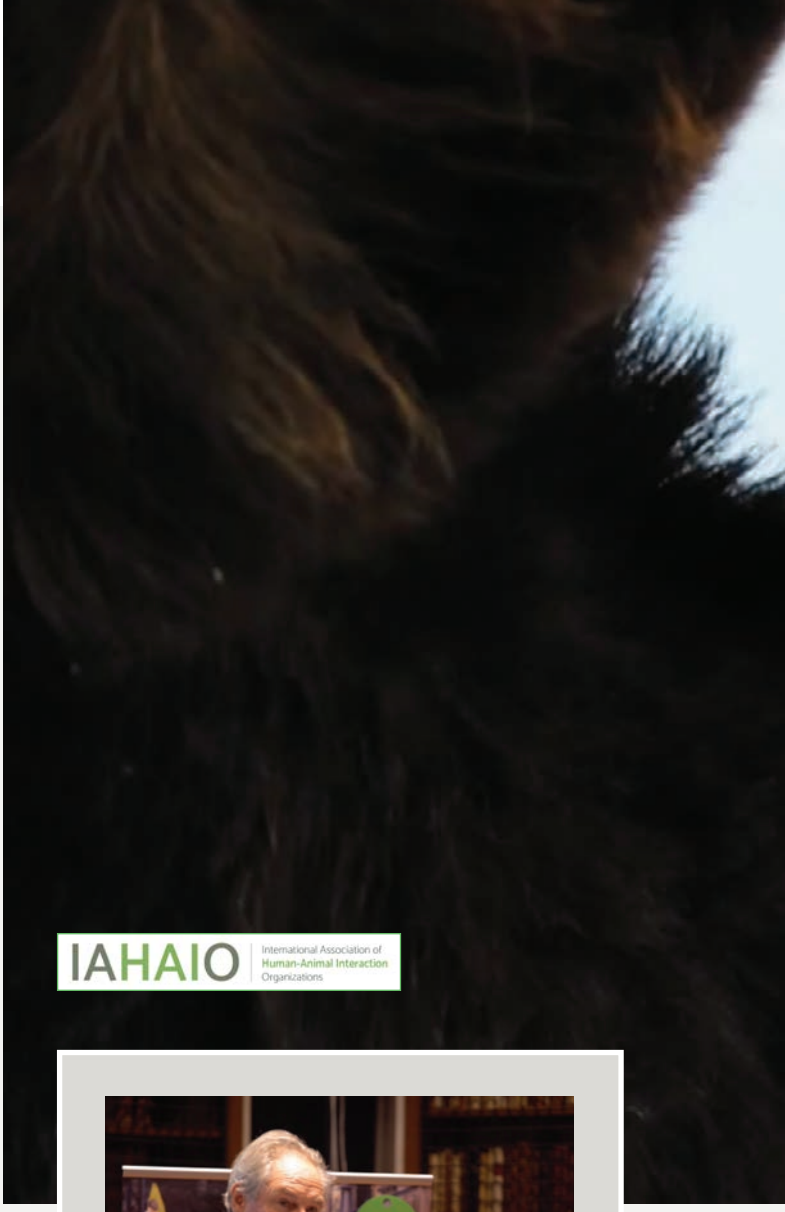
A 2000-year-old Roman mural discovered buried beneath the ruins of Herculaneum, in modern-day Italy, appears to show a blind man being led by a dog. If so, this is the earliest recorded example of an animal-assisted intervention (AAI).

Today, a wide range of animals, especially but not only dogs, are used to support people living with a variety of conditions, helping them to enjoy more fulfilling lives. These include fully trained and officially recognised guide dogs for the blind, hearing dogs for the deaf and assistance dogs for individuals living with a range of physical and mental challenges. AAIs also include a host of less formal interventions, such as the calming influence of introducing dogs to families with autistic children or various types of pets, farm and exotic animals – dogs, guinea pigs, lambs, alpacas, penguins even - that are used in community settings, such as special needs classrooms and care homes, by trained handlers where they help reduce tension and anxiety and promote social interaction amongst other benefits.

Over the past decade Ceva has been living up to its 'together beyond animal health' vision by supporting various activities related to AAI. The focus of much of this work is to work with practitioners and researchers to help improve the quality of AAIs, especially through paying careful attention to the welfare of animals as well as people. While there is now a growing body of evidence, based on well conducted studies, to show the impact of AAI on the health and wellbeing of people, until recently there has been few studies that have examined the impact of AAI on the animals.

While the concept of 'One Health', which links the health of people, animals and the environment, has become well known, there is now increasing recognition of the need for a 'One Welfare' approach, which recognises the need to consider the wellbeing of both people and animals.

Ceva has supported a wide range of AAI related activities over the past decade. These include supporting research into various aspects of AAI to increase understanding of the approach and to enable evidence-based improvements to be made; helping to bring together AAI researchers and practitioners to facilitate exchange of ideas and experiences; and direct support to individual AAI programs in Australia, Brazil, France, Sweden and the UK to enable them to achieve even more.



SUPPORTING AAI RESEARCH

Ceva supports the work of a number of the leading researchers in the field of AAIs, all of whom are members of the pioneering Faculty of Psychology and Educational Sciences at the Open University in Heerlen, the Netherlands.

Ceva support helps Marie-Jose Enders-Slegers, who is Professor of Anthrozoology at the Faculty and also President of the International Association of Human-Animal Interaction Organizations (IAHAIO), carry out her research. This currently focuses on developing methodologies to assess the behaviour of animals in AAIs and tools to enable professionals in this field to easily determine whether the animals are at ease and healthy.

Ceva also supports the work of Tynke de Winkel who is working to develop a scientifically-based model that can be used to measure the welfare of dogs in AAIs. As she explains:

"A lot of research is only possible when there is support from companies. We are very grateful that Ceva helps support this important work. So far, there is a lot of research on the impact for people, but we think it is also important to focus on the animal. If the animal welfare is very poor, maybe the results of the animal-assisted intervention is also very poor: we think the two are related to each other."

Finally, Ceva supports the work of Richard Griffioen, a visiting researcher at the Faculty and busy AAI practitioner. In late 2020, Richard completed his thesis, which worked towards his dream of having ***"a theory that explains how animal assisted interventions work and [can] make them better."*** Careful observation of AAI sessions involving children with either Downes Syndrome or who were on the autistic spectrum and dogs suggested the beneficial impacts may be due to synchrony, i.e. the coordination of behaviour between the

Speaking at an IAHAIO seminar held in Amsterdam in October 2018, One Health in AAI: Current trends and future collaborations in research and practice, director of communication Martin Mitchell explained Ceva's involvement:

"Why do we support IAHAIO? It's quite simple. We have a vision, together beyond animal health. What do we mean by that? Well it's quite close to the theme of this seminar – One Health and the benefits of animal-assisted interventions."

child and the dog. Richard's work also demonstrated a decrease in cortisol levels of children, an indication of decreased stress, during the AAI sessions with dogs.

FACILITATING EXCHANGE OF IDEAS AND EXPERIENCES

Since 2010, Ceva has been proud to sponsor the International Association of Human-Animal Interaction Organizations (IAHAIO). The IAHAIO aims to provide international leadership in advancing the field of human-animal interaction through promoting research, education and collaboration among its membership, policy makers, practitioners, other human-animal interaction organizations and the general public.

In April 2019 the IAHAIO held its 15th triennial conference in Brewster, New York with the theme Science Meets Practice: Creating Healthy Environments for People and Animals. This conference highlighted the interconnectedness of the science and study of human-animal interactions and the practical delivery of programs in wide-ranging environments. Conference sessions enabled participants to share and learn about AAIs for children and adolescents, studies about best practice and effective methods for studying AAI and evaluating outcomes.

Amongst those attending the event at Brewster was Jody Donohue, Ceva's U.S. communications manager, who noted that:

"Attendees included researchers, practitioners, students, educators, social workers, psychologists and others interested in learning more about current innovations across the globe in the field of animal-assisted interventions and human-animal interaction. So many of these professionals shared stories of how Adaptil® has helped reduce stress in their working dog programs, supporting people of many diverse backgrounds and abilities."

DIRECT SUPPORT TO AAI PROGRAMS

Aliénor Sud-Ouest Guide Dog School, France
© Radio France

ALIÉNOR SUD-OUEST GUIDE DOG SCHOOL

In France, Ceva provides support to the Aliénor Sud-Ouest Guide Dog School (Bordeaux), which trains future guide dogs for the visually impaired. In France, just 160 fully trained guide dogs become available each year: this meets only a fraction of the demand from around 200,000 people who could benefit from the support such dogs provide.

ASSISTANCE DOGS AUSTRALIA

In 2016, Ceva Australia committed to sponsoring the training of an assistance dog in partnership with Assistance Dogs Australia. From the outset, Ceva staff were fully onboard; they held a competition for the honour of naming the golden retriever pup – the winner chose Lola – and closely followed progress throughout the two-year training period and beyond. Now fully trained, Lola has a full-time role as an assistance dog at North Gosford Training Centre, a special school that caters for children aged 10-16 years with a history of behavioural difficulties or emotional disturbances.

Proud of the part it has played in enabling Lola to be trained, Ceva Australia looked for ways to extend its relationship with this inspiring charity. The second dog the company has sponsored, a male black Labrador puppy, is currently being trained and once again employees are competing for the honour of naming him. Chris Abott, Ceva's country manager for Australia and New Zealand, explains: ***"We are also talking to Assistance Dogs about how we can maybe help them use Adaptil® to support the training and help with some of the stress these dogs encounter during their day-to-day lives."***

HANDI'CHIENS

Handi'Chiens is another French organisation with a mission to train and provide service dogs for children and adults living with a range of conditions, 'social companion' dogs for institutions such as day care facilities for the elderly, and response dogs for people with epilepsy – all at no cost to the recipients. Ceva was inspired to support Handi'Chiens after Mélanie Rougier, one of the company's veterinarians, supported the organisation in various ways including taking part in the Raid Amazones, a gruelling annual international team sporting challenge for women. Building on the enthusiasm that this initiative generated both within the company and externally, Ceva Laval Campus decided to top up the funds the team had raised to cover the full costof training an assistance dog. In 2018, Ceva went on to demonstrate its long-term commitment by signing a 5-year partnership agreement with Handi'Chiens to support the training of service dogs.

DOGS FOR GOOD

In 2018, Ceva began a long-term partnership with the UK charity Dogs for Good. Previously known as Dogs for the Disabled, the organisation uses dogs in a wide range of innovative ways so they can help people overcome specific challenges and enrich and improve lives and communities. To begin with, the focus of the partnership has been on supporting Dogs for Good to develop a comprehensive online library of high-quality, evidence-based and independent information about all aspects of dogs. Initially this is targeted for use within Dogs for Good but the ultimate aim is to create and make available the 'go to' source of information for all dog owners and keepers. In 2018, Ceva was also proud to support Dogs for Good to stage a series of events around the country to acknowledge the 'power of dogs' as they celebrated their 40th anniversary. At these events, inspiring speakers revealed how dogs have changed their lives. Going forward, Ceva is keen to explore additional activities including exploring how Adaptil® can be used to help dogs engaged in Dogs for Goods various programs to cope better with potentially stressful periods of their lives.

HEARING DOGS FOR THE DEAF

Staff at the UK charity Hearing Dogs for the Deaf were concerned at the relatively low success rate for the dogs they trained to become assistance dogs: less than 40% graduated successfully and more than 60% had to rehomed as pets. This prompted the charity's staff to devise a new program which enabled the dogs to live in family homes throughout their training: previously part of the training was kennel-based which many dogs found very stressful.

At the same time, the association introduced Adaptil® collars at four key stages of the dogs' socialization and training programs: when they leave their mothers; for the first month of their socialization phase living with families; as they enter the more intensive training phase; and when they are eventually placed with their deaf partners.

The collars are also used at other times, such as to help the dogs cope with fireworks or other short-term stressful experiences. These changes led to a significant improvement in the training program's success rate – from 39% before to 68% after the changes were implemented.

Jo Gray, Head of Quality Assurance and Welfare at Hearing Dogs said:

"Minimizing stress and maximizing enrichment is a key focus point of the hearing dog operational teams. We recognize that each dog is an individual with needs that will differ and so our approach to the training journey needed to adapt and change too. Using Adaptil® for each dog in training is one such tool that encourages a well-rested, relaxed dog that is supported through its learning. This has had a very positive impact on the welfare of our dogs and allowed us to help more deaf people by providing them with the gift of a hearing dog."

HUMLAMADEN REHABILITATION CENTRE

In Sweden, the Humlamaden Rehabilitation Centre, established by Lis-Lott Anderson, helps patients with various medical conditions to recover through horse and dog assisted therapy. Ceva has also helped to bring the French and Swedish teams together, which has led to the development of new standards for animal-assisted interventions.

For the past 5 years, Ceva has also supported Mathilda Strom, an AAI practitioner and teacher and an ambassador for Adaptil®. As part of this support, Ceva sponsored Mathilda to attend the recent IAHAIO triennial conference; she really enjoyed the opportunity to meet with practitioners and researchers and returned home to Sweden inspired to do even more. Matilda and her dogs work with a wide range of people including those who are born with or experience traumatic brain damage, children in schools, the elderly, people living with drug-related problems and people with autism. Commenting on her work with children on the autistic spectrum, Matilda explained:
Matilda explained:
"We have seen great results. Normally they can be a bit scared of being with other people. When we use the dogs, it makes them feel relaxed. The teachers have told us that after we have done the work with the dogs, they can see that the kids are playing after school."

ARDRA
(ASSOCIATION FOR RESEARCH AND DEVELOPMENT OF RE-EDUCATION IN AUVERGNE)

Through its participation with IAHAIO, Ceva came to support two projects, one in France and one in Sweden. In France, Neurologist Dr Didier Vernay and equine psychotherapist Cecile Cardon from Clermont-Ferrand Hospital University work alongside ARDRA (association for research and development of re-education in Auvergne) to use equine therapy to assist people with multiple sclerosis. Not only do patients benefit through this programme, but it provides a valuable opportunity to measure the effects of the human-animal interaction on patients. The results of this study will allow for more effective and specific therapy outlines, which can be used to treat other patients, including those with conditions such as autism.

ASSOCIAÇÃO DE EQUOTERAPIA DE CAMPINAS

Associação de Equoterapia de Campinas (AEC), a Brazilian equitherapy project that helps children and young people who suffer from disabilities, neurological problems and conditions such as autism, was saved from closure due to lack of funds after an intervention by Ceva. The programme, based in the Sao Paulo region of Brazil, uses rescue horses to improve the lives of their young participants who are referred to the project by local medical authorities and therapists. Following the intervention, plans are now being drawn up to expanded the programme so that more children and young people can benefit.

CEVA'S SUPPORT LOOKING FORWARD...

Over recent years, working with assistance dogs has become a global theme for Ceva - as the projects outlined above from all around the world testify. Looking ahead to how Ceva's support in this area should develop, Martin Mitchell explains: "As leaders in the area of animal welfare I think we have got to go further. We have a responsibility to really understand how those dogs are thinking, what is really happening in their minds, are they stressed, what more can we do to create the happiness that makes the whole bond so much more valuable."

As well as their proven contribution to improving people's wellbeing, evidence is now beginning to emerge that suggests AAIs can also have wide ranging economic benefits through enhancing the health and welfare of people. This is an area that Ceva is keen to explore further in the future. For example, with an estimated lifetime cost to the UK economy of up to £4.6 million for an individual with autism, it is easy to see how AAIs could make a real difference to individuals as well as wider society.

WHAT IS ADAPTIL®?

Adaptil® is the synthetic copy of the natural dog appeasing pheromone released by the mother dog 2-3 days after giving birth. This pheromone comforts and supports the puppies, giving them the confidence to explore the outside world. This dog appeasing pheromone has been proven to have a comforting effect on both puppies and adult dogs during stressful situations and also helps support their training and socialisation.

Ceva is a pioneer and global leader in the field of pheromone-based behavioural products for dogs and cats.

GROWING OLD TOGETHER: THE ELDERLY AND THEIR PETS

The ongoing Covid-19 pandemic has impacted on the lives, health and wellbeing of billions of people all over the world but the elderly have been particularly hard hit. Care homes for the elderly have had to close their doors to visitors, leaving their residents isolated from their families and friends on the outside. For those living with dementia this must have been especially confusing.

Even before the pandemic, many elderly people found the process of moving into a care home a very emotionally-charged and traumatic experience. In addition to giving up their homes, filled with a lifetime of memories, many also had to face the prospect of giving up their cherished dogs and cats: in France, an estimated 25% of people over 80 years of age have a pet. While some lucky pets could be passed on to younger family members, in many cases these animals ended up in local animal shelters. Many of these pets are themselves in their twilight years and have chronic age-related conditions. At best, they often face long waits for new owners, most of whom wanted younger, healthier and more energetic pets to complete their families. Inevitably, some of the former pets of the elderly end up being euthanised.

A fortunate minority of elderly people entering care homes are able to take their pets with them. The benefits to mental and physical health and general wellbeing of pet ownership is increasingly recognised. While some care homes allow new residents to bring their animals with them, there tends to be conditions: the pets need to be small and well behaved and the owners need to be able to care for their animals themselves. Most care homes, however, do not allow pets citing concerns about hygiene, inconvenience to other residents and additional costs that they may incur.

Concerned by this situation, two years ago a new charity, TERPTA, was established in France with the aim of developing and testing a totally new approach. As Irène Brizard de Forges, general secretary of TERTPA, explained:

"Each year, 10,000 seniors reluctantly separate from their animals to enter a retirement home".

TERPTA is an acronym derived from a quote taken from the novella Le Petit Prince [The Little Prince] written by the renowned French writer Antoine de Saint-Exupéry:

"Tu es responsable pour toujours de ce que tu as apprivoisé" [You are responsible, forever, for what you have tamed].

"You are responsible, forever, for what you have tamed"

Antoine de Saint-Exupéry

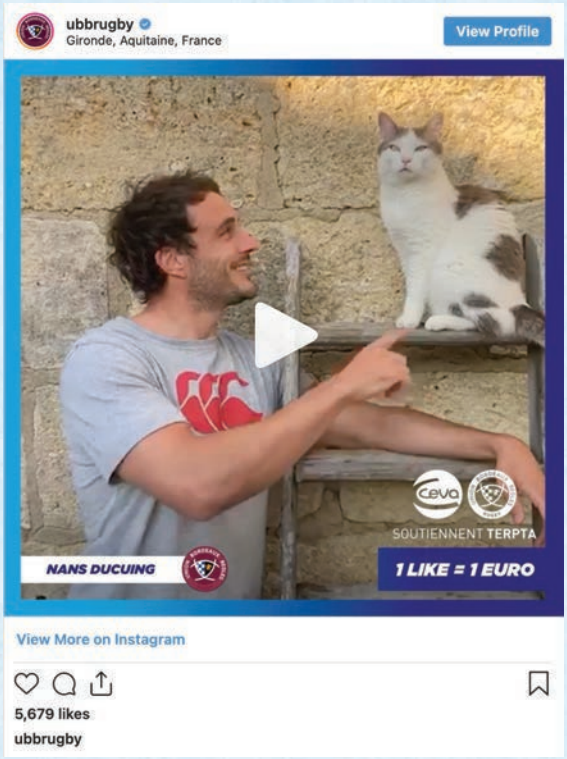
© Médiation animale - Nord Info

As part of its response to the Covid-19 crisis, Ceva decided to support this initiative, which fits well with the company's commitment to promoting the human-animal bond.

Marc Prikazsky, CEO of Ceva Animal Health explained:

"It is essential for their health, both mental and physical, that our elders can keep their pet when they enter a nursing home. It is for this reason that we support this initiative at a time when containment has made us particularly aware of the isolation that older people face."

So, as a first step, in May 2020, Ceva teamed up with the Bordeaux Bègles rugby union team, for whom Ceva has been a long-term sponsor. Several Bordeaux Bègles teammates appeared in a short video which featured them with their own cats and dogs together with photos of elderly people and their pets and some brief information about the TERPTA initiative. Over a period of several days, for every 'like' the Instagram video received Ceva donated €1 to the charity. More recently, Ceva has worked with TERPTA to identify and select two care homes, one In Lyon and one in Nice, where the TERPTA model will be implemented during 2021.



TERPTA has developed and is now piloting a novel solution. The organisation enters an agreement with a care home. The care home provides space in their grounds. On this site TERPTA erect a purpose-built chalet-style building in which the dogs and cats of the care home residents are housed. The chalet is equipped with all the facilities needed to keep the pets happy and healthy and during the day it is run by volunteers, especially those taking part in the National Civic Service. This is all provided at no cost to the care home or pet owners.The National Civic Service, which was established in 2019, is currently being piloted by 2,000 volunteers. Eventually it is planned to expand the program to include 800,000 French 15 to 16-year-olds each year. After a 2-week training period, they spend 2 weeks working on a local project

The initial TERPTA pilot is being run at one care home and involves nine cats and dogs. Their owners and other residence are free to visit the animals on a daily basis where they benefit from interaction not only with their pets but also with other people. To build on this pilot and expand the scheme to other care homes, TERPTA is currently fund raising.

Fabienne Houlbert, founder of TERPTA added:

"To give up under duress is to slowly kill not only the animal but also the reason for living of its elderly master. With the TERPTA system, it is finally enabling them to age together in complete serenity."

While Ceva's partnership with TERPTA is a new one, the company has partnered with the UK charity Dogs for Good for several years. So far, Ceva has taken a particular interest in Dogs for Good's work with families with autistic children. Families who receive either fully-trained assistance dogs or who receive training and

support in relation to their family pets have benefitted enormously, especially from the calming influence of a dog.

But Dogs for Good also has a program which targets older people living with dementia. Initiatives include placing full-trained assistance dogs with elderly couples, one of whom has early-stage dementia, as well as activities that use 'community dogs'. The latter are highly trained dogs that work in a range of community settings. Together with their handlers these dogs undertake a range of specific dog-assisted interventions, such as visit people living with dementia in their homes to encourage their creativity or sharing of memories, motivating them to get out to exercise and engage in day-to-day activities or bring people together to take part in 'Dog Days' event. Dog Days are regular social events open to people with all stages of dementia which enable those who attend to interact with the dogs and also the other people present around a series of themed dog activities. Interactions with dogs has been shown to bring a number of benefits to people living with dementia including stimulating conversation, connection and reminiscing, interrupting negative thought patterns, engaging in purposeful activity and reducing anxiety, and simply bringing joy.

But as Peter Gorbing, CEO of Dogs for Good explains, Covid has severely impacted on the work they can do and forced the organisation to think outside the box.

"We have been doing some very interesting virtual work which will open up new opportunities for us to reach more people in the future. This has been particularly strong on the dementia side of our work where we are running regular virtual bingo sessions as well as virtual dog walks. These activities have been incredibly well received and have been a valuable way of keeping people engaged with their community during this difficult time".

So, whereas pre-lockdown, the community dogs and their handlers could engage with clients face-to-face, for now these sessions have gone online. For the virtual dog walks, the person with dementia and their carer go for a walk in their local area at the same time as the handler and community dog go for a walk in their local area – the two are brought together by an app that provides a secure video link. This enables two-way communication, and the sharing of sights and sounds encountered. The person living with dementia can even interact with the dog by giving commands, such as sitting at the kerb. This means the experience is not a passive one – the client is truly involved with the dog and shares responsibility for the dog during the walk. The virtual dog bingo sessions are group video sessions in which the community dog draws the numbers by selecting numbered balls from a basket. This brings out the participants' competitive spirit and stimulates much laughter and friendly banter between groups members.

As Carla Mounsey, one of the dementia community dog handlers, explains these activities are ***"designed to be super-fun and to restore some routine back into peoples' lives, therefore helping them with motivation to exercise and just bringing them the joy that dogs bring."***

CEVA HELPS ENSURE ELITE DETECTION DOGS REMAIN HEALTHY AS THEY PROTECT ENDANGERED WILDLIFE IN WEST AFRICA

Since 2018, IFAW (the International Fund for Animal Welfare) has been working with the government in Benin, West Africa to extend the mission of the 'Cotonou canine brigade'. While previously the dogs in the brigade were used to detect drugs and explosives, now additional dogs are being trained to help tackle the illegal trade in endangered West African wildlife, especially by detecting smuggled elephant ivory and pangolin scales. Depending on the breed, a dog's sense of smell is 10,000 to 100,000 times more powerful than that of humans.

The IFAW program has addressed all aspects of the dogs' health and welfare, as well as improving conditions for their handlers. The existing kennels and other facilities have been renovated, improved standards of dog care introduced, including proper nutrition and health care, and handler training programs resumed. A key objective was to change the way handlers saw their dogs – not simply as tools but as allies in the fight against wildlife trafficking.

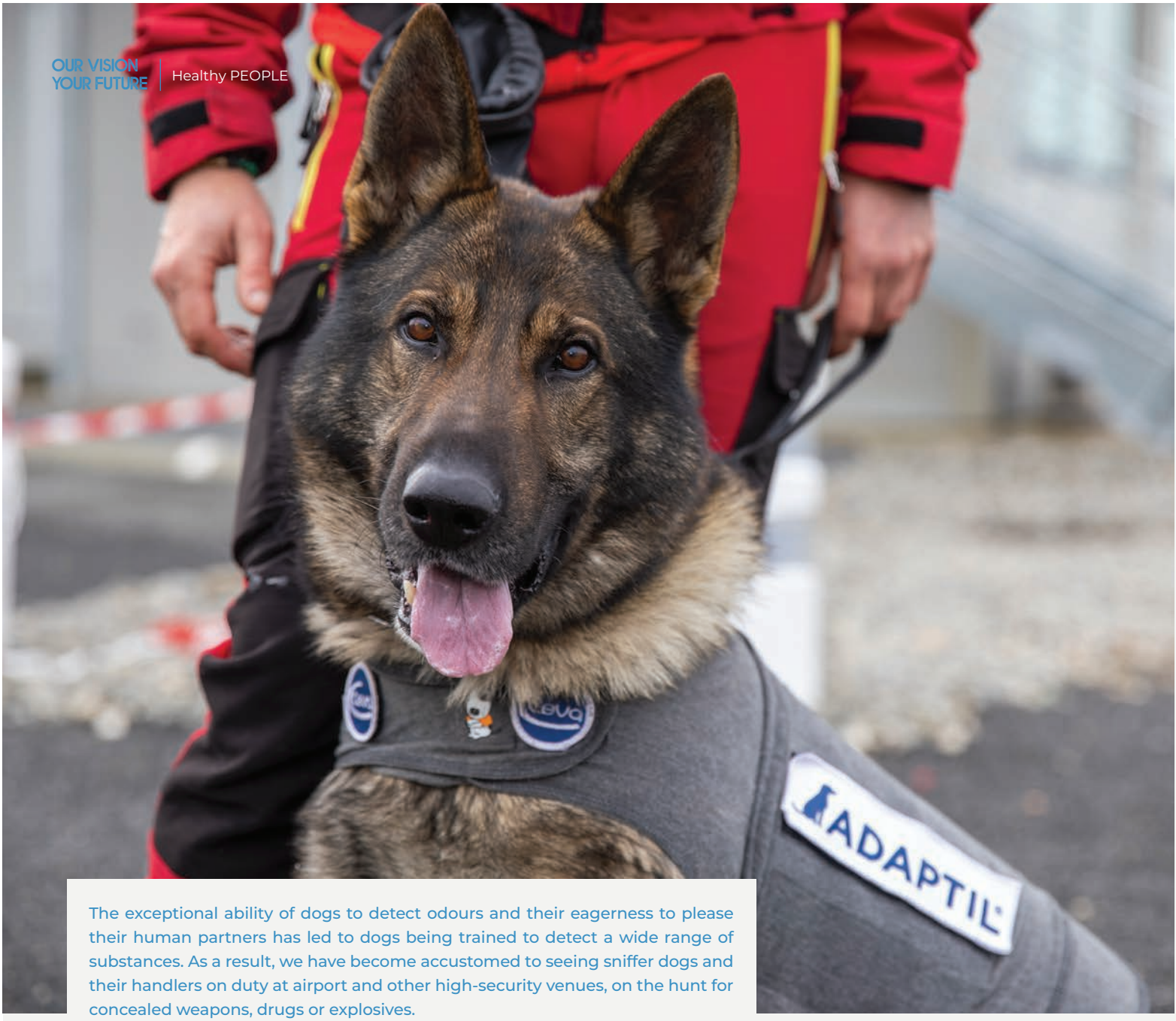
Eight dogs are already being trained. They came from either the local community or were relocated from French rescue shelters. Others will join them soon. When trained, the dogs and their handlers will be deployed at key trafficking points in Benin, such as air and sea ports.

Benin, Burkina Faso and Niger are home to around 3,000 elephants – the last but also a highly threatened stronghold for this species in West Africa.

Pangolins are believed to be the world's most trafficked mammal. Their scales have long been used in traditional Chinese medicine.

As Marie Varloud, Ceva's technical manager for parasiticides in companion animals, explained Ceva have partnered with IFAW to help ensure the detection dogs remain healthy:

> *"We are extremely proud to contribute to this great project where dogs and their human partners play a key role in protecting wildlife and biodiversity. These teams are doing an incredible job in a very challenging environment. The dogs are true athletes who deserve the very best veterinary care to protect their health and welfare. It's always rewarding when we see our products and services contributing in this way."*



The exceptional ability of dogs to detect odours and their eagerness to please their human partners has led to dogs being trained to detect a wide range of substances. As a result, we have become accustomed to seeing sniffer dogs and their handlers on duty at airport and other high-security venues, on the hunt for concealed weapons, drugs or explosives.

Trials are also currently underway involve using dogs to detect patients with a range of diseases including some bacterial infections, malaria, cancer and Parkinson's diseases. Although these trials have produced interesting and encouraging results, detection dogs are not yet in routine or widespread use in clinical settings.

There is, however, growing evidence that elevated levels of a 'signature' of volatile organic compounds (VOCs) are associated with a specific disease. Dogs can be trained to detect these odours in the same way they can be trained to detect other substances, that is through positive reinforcement. During training, dogs, which are naturally eager to please their handlers, are rewarded with praise and treats when they respond appropriately to the target substance.

Now, as part of Ceva's response to the Covid-19 pandemic, a new initiative aims to explore the ability of dogs to detect patients who have tested positive for Covid-19.

The Cynocov project is being led by Bordeaux University Hospital, suppor-ted by Ceva and uses dogs and handlers from the local police and fire service.

The work is based on methods developed by Professor Dominique Grandjean from the National Veterinary School of Alfort. Professor Grandjean is a canine specialist and since April 2020 he has led an international team investigating the use of dogs to detect Covid-positive patients. He also holds a position in the Paris fire brigade, where he is responsible for the canine search and rescue team, advises the French ministry of the interior on working dogs, and works closely with police and army dog units.

Since early January, five police and fire service dogs – previously used to detect explosives or missing people - have been attending the Cynocov training centre, housed in a new building especially erected in the grounds of Ceva's headquarters in Libourne. The dogs, Malinois and German shepherds which previously searched for explosives or missing people, are being retrained to identify Covid-positive patients by sniffing sweat samples collected using absorbent pads placed under the armpits of infected and uninfected patients.

CEVA HOSTS TRAINING CENTRE FOR COVID-19 DETECTION DOGS

"If successful, the tool could be extremely useful for rapidly and inexpensively pre-screening large numbers of people in many settings – airports, schools, shopping malls, businesses, sports and entertainment venues. Dogs could pre-screen hundreds of people an hour more cheaply than conventional testing methods such as the RNA-amplification technique PCR.
Ceva is delighted to be able to support this exciting project – another excellent example of One Health in action."

Pierre-Marie Borne, Ceva lead on the Cynocov project

Although teams in around 40 countries all around the world are working with dogs to detect Covid-positive patients, to date there have been few peer-reviewed studies published. According to Professor Grandjean, one reason for this is that: "To publish papers on detection dogs is very difficult because most reviewers do not know anything about working dogs".

One of the few studies that has been published, by Professor Grandjean and his team, reported that the eight dogs studied correctly detected sweat samples collected from positive patients between 83 and 100% of the time. Performance of individual dogs varied: the best identified all 68 positive samples with which it was tested.

Airports in the United Arab Emirates, Finland and Lebanon are already using dogs on a trial basis to detect Covid-19 in sweat samples from passengers; these are then checked against conventional tests.

Preliminary results from Finland and Lebanon suggest that the trained dogs can identify cases days before conventional tests picked up the virus. The best two performing dogs in the Lebanon trial are said to have been 100% accurate in detecting negative cases and correctly detected 92% of PCR-positive cases.


HEALTHY
PLANET

CEVA'S COMMITMENT TO SAFEGUARDING NATURE'S PRICELESS BOUNTY

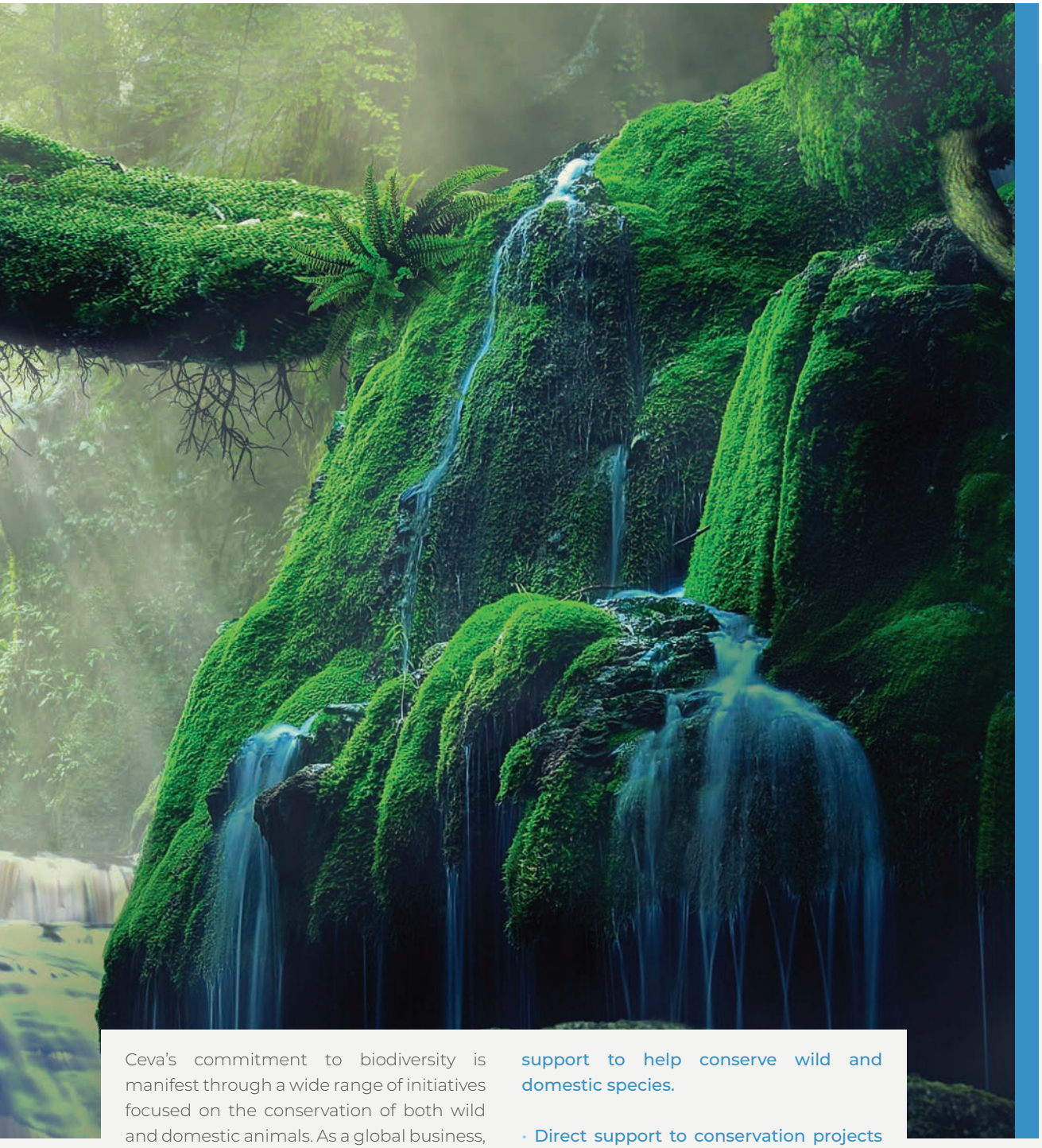
Biodiversity is often defined as 'the variety of all forms of life, from genes to species, through to the broad scale of ecosystems'. As a leading global life-sciences business, Ceva's commitment to the conservation of biodiversity is fundamental to its vision, 'Together beyond animal health'.

A 2019 U.N. report on biodiversity[1] showed that human activities are impacting on nature more than any time in human history: extinction is looming for over 1 million species of plants and animals; at least 680 vertebrate species had been driven to extinction since the 16th century; almost 10% of all domesticated breeds of mammals used for food and agriculture had become extinct by 2016, with at least 1,000 more threatened.

1 : UN Report: Nature's Dangerous Decline 'Unprecedented'; Species Extinction Rates 'Accelerating' – United Nations Sustainable Development

The revered American biologist, naturalist and writer E.O Wilson, variously described as the 'new Darwin' and the 'father of biodiversity', succinctly explained why we should care about biodiversity:

> *"We should preserve every scrap of biodiversity as priceless while we learn to use it and come to understand what it means to humanity."*



Ceva's commitment to biodiversity is manifest through a wide range of initiatives focused on the conservation of both wild and domestic animals. As a global business, some of these initiatives take place all around the world but, reflecting its active role and deep roots in its local community, there is a particular focus on the rich diversity of livestock and other domestic animals found in the Nouvelle-Aquataine Region, where Ceva has its headquarters.
Wherever its acts and whatever the scale, Ceva's work on biodiversity is always undertaken through broadly based partnerships made up of local, national and international organisations.

Ceva's activities related to biodiversity fall into five broad categories:

- Using Ceva expertise, facilities, resources and know-how to provide practical support to help conserve wild and domestic species.
- Direct support to conservation projects run by partners.
- Recognition and celebration of individuals and groups who are making outstanding contributions to agrobiodiversity.
- Promotion and awareness creation of the value and importance of rare breeds of livestock and other types of at-risk domestic animals.
- Broad commitment to support all forms of animal agriculture – traditional and modern, intensive and extensive.

Below, examples of Ceva's activities under these five headings are described.

USING CEVA EXPERTISE, FACILITIES, RESOURCES AND KNOW-HOW: CEVA'S BESPOKE VACCINE SERVICE HELPS ENDANGERED ALBATROSS

For the vast majority of poultry farmers throughout the world, Ceva's unrivalled range of new generation and conventional vaccines enable them to protect their birds from all the major threats to health and productivity. In those rare situations where something more is needed, Ceva Biovac can rapidly produce bespoke vaccines tailored to meet the specific disease challenge on individual farms based on pathogenic organisms collected on site. Over recent years, Ceva Biovac has successfully developed a unique tailor-made vaccine that has been used by a pioneering international team of scientists and conservationists to protect a rather unusual type of bird that could hardly be more different from a chicken – the albatross.

Amsterdam Island is a 55 square kilometre volcanic island situated in the southern Indian Ocean approximately 2000 miles and equidistant from Madagascar, Australia and Antarctica, making it one of the world's most isolated islands. It is an important breeding site for various types of seabird including three species of albatross and is the only breeding site in the Indian Ocean for the northern rockhopper penguin.

During the breeding season, the island is home to the entire global population of the Amsterdam albatross, which numbers less than 60 pairs, around 22,000 pairs of Indian yellow-nosed albatrosses, which represents 65% of the species' global population, and also 400 pairs of dark-mantled sooty albatrosses. All three species are categorised as 'endangered' by the IUCN (International Union for Conservation of Nature), the global authority on the status of the natural world.

No-one knows for sure how it arrived on the island but since 1980 the disease avian cholera, caused by the bacteria Pasteurella multocida, has had a devastating impact on Amsterdam Island's Indian yellow-nosed and dark-mantled sooty albatross chicks and also its rockhopper penguins.

The detailed epidemiology of avian cholera has been gradually revealed through long-term studies conducted by a multi-disciplinary team on and off the island over the past decade. One member of the team is Jérémy Tornos who is being supported by Ceva while he undertakes his PhD on this topic at CEFE-CNRS (the largest French research centre for ecology and

evolutionary ecology) and the University of Montpellier.

Over the past century or more, seafarers accidently or deliberately introduced brown rats, house mice, cats, chickens, pigs and cattle to the island. The cattle, pigs and chickens have now been removed but the other introduced species remain – at least for now.

The Indian yellow-nosed albatross nests on cliffs around the edge of the island but the Amsterdam albatross nests further inland on a high plateau. The researchers have discovered that important vectors of avian cholera on the island may include brown rats and brown skuas. The introduced rats are carriers of Pasteurella multocida and may infect chicks when they circulate between nests or when they bite chicks at the nest. Brown skuas, which are large predatory seabirds, hunt for chicks around the edge of the island but seldom fly inland to the Amsterdam albatross breeding colonies.

In some years almost all yellow-nosed albatross chicks have been killed by the disease, although thankfully the adults are unaffected. The high mortality rate in chicks is recognised to be a major cause of population decline in yellow-nosed albatrosses (87% decline between 1981 and 2016; less than 15% of nests successfully fledged chicks over the 15-year period to 2016). The numbers of Amsterdam albatross are actually increasing and large-scale mortality of chicks has not been observed, but the very small number of birds making up the entire global is a cause for concern.

The vaccine for use in albatrosses was developed by Ceva Biovac using the same approach they use to develop bespoke vaccines for poultry farms. A strain,

named D2C, of the causative organism of avian cholera, Pasteurella multocida, was isolated from a dead dark-mantled sooty albatross chick collected from Amsterdam Island during the 2011/2012 breeding season. The bacteria were then cultured in Ceva Biovac's lab and then killed and formulated with mineral oil adjuvants to produce an inactivated vaccine. The same isolates were also used to develop a test to detect antibody against this strain of P. multocida which could be used to test plasma samples collected from the albatross in the field.

The vaccine was used in a series of vaccination trials on wild Indian yellow-nosed albatross chicks carried out between 2013 and 2020. The first trials enabled the researchers to identify the optimum age for vaccination, which was found to be 10 days after hatching: vaccinating too early would mean that the chick's immune system was too immature so that a protective immune response could not be mounted but leaving it too late risked an avian cholera epidemic occurring with an associated high mortality rate.

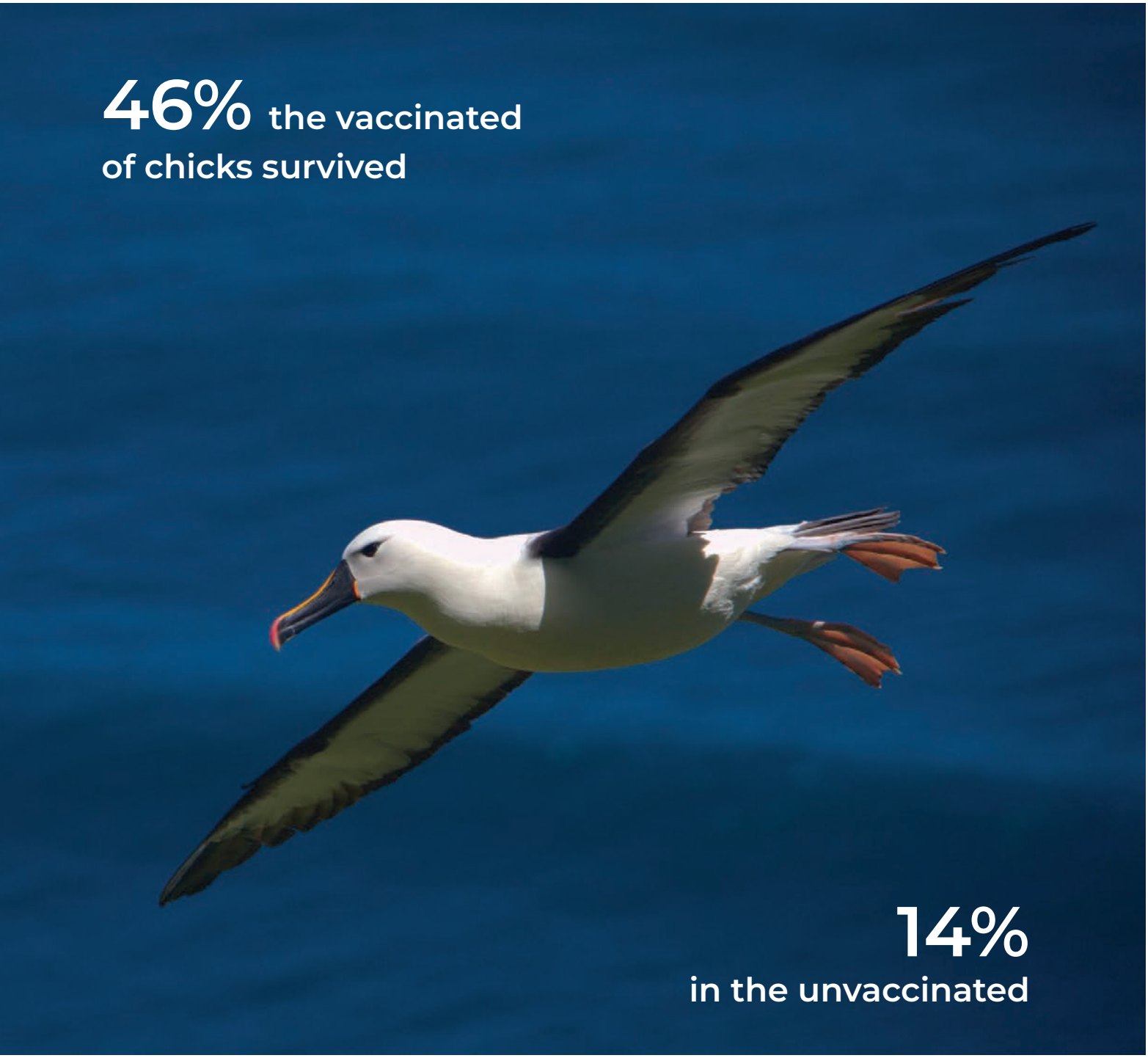
What is believed to be the first-ever immunization trial in albatrosses, and the first evaluation of a tailor-made vaccine in a threatened wild animal population, took place during the 2015/2016 breeding season on Amsterdam Island. Chicks from 30 Indian yellow-nosed albatross nests were vaccinated. For the trial these chicks were compared to two control groups: the first was unvaccinated but was sampled periodically along with the vaccinated chicks to track antibody levels to this strain of P. multocida; the second group was left undisturbed and only observed remotely to assess any impact from handling the chicks on their survival.
The result of the trial was clear: in the vaccinated group 46% of chicks survived compared to just 14% in the unvaccinated group. There was no difference in survival between the unvaccinated but sampled group and the unvaccinated and unhandled group. Also, all the vaccinated chicks developed antibody against this strain of P. multocida whilst none of the unvaccinated chicks did so.
The researchers involved in the study concluded that the results "suggest that using a specifically tailored vaccine could be a key tool to effectively protect endangered seabirds from disease outbreaks threatening them with extinction."

Although the trial showed that the vaccine successfully protected the chicks from the disease and reduced the risk of chick death by a factor of more than 2.5, the long-term impact on survival will not be known for many years, until these long-lived birds return to the island as adults to reproduce.
Trials have been conducted annually from 2013 in order to optimize vaccination. The results are generally very promising. However, in 2018, the positive effect of the vaccine could not be detected. Several possible contributary factors may explain this. Firstly, very high predation from rats was recorded that year. Secondly, the discovery in 2018 of a new strain of P. multocida, named A18Y007B1, may have played a role. This strain is genetically quite distinct from D2C. It is unclear whether it has been circulating on the island for some time or was recently introduced. However, it is not a variant that could have evolved from D2C. The circulation of two or more strains in the population may reduce the efficacy of the autologous vaccine against only one strain, but at the same time shows the importance of bespoke vaccines.

Ceva scientists undertook the genetic characterisation of both the P. multocida strains and have also developed a new bivalent vaccine formulation designed to protect against both strains. This was field tested in the 2019/2020 breeding season and was shown to be effective in protecting the albatross chicks. They have also modified the vaccine to provide longer-lasting protection. Clearly vaccinating thousands of albatross chicks every year would be a huge undertaking. Vaccine trials have been undertaken with breeding female albatross and these have demonstrated that maternal antibody can be transferred from females to their chicks, potentially conferring protection of its offspring for several breeding seasons.

Work is also underway to eradicate all rats from the island. Pilot-scale testing of the use of poison-bait technology was done in the last few years and this will now be scaled up over the next 2 years.

As Jérémy Tornos explains: ***"It will be very important to maintain vaccination trials during and after eradication to better understand the role of rats in the circulation of the pathogens. This result could offer important tools for protecting native species on Amsterdam Island, but also for threatened species in other ecosystems." And looking forward, Jérémy added: "I hope to be able to continue to develop such inspiring research with both basic and applied implications for biodiversity".***



Alain Schrumpf, Ceva Biovac general manager summed up the experience so far:

"We are proud to have been able to work with our colleagues at CEFE-CNRS to show proof-of-concept for the use of autogenous vaccines in albatross – which we think is the first time this has done for an endangered wild animal. It is reassuring to know that this option is now available in the toolbox alongside other tools, such as poison baits for rat eradication, and can be utilised when and however needed in the future. It will be fascinating to see how the disease pattern on Amsterdam Island changes when the rat population is reduced and, hopefully, finally eradicated. Meanwhile, we at Ceva Biovac remain on standby, willing and able to produce vaccines as required to help ensure the continued existence of these magnificent sea birds."

DIRECT SUPPORT TO CONSERVATION PROJECTS RUN BY PARTNERS

The black bee

One of the organisations that Ceva supports is Conservatoire des Races d'Aquitaine (CRA). Founded in 1991 to address the disappearance of the biological and cultural diversity associated with breeds of farm animals in this French region, today CRA works to safeguard, maintain and promote livestock and other types of domestic animals so that they can contribute towards a local and sustainable regional economy. Ceva supports CRA as part of its commitment to both biodiversity and also to the development of the Nouvelle-Aquitaine Region where Ceva has its headquarters.

Nouvelle-Aquitaine is amongst the richest regions in Europe for animal biodiversity. But following the Second World War, and the push for modernization and intensification of agriculture, many of the region's unique breeds of livestock were at risk of extinction.

For example, until the 1930s, the Bordelaise breed of cattle was the main source of milk, cream and butter for Bordeaux. But by the 1960s, the breed was feared to have become extinct as farmers had replaced the traditional breed with more productive Friesian and Holstein cows. A few surviving cows were discovered in the 1980s, however, from which foundation the breed was rescued.

What saved the Bordelaise and the other breeds, explained Alain Rousset, President of the Regional Council of Nouvelle-Aquitaine, was the passion of women and men who fought to keep these breeds at a time when they were widely regarded as being unproductive, uncompetitive and unprofitable.

In 1991, there were less than 10 Bordelaise cows in existence. Today, thanks to the dedication of passionate and enthusiastic breeders, the application of modern breeding techniques such as artificial insemination and a breed survival plan overseen by the CRA, there are over 200 Bordelaise cattle in France. Though still a small number, this represents a significant recovery over the past 25 years.

In addition to preserving the genetic heritage of the breed, under the guidance of CRA, new uses for Bordelaise cattle and other local breeds are being identified. For example, their hardiness and, compared to modern breeds, relative lightness makes them well suited to conservation grazing (also known as ecopastoralism). This means they can help safeguard and improve the biodiversity of a range of sensitive habitats, such as nature reserves, and also help to

manage public green spaces through carefully managed grazing, which is more environmentally friendly and sustainable than mechanised alternatives.

CRA's latest initiatives are focused on preserving the local black bee and a variety of local breeds of poultry including chickens, turkey and geese. The black bee, which is naturally found in much of western and norther Europe, is hardy and well adapted to the local flora and seasons; unlike the introduced yellow bee, black bees do not need artificially feeding to enable them to survive. The native black bee is threatened due to hybridization with the yellow bee. The CRA program identifies pure black bee colonies and works to preserve and multiply them so they can continue to exist in the wild and also be made available to bee keepers, enabling them to provide pollination services as well as produce honey and other products valued by consumers.

The Bordelaise cow

RECOGNITION AND CELEBRATION OF INDIVIDUALS WHO ARE MAKING OUTSTANDING CONTRIBUTIONS TO AGROBIODIVERSITY

For the past eight years, Ceva has shown its support for the conservation of agrobiodiversity by supporting an annual prize for French famers. Co-founded in 2012 by the Fondation du Patrimoine and Ceva, under the patronage of the French Ministry for Agriculture and Food, the 'Fondation du Patrimoine National Animal Agrobiodiversity Prize' highlights rare French breeds that represent a unique genetic heritage. To date, more than 20 livestock owners or breed associations have been recognized and rewarded.

Célia Verot, General Director of the Fondation du Patrimoine.*"The Fondation du Patrimoine has been tasked with safeguarding both our built heritage and our natural heritage. We do not distinguish between nature and culture, biodiversity and human activities. Our local agricultural breeds and varieties have shaped the landscape in the countryside, and still today they continue to preserve them. They are rich in a unique genetic heritage. With this prize, we are proud to provide our support to breeders who are working to preserve this living heritage, which belongs to us all."*

The annual prize rewards actions taken for the preservation and commercial development of French rare breeds. In selecting the winners, the jury bases its decision on three major criteria: the economic value of the project, its social or environmental impact on the region, and the awareness promotion and communications activities undertaken in the interest of preserving a given breed.
The winners for 2020 clearly illustrate how those who keep rare breeds are striving to develop and utilize the economic and environmental as well as genetic value of their animals.

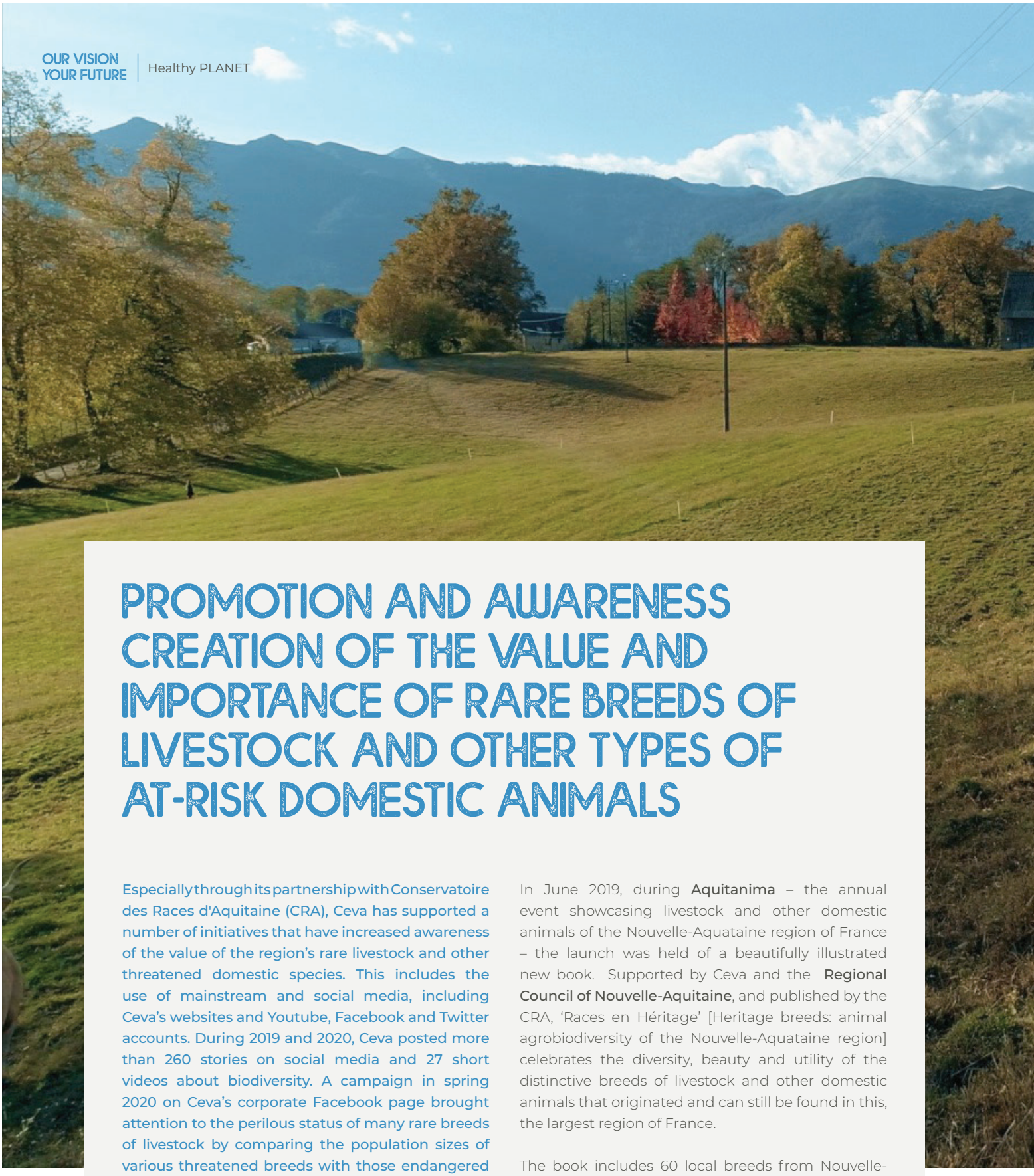
The first prize winner in 2020 was Sarah Bernhard who breeds Lorraine goats, which were only officially recognised as distinct breed in 2013. For the past 4 years, Sarah has raised a herd of Lorraine goats in free-range

The first prize winner in 2020 - Sarah Bernhard with the Lorraine goats

conditions in Haute-Marne, in the Grand Est region of Northeastern France. In order to promote this hardy but rare goat breed (there are only around 700 in France) she had the idea of creating a range of cosmetics based on goat milk, such as soaps, lip balms and body butters. To do so, she has set up a production laboratory allowing her to develop several cosmetic products, the production and marketing of which was launched in spring 2020.

Second prize in 2020 went to Laines à l'Ouest (Wool of the West), a collective of Normandy-based sheep farmers who keep three rare breeds, the Roussin de la Hague, Avranchin and Cotentin sheep. The collective aims to commercialize the wool of these endangered breeds: there are just 3,000 Roussin de la Hague sheep in France, around 700 Avranchin and about 1,000 Cotentin sheep. Since 2017, Laines à l'Ouest has been working on the production of knitting yarn made in Normandy, collecting fleeces from 20 breeders in the region. Each year, the volume of wool collected has doubled; this requires that measures be taken to improve sorting and storage methods, and increase the visibility of the collective amongst knitters outside the region. Overall, its objective is to promote awareness among the general public of the French heritage of animal husbandry and artisanal craft.

Third prize in 2020 went to Achille de Sparre, who breeds free-range Solognote sheep and Limousin pigs in the Centre-Val de Loire region of France. He sells products made from these two breeds, including fresh meat and prepared meat products, and also provides eco-grazing services accompanied by educational communications activities. In order to promote the commercial development of farm-to-table products, several breeders based in Sologne, including Achille, are working to establish a protected designation of origin (PDO). This would confer official recognition within the European Union that their products are produced, processed and prepared in a specific geographical area, using the recognized know-how of local producers and ingredients from the region concerned.



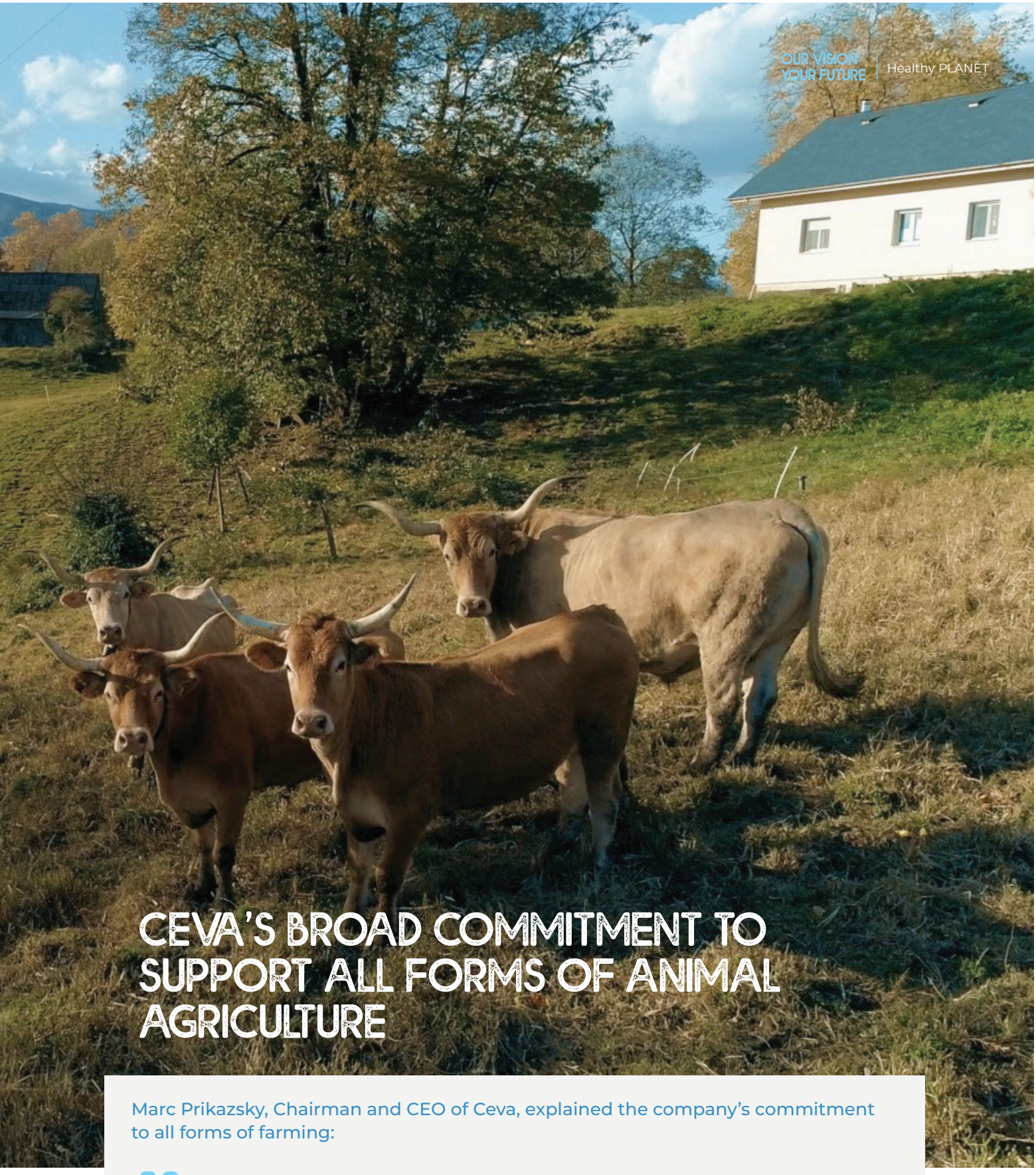
PROMOTION AND AWARENESS CREATION OF THE VALUE AND IMPORTANCE OF RARE BREEDS OF LIVESTOCK AND OTHER TYPES OF AT-RISK DOMESTIC ANIMALS

Especially through its partnership with Conservatoire des Races d'Aquitaine (CRA), Ceva has supported a number of initiatives that have increased awareness of the value of the region's rare livestock and other threatened domestic species. This includes the use of mainstream and social media, including Ceva's websites and Youtube, Facebook and Twitter accounts. During 2019 and 2020, Ceva posted more than 260 stories on social media and 27 short videos about biodiversity. A campaign in spring 2020 on Ceva's corporate Facebook page brought attention to the perilous status of many rare breeds of livestock by comparing the population sizes of various threatened breeds with those endangered species of wild animals.

Ceva's support allowed CRA to launch a website, Histoire de Biodiversité, which enables it to share its stories of preserving environmentally friendly farming practices, supporting herders and safeguarding threatened local breeds with the general public in France and beyond.

In June 2019, during **Aquitanima** – the annual event showcasing livestock and other domestic animals of the Nouvelle-Aquataine region of France – the launch was held of a beautifully illustrated new book. Supported by Ceva and the **Regional Council of Nouvelle-Aquitaine**, and published by the CRA, 'Races en Héritage' [Heritage breeds: animal agrobiodiversity of the Nouvelle-Aquataine region] celebrates the diversity, beauty and utility of the distinctive breeds of livestock and other domestic animals that originated and can still be found in this, the largest region of France.

The book includes 60 local breeds from Nouvelle-Aquataine including 14 types of cattle plus horses, donkeys, sheep, goats, pigs, dogs, rabbits, geese, ducks, pigeons, chickens, turkeys and even bees. Breeds featured include well-known ones, such as the Pyrenean Mountain dog, as well as less familiar ones, such as the Pyrenean donkey, Sasi Ardi sheep and Béarnese cattle.



CEVA'S BROAD COMMITMENT TO SUPPORT ALL FORMS OF ANIMAL AGRICULTURE

Marc Prikazsky, Chairman and CEO of Ceva, explained the company's commitment to all forms of farming:

"It is our duty to support all forms of agriculture. While we need sustainable intensive agriculture to feed a growing population, traditional agriculture is also essential to preserve our planet's biodiversity and conserve our genetic heritage. It is this genetic wealth that constitutes the most efficient protection of our ecosystem in the face of climate change and emerging diseases. In addition, these traditional forms of agriculture allow the preservation of our economic and social fabric and ultimately our cultural identity."

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