Over the past few months, several new experts have joined our R&D team, expanding our expertise into new fields such as molecular microbiology, immunology, and OMICS techniques. Today, the team is organized around six major platforms: 1. Microbial culture collection and screening 2. Microbial characterization 3. Process and formulation 4. Mechanistic research 5. Applied R&D & Corporate transversal team including a disruptive research unit.
**Why are pigs sensitive to mycotoxins?**

Mycotoxins are a threat well known to feed producers. They are toxic secondary metabolites produced by molds, particularly present on cereals. Among all livestock species, pigs are one of the most strongly impacted by the presence of mycotoxins in feed for two reasons:

1) they consume large quantities of cereals, and
2) they are particularly sensitive to mycotoxins.

Recent findings indicate the pig intestine, especially the gut barrier, and the animal’s immune response are two main targets for mycotoxins from feed. This means there is an increased risk for pathogen translocation from the gut lumen to the blood flow while systemic immunity is altered. Mycotoxin contamination can thus be linked to a higher risk of infectious diseases and decreased vaccine efficacy.

A variety of solutions, including administration of probiotics, are under investigation to tackle the effect of mycotoxins in pigs.

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**Microbial ecosystems management in aquaculture**

Adding selected bacteria directly into the water (bioremediation approach) improves these ecosystems, resulting in enhanced nitrogen and organic matter cycling in the pond. This has a positive influence on the composition of the water, a prerequisite for optimal performance.

I truly believe shrimp microbial management should be a multifactorial approach, involving shrimp nutrition and management, as well as water and pond microbial management.

**What is the reception of these approaches in the market?**

In recent years, awareness of the probiotic concept has advanced significantly across the aquaculture sector. However, the importance of selecting high quality microbial products with a guaranteed composition, level of specification, and proof of safety is often underestimated at the farm level. In Asia, shrimp farmers have long seen the benefits of integrating bioremediation bacteria. The understanding of the mechanisms that regulate the microbial population in a shrimp pond, and how to harness them, still needs more research.

I am convinced that bioremediation potential is still largely untapped. It is a very promising area of research, and new OMICS technologies, for example, can help us decipher complex microbial interactions.

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**Can you describe briefly Lallemend’s approach to microbial management in shrimp farming?**

As we always do at Lallemand, we took a microbiologist’s approach to shrimp production.

Microorganisms play a crucial role in the success of shrimp farming. First, microorganisms in the gut affect productivity through the gut microbiota, which can be addressed with probiotics and specific yeast derivatives proven to improve growth and, more globally, overall performance.

Water and pond soil also house microbial ecosystems, which play a crucial role in nutrient utilization and nitrogen recycling.

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**Stéphane Ralite, Aquaculture Product Manager, Lallemand Animal Nutrition**

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**Fungus (Photo: INRA)**

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**Shrimp ponds**
New data presented at the European Symposium on Poultry Nutrition (ESPN) contributes to our understanding of the mode of action of *P. acidilactici* in the poultry gut, indicating the probiotic - already well documented to enhance feed efficiency and performance in laying hens - also plays a role in energy metabolism.

■ Proof of concept study

An innovative trial done in Olzstyn University showed a positive effect of *P. acidilactici* on feed digestion (Mikulski *et al.*, 2019). This trial studied the effect of nutrient density, testing a reduction of 100 kcal/kg energy density, and *Pediococcus acidilactici MA18/5M* supplementation on layer performance. The zootechnical results indicate dietary supplementation with *P. acidilactici* tends to compensate for the effect of energy dilution on performance.

These data are aligned with other results across various conditions. According to a compilation of 24 studies, *P. acidilactici MA18/5M* has been identified to be effective in increasing egg production by 3% and reducing the feed conversion rate by -2.7% (Demey, 2018).

■ A 4-ways action

Taken together, the modes of action of this unique probiotic, and its potential to improve energy digestion and save metabolic cost can be summarized into FOUR main axes:

1) Optimizing carbohydrates digestion
2) Balancing the gut microflora
3) Enhancing the gut maturity
4) Modulating the inflammation

■ Practical implications

The new findings about *P. acidilactici MA18/5M* digestibility are another tool to manage formula cost for poultry production. Laying hens will extract more energy from the feed and will use it to increase laying rate or feed efficiency. Nutritionists have two options:

1- Use the probiotic on top of the formula to improve overall zootechnical performances
2- Use *P. acidilactici MA18/5M* to reduce the cost of energetic raw material and benefit from its probiotics effects.

In both cases, the probiotic will have a positive impact on the balance of the gut microflora, with positive consequences on animal health and preserve its potential of production.

Figure 1

Effect of nutrient density and *P. acidilactici MA18/5M* supplementation on layer performance
Precision feeding:  
the yeast factor

Effects of the rumen specific live yeast *Saccharomyces cerevisiae* CNCM I-1077 on fiber degradation is well documented. Thanks to the mode of action of the live yeast, an algorithm could be developed to predict the effect of the supplement on feed digestibility when formulating for ruminants.

Building a dynamic model

*S. cerevisiae* CNCM I-1077 (LEVUCELL SC) improves neutral detergent fiber (NDF) degradation in the rumen through its modulation of the endogenous microbiota. However, we also know this effect must be modulated by the pH of the rumen. Indeed, a low pH has a deleterious effect on the ruminal fibrolytic microflora. Hence, the lower the pH, the lower the fiber degradability. The other known effect of Levucell SC is the stabilization of the rumen pH. Therefore, the extent of effect of the yeast on fiber degradation is even more important when the pH is low or the diet is acidogenic.

We evaluated the effect of LEVUCELL SC on the degradability of a large array of feed and forage samples. Then, estimated the rumen pH according to the level of rapidly fermentable sugars in the ration. With this information, it was possible to establish an algorithm that predicts the percentage of extra energy available from a ration in the presence of this rumen modifier. By taking into account the kinetics of fiber degradation and the environment of the rumen (pH), we are providing a new dynamic approach to feed formulation. The innovation was to build a biological system that takes into account the rumen microbiota activity (Figure 1).

Field validation

The algorithm was validated at the farm level by Professor Djamila Lekhal at the Purpan Engineering School in Toulouse, France (Ali Haimoud-Lekhal et al., 2016). In this controlled trial, conducted on 38 Holstein dairy cows fed a non-acidogenic diet based on corn silage, alfalfa hay and bicarbonate, the live yeast supplementation increased milk production by 1 Kg/day while improving feed efficiency by 6%. This is correlated to the predicted effect using our algorithm (+1.1 Kg Milk/day). Other studies also confirm the accuracy of the prediction.

Implication for feed formulation

At the feed mill level, this model can be implemented within formulation systems to give an energy value to the live yeast supplement and help precision feeding. The live yeast effect can be considered either when seeking to maximize milk production or to reduce feed costs in a context of least cost formulations.

### Figure 1

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LEVUCELL SC
Rumen Specific Yeast

Rumen input
Couple pH-NDFd

Rumen pH
stabilisation

Forage digestible
NDF increase

Total digestible
Nutrient improvement

Net Energy of Lactation
(NEL)

Effects of Levucell SC in the rumen
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Heat stress management
starts in the silo!

Heat stress is a well-established and growing issue for ruminants across the world. It has a huge financial impact linked to both milk and meat yield reduction and also a longer-term impact on animal health. Housing, nutrition and herd management are important to limit heat stress risks and impact, but forage quality shouldn’t be overlooked, meaning that heat stress management requires planning ahead!

Why silage quality is even more important in summer?

When ensiled forage represents a major part of daily feeding, it’s essential the silage produced is of the highest quality possible. Poorly fermented and preserved silages are often of lower feed quality and tend to heat considerably at feedout and, as such, animals will avoid eating this silage. Moreover, aerobically unstable silages help create an ideal environment for natural populations of undesirable yeast and mold to proliferate, lowering both nutritive values and palatability while also significantly increasing dry matter (DM) losses. Heating silage could see its nutritive value decrease by as much as 16% before molds become visible (Borreani et al, 2018) and DM losses can be more than 15%. Poor quality silage is also prone to higher levels of some mycotoxins such as deoxynivalenol, which has negative effects on rumen microflora and will upset the microbial balance in the rumen. As a result, the already stressed animal will be placed in further danger of Sub Acute Ruminal Acidosis (SARA) development.

Focus on silage management

Silage management is the first key to improve the silage quality and stability at feedout, even under hot temperatures. The best management practices should be implemented at harvesting. It is important to pack the silo properly, seal it with good quality plastic (oxygen barrier plastic, if possible) and weigh the cover down correctly. Using an appropriate forage inoculant is crucial in producing the best quality silage possible. Products containing bacteria that have been tested extensively and independently, such as Lactobacillus buchneri NCIMB 40788, have been proven to inhibit yeasts and mold development in the silo and at feedout. This not only reduces DM and energy losses of the silage, it also ensures high-quality silage, especially during the more challenging summer months.

For more tips on silage management, visit our brand new website www.qualitysilage.com

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Feeding poor quality silage in summer:

- **Feed temperature**
- **DMI**
- **Feed value**
- **SARA risks**

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Practical benefits

- **Feed temperature**
- **DMI**
- **Feed value**
- **SARA risks**
High summer temperatures increase the chance that sow herds will be exposed to heat stress. Heat stress in sows causes a longer weaning-to-estrus interval, decreased farrowing rates and failure to maintain pregnancy. Conception rates of sows are also lower in the summer. When sows are bred in the summer, they farrow smaller litters, and the average piglet weaning weight is significantly smaller than other seasons. Supplementing sow diets with antioxidants is crucial during the hot season, as proven by recent data.

**Weaning to oestrus**

A specific fertility program containing vegetal superoxide dismutase (SOD) and selenium yeast as primary cellular antioxidants can help balance the negative impact of heat stress on the reproductive performance of sows, by reinforcing the antioxidant status of the animals. First and foremost, the application that shows the biggest impact on several parameters is the weaning-to-estrus interval. Embryo development requires high antioxidant supplementation to protect the fetus’ growth and allow for good implantation in the uterine wall. Supplementing the sow with a high-quality antioxidant blend from after weaning until insemination will help improve the fecundation and nidation process, ensuring good embryo viability and subsequent piglet quality.

**New data under heat stress**

A study performed in a commercial farm (Barbé et al. 2019) demonstrated a positive effect of the Lallemand antioxidant blend on all the important parameters that are usually negatively impacted during summer, such as: farrowing rate, return to estrus and rate of born alive piglets.

ALKOSEL + MELOFEED group. The reduced mean percentage of stillborn piglets showed the biggest effect in sows between parities 3 and 6, corresponding to the highest reproductive performance in the sows’ life cycle.

During heat stress, the overproduction of reactive oxygen species (ROS) could overwhelm the animal’s own antioxidant capacity and lead to an imbalanced oxidative status. Supplying sows with a specific antioxidative solution will help rebalance the oxidative status and reduce the impact of ROS on the organism. This specific blend was formulated to optimize the antioxidant defense in sows around insemination and is a promising concept to support reproductive performance, especially during the summer season.

**Figure 1**

Field trial conducted in Germany with antioxidant blend containing selenium yeast and vegetal SOD for 5 days before weaning to insemination (n = 429 sows; *p < 0.01).
“There is great cooperation between our teams”

1. How long have you been working with Lallemand Animal Nutrition’s products?
Witold: Since we started in 2007, we are the exclusive distributor of Lallemand Animal Nutrition products for Poland. We distribute the whole portfolio of Lallemand solutions, including probiotics, yeast cell walls, antioxidants, and silage inoculants.

2. Can you tell us a bit about your route to market for Lallemand solutions?
Witold: Poultry is our main market. Annual broiler feed production is 5 M tons, and it’s growing. We are very proud that Lallemand got the first food safety claim in Europe for S. c. boulardii in broilers, and we started selling it last year. We are aiming to address campylobacter contamination, the main problem in Poland at slaughterhouses.

Krzysztof: The dairy market is composed of a majority of 50- to 70-cow family farms with great potential for growth. We have built the market from the ground up, visiting and advising farmers. For silage additives, we focus on education. We conduct many Silage Schools and already have 3 pilot farms. For feed additives, we have created a line of farmpacks to directly penetrate the end market. Our core route to market remains the premixers and feed mills.

3. Why did you choose to work with Lallemand?
Krzysztof: For the quality and efficacy of the products, of course, but we also love the people. Lallemand is a family company, and we have been growing together from the beginning – we are like family. We have a very similar way of conducting business, of creating direct relationships with our customers, and we really work as a team.

Witold: Lallemand is a very solid and loyal supplier. We have built the business together in Poland. Lallemand invests a lot in marketing and in science, providing strong scientific support that can be used in front of customers. Lallemand is also the only probiotics supplier of both bacteria and yeast. Also for the people; business is done between people, and, with the Lallemand team, we can have tough discussions, but we always find a solution in the end. There is great cooperation between our teams, and this is capital for my customers but also for my employees.

#PASSION FOR FERMENTATION

1988 beginning of bacteria production
Over 30 years ago, Lallemand started to focus on bacteria for the malolactic fermentation of wines. In 1988, we started our own production with the acquisition of a first bacteria plant in France, followed by the Milwaukee plant. We developed solid expertise in bacteria production. Today, the group operates five bacteria plants in Europe and North America - two are dedicated to animal nutrition.

The first bacteria plant of the group is based in Saint Simon, Auvergne (France).