AB·NEO

Do early life experiences affect lifetime performance?

Paul Toplis
Technical Director

Pigs and science make a great couple. The pig industry has been very demanding of science and science has delivered big time. But does science ever hold our industry back?

I think it is true that the older we get the more we cling to scientific beliefs in the face of contrary evidence. Some call this 'cognitive prejudice'. I have had a bad dose of it twice in recent years. At the turn of the century science proved conventional phytase levels cannot work in the presence of high levels of zinc oxide in starter diets and the dogma lasted for a decade. It was not until early in 2010 that I finally recovered from my first bout of cognitive prejudice and put SuperDosing of phytase into all commercial starter diets Primary Diets manufacture. It took an international phosphate shortage to force a desperate trial using very high levels of phytase to see if we could overwhelm the zinc oxide issues and release some phosphorus.

We saw improvements unrelated to phosphorus which I just refused to believe. However we persisted with further trials and in the end an overwhelming dataset from our university program overwhelmed my disbelief. We now know that the benefits of SuperDosing have nothing to do with phosphorus release but with phytate destruction. Science prolonged a dogma and then dragged its heels in accepting a new truth and in so doing denied the pig industry valuable margin for several years.

I experienced the second dose of cognitive prejudice more recently in the area of improving lifetime performance. During a search to find novel ways of creating a palatable pre-weaning diet to drive feed intake, we trialled a new generation of product through a university program. It resulted in significant improvements in post weaning performance but disbelievingly showed little or none of the anticipated increase in preweaning feed intake or weaning weight. My cognitive prejudice kicked in 'this just could not be happening.

This must have happened by chance. Conventional diets and conventional manufacture had never done this in 40 years of testing, so I believed this can't be the case with our new product. Other scientists reinforced my own disbelief but then a different university trial gave even better lifetime performance results. Further trials produced impressive lifetime performance advantages to slaughter so I had to prove this phenomenon could be repeated at farm level. It delivered similar results on 4 out of the first 5 closely monitored farm trials and in so doing confirmed the new category of 'accelerators' that switch on lifetime performance when offered to neonates.

This new accelerator delivers around at least £1/pig net margin (twice that of SuperDosing) and our ongoing research into its mode of action is in place to remove any remaining traces of my cognitive prejudice. I have found the best way to overcome my own cognitive prejudice is to rely heavily on data and so it is encouraging to see that it is now probably the most popular pre-weaning product being used in the UK.

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Time to rethink the role of pre-weaning diets

Paul Toplis
Technical Director

Pre-weaning feeding is the practice of offering solid feed to piglets while still with the sow. I find pig producers can be suspicious of me when I expound the benefits of pre-starters. "It's just another attempt to sell us something we don't really need. A get rich quick con!; That was never the case and the latest research shows the reason to offer something to neonates just got bigger – much BIGGER.

"Piglets just don't eat before weaning" – WRONG

I can understand this frustration as very little is eaten and what is eaten is all eaten by little more than half of the litter. A piglet weaned at 26 days will have eaten 6kg of sow's milk (dry matter) and average about 150g of pellets. As only half the pigs in the litter are eating, those that eat will eat 250-300g of pellets or around 5% of the total solids intake. What good is 5%? Well when bread is made only 0.5% yeast is added to the flour, which is ten times less than a piglet eats in proportion to milk solids. Would you leave the yeast out because it is too small an amount? Yeast has a specific fermentation job to do and that is certainly one (of many) things the traditional pre-weaning feed is there to do. They help to promote microflora (similar to fermentation) along the gut which, among other things, recognise and deal with feed ingredients.

"If they ate more of your feed I would use it" – WRONG THINKING

Where did this infatuation with 'eating more' come from? Feed intake before weaning is about preparation for post weaning and not about maximum feed intake for maximum growth pre-weaning. Pigs which eat small amounts, educate their microflora, educate their immune systems, induce enzyme secretion and grow their guts. The 80:20 rule applies. Almost all the benefits come from the first small amount of feed eaten. Eating more before weaning delivers very few extra benefits. In an ideal world every piglet eats small amounts of feed every day up to weaning. So target 150g/piglet (up to 2kg/litter) and stop worrying if they do not eat more. Worry about your sow feeding in lactation if they do!

"If it increased my weaning weights I'd use a pre-weaning diet" – WRONG AGAIN

Feeding up to weaning is all about conditioning the microflora, the gut, the enzymes and the whole nutrient delivery system. It is about growing THE GUT and not growing the piglet. You would be amazed by how few pellets it takes to dramatically transform the gut.

"Pre-weaning feeding just doesn't work" – UTTER NONSENSE

Traditional pre-weaning feeding has been shown to improve post-weaning feed intake and performance. Improved FCR (lower cost/kg gain) is explained, in part at least, by the improvement in gut structure and microflora brought about by pre-weaning feeding.

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Change the pig. Transform the growth curve.

Paul Toplis
Technical Director

CHANGE THE PIG – TRANSFORM THE GROWTH CURVE

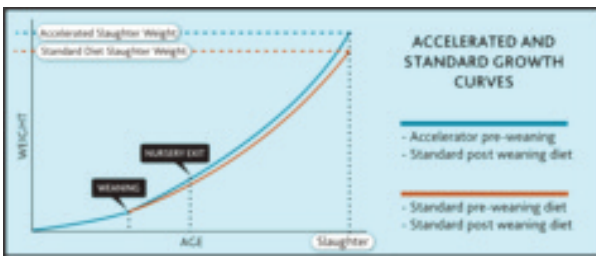
Animal scientists will spend hours at conferences arguing whether to draw a straight or a curved or a broken line through their data points. The shape of the line really matters because it impacts on profit. It tells us how our diets might need improving (cost) and the growth we can expect (value). There is a well-established conventional curve that shows how pigs grow. However, there is now also a new accelerated growth curve for pigs that tells a different lifetime performance story for pigs that have been offered an accelerator from day 4 to weaning.

CONVENTIONAL CURVE: BETTER START – BETTER FINISH

Feeding a better diet to enhance weaning weight or nursery exit weight is known to advance the piglet up the conventional curve to give around a 3:1 weight benefit by slaughter (0.2kg at weaning gives 0.6kg at slaughter or 0.5kg nursery exit weight gives 1.5kg at slaughter – ROI of also around 3:1). Pigs fed a better diet improve their early growth and 'jump up' the same curve so they are heavier if slaughtered at the same age or younger if slaughtered at the same weight. This is all about early extra nutrients to give extra growth. We are all familiar with this curve as pig producers and have observed it for many years.

ACCELERATORS. A TRANSFORMATIONAL GROWTH CURVE

When offered up to weaning, Accelerators affect the pig's metabolism in a way that does little or nothing to growth pre-weaning. Pigs do not follow the 'higher up the same curve' pattern seen with improved conventional diets because the accelerated growth benefit kicks in after weaning and on similar nutrient intakes from unchanged post weaning diets. The pig utilises nutrients for growth more efficiently and is placed on a new and different curve by its improved metabolism and lower immune activity. This is all about efficiency, about how nutrient intake is used more effectively and not about increased nutrient intake. In university and farm trials an extra 4 and 5kg at slaughter has been delivered from zero improvement in weight at weaning without changing any post weaning diets (delivering a credible ROI of 5:1). As such, the transformational growth curve is seen on standard diets fed from weaning onwards. With Accelerators, the pig has been changed, not the diet and this is why the conventional 3:1 rule of thumb no longer applies with Accelerators, in fact trials are showing a transformational 4:0 (slaughter:weaning weight improvement).



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Is current early weaning legislation lagging behind new pre-weaning technology?

Paul Toplis
Technical Director

As new technology advances and enables farmers to wean their best hyperprolific litters at 12 days old, is now the time to challenge and review legislative and farm assurance restrictions on early weaning that may have become outdated by recent advances in neonate technology?

How things change. Instead of asking how to increase their pig numbers, my customers are now starting to ask me what to do with all these extra piglets! Litter size is increasing quite rapidly across the world and it's become a challenge in some European countries – a nice challenge but still a challenge. With so many piglets competing for a teat it is almost inevitable that pre-weaning mortality increases as litter size increases. To reduce the pressure and save as many piglets as possible the Danes use foster sows, the Germans use supplementary milk in the farrowing crate, the Dutch use Rescue Decks and the British use them all. They all work well as a means of supplementary rearing when used by skilled stockpersons but when stockmanship is compromised failures are seen. Some of my customers tell me that the most reliable systems are those that are easiest to use by removing some of those aspects which require more time and skill (e.g. preparing supplementary milk at the correct concentration and temperature).

PIGLET SUPPORT WITHOUT THE USE OF LIQUID MILK

Supplementary rearing boxes using specialist dry pelleted diets (easily used by all staff whatever the skill level) are being more widely used to rear strong 12 day old litters and reduce litter sizes. Using these boxes ensures that less viable/smaller piglets are more able to compete on the sow. The boxes which are about half the size of an individual farrowing crate are used as the first step in a shunt foster. They are kept within existing farrowing accommodation and provide heat, high lactose pellets and water.

REARING BOXES. HERE TO STAY?

We have seen these rearing boxes come and go in the past but I believe two things have changed that now make them more likely to be used more consistently. A new generation of neonate nutrition like Axcelera-P is now available and there are many more farms that have too many piglets. This approach is now easy to use, proven to work by saving more pigs and supports the productivity of pioneering pig producers.

OUTDATED LEGISLATION?

Concerns over the legislation which prevents routine weaning before 28 days of age is one factor weighing on the minds of the more progressive producers. Their dilemma is that they now have access to new technology that enables them to easily wean a few of their best 12 day old litters early, or do they just accept higher mortality across their excess pigs? Is now the time to challenge legislation that still reflects the pig husbandry of its time? Isn't there an argument for legislation to be updated to reflect advances in neonate technology that now make it possible for progressive farmers to safely rear more pigs in a more pioneering way?

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Are accelerators a new way of reducing pre-weaning mortality?

Paul Toplis
Technical Director

A NEW WAY OF PRODUCING MORE PIGS.

Everyone wants more live pigs. Most pig producers put a lot of time and effort into keeping pre-weaning mortality as low as possible. Through improving management around farrowing and in early lactation, mortality has been reduced from the mid-teens to around 10% with the best stock people achieving single figures. Achieving a low mortality is given priority because of a simple relationship between the more pigs sold the greater the profit. What is strange is that no one views pre-weaning feeding as a way of reducing mortality. If you had asked me a few years ago if pre-weaning feeding could lower mortality I would have answered 'unlikely'. But working with customers with big litters has changed my mind. It must be five years ago that the more progressive producers started to ask me for help due to falling weaning weights and increasing mortality as their litter sizes increased. Traditional creep feeding was not really helping, so much of my early efforts centred around offering supplementary milk feeding in every farrowing crate. This approach was very effective, producing more and heavier pigs from every litter. However, the cost and time with such an approach was prohibitive (I calculated break even to be around 13.5 born alive) resulting in a slow uptake by pig farmers. A common request was for a pellet that would do the same job, require no extra equipment and be straightforward to use.

ACCELERATORS AND PRE-WEANING MORTALITY.

It seems unlikely that a pelleted pre-weaning diet could reduce pre-weaning mortality but accelerators are proving to be very effective at bringing more pigs to weaning. In our trials, we were not looking for mortality benefits but instead focused on lifetime performance and we did not notice the mortality benefit at first. Mortality was reduced in academic trials (but we ignore those because they have such good facilities and extra staff), then when mortality reduction was even greater in farm trials we still viewed it as solving temporary issues specific to those farms at that time rather than it being a universal effect. It came as something of a revelation when the same mortality reductions began to appear in our international trials. Mortality reduction is proving statistically significant and repeatable across farms across different countries – and is worth a lot of money.

COST EFFECTIVE. EASY TO USE.

We had discovered a breakthrough in mortality that for once is both cost effective and easy to use. With litter size increases between 0.25-0.4 piglets per litter there is a minimum of a 3:1 payback (even at current low meat prices) from mortality reduction alone. Remember accelerators have been developed to improve lifetime performance beyond weaning through epigenetic changes and so additional income from pre-weaning mortality is a bonus. Our findings are backed up by classic work on pre-weaning mortality from around 30 years ago which showed the number of piglet deaths listed as starvation was around 25% of all deaths. That means starvation contributes to around 0.325 piglet losses per litter, a prediction almost identical to what accelerators are saving. After ignoring the pre-weaning effect of accelerators as a side issue it now has my full attention!

Accelerators: Exploring their unique mode of action

Paul Toplis
Technical Director

When we first started to see the accelerator effect in pigs, we had not experienced such a large jump in performance caused only by a change to the pre-weaning diet. Although feed intakes were not significantly different compared to the top selling, successful creep feed, the effects were profound in two areas:

- Lifetime performance through every stage; nursery, grower and finisher with no suggestion of compensatory growth.
- Reductions in pre-weaning mortality.

These two commercially relevant factors and their significantly positive effects on ROI have made the new accelerator technology of worldwide interest to pig farmers. Consistent results were seen in further AB Neo research through academic and farm trials to confirm that we had indeed discovered a significant breakthrough. So we knew what the repeatable and predictable effect was on pigs and we knew how to achieve it, but we didn't know why Axcelera-P worked as it did. What was the mode of action? Because of its step-change in performance (not the incremental improvement seen time and again in nutritional improvement trials) and how it appeared to switch on a pig at such an early age, we didn't expect to find a conventional mode of action (such as simply offering more or improved nutrition).

OUR PATH TO THE MODE OF ACTION

It is clear that the significant positive change is happening in the neonatal pig. Studies in humans and in laboratory rodents have suggested that early-life events can have long-term effects on intestinal microbiota (gut micro-organisms), their interaction with the animal's metabolism and the expression of the appropriate immune response in protecting the animal and relating to food tolerances. There is every reason to believe that this is also true of neonatal pigs. AB Neo is working closely with Bristol University whose world leading expertise focuses on answering interesting scientific questions relating to gut microbiota and performance. Our collaborative research is focusing on three areas.

- **Microbiota.** Investigating the extent to which the early diet in piglets programs long-term changes in composition and function of intestinal microbiota. Specifically, to what extent does early-life diet influence the succession (rather than short-term composition) of microbial communities.
- **Metabolomics.** Investigating the extent to which the diet and microbiota program long-term effects on the developing metabolic system of the piglets. Specifically, are these also only manipulable early in life, or can they be manipulated later?
- **Immune system.** Investigating the extent to which diet, microbiota and metabolism program long-term effects on the piglet immune system. Specifically, do they change the cost-benefit ratio for expression of immune responses to acute, clinical pathogens; to subclinical infections; and to harmless commensal bacteria and diet.

Our work with Bristol University is very exciting and we are confident that, by working with our own pigs whose performance has been accelerated, we have a strong probability of identifying the specific mode of action. We can then improve the mode of action further, seek more efficient and cost effective ways to create the accelerator effect, and start work on accelerating other species.

University of BRISTOL

Programmed lifetime health and performance by changing the neonatal immune system?

Paul Toplis
Technical Director

We know from our own experiences that compared with indoor reared pigs, outdoor born pigs tend to show better performance and health. These are two measurable benefits that we desperately want because of the economic advantages they deliver.

Understanding why outdoor pigs are more robust has proved difficult. Producers have long argued over the reasons for the difference, with theories due to differences in genetics, nutrition, infection pressure, temperature or sunlight. With 40% of the British herd farrowing outdoors many producers have their own experiences to bring to the argument but whilst they validate the 'outdoor pigs perform better and are healthier' argument they are far from finding the real cause.

To try to improve our understanding of the causal effects we embarked on an academic trial from conception to the end of the nursery (at 8 weeks of age). This trial confirmed pigs born and reared outdoors up to weaning had better performance and health than their indoor contemporaries throughout the nursery. Our conclusion was, 'It is as if outdoor born pigs are programmed for better performance and health by the outdoor experience in their neonatal period'.

This trial was one of the founding studies for our Accelerator technology as it taught us pigs could be programmed as neonates for lifetime health and performance. In my last article I used some scientific terms (microbiota, metabolomics, immunity) to show the areas of AB Neo's research as we identify the mode of action of our accelerator. The latest revelations are coming from a focus on a new understanding relating to the immune system which is potentially game changing when considering our traditional understanding of the immune system.

THE IMMUNE SYSTEM – BUT NOT AS WE KNOW IT?

We have all been reared on the sure and certain knowledge that the immune system can be understood to have two parts; the innate part which is general in nature and has no memory and the adaptive part which has a memory (which we exploit through vaccination). Recent research is suggesting that the innate immune can be programmed. If it can be trained or programmed intelligently in neonates through interactions within the gut then we can reduce a lifetime of lost performance through the chronic activation of the innate immune system which is detrimental to health and general well being of the pig. Our research is investigating how accelerators can influence the billions of neonatal gut micro-organisms (the microbiota) to become a more intelligent programming system for the innate immune system.

One fascinating view into how accelerators might be working has come from work with the neonatal mouse where research has showed gut microbiota can improve immune defences against respiratory disease – a scourge of modern pig production. If there are parallel observations that are true for pigs they would go a long way to explain the lifetime performance and efficiency improvements experienced by accelerated pigs. Exciting and potentially game-changing times.

Do Early Life Experiences Determine Lifetime Performance? 1 Year On

Paul Toplis
Technical Director

By asking this question a year ago about accelerators (products that change the pig's lifetime growth trajectory) I was conscious that many of us suffer from 'cognitive prejudice' – preferring to follow outdated understanding even in the face of new and contrary evidence. One year on views have started to change and we have discovered many new things.

PREWEANING MORTALITY

Trials around the world (France, Spain, Italy, Hungary) show that a reduction in pre-weaning mortality by up to 5% is part of the accelerator effect – and not as we had first thought, being due to the extra care taken when running a trial. With 1% mortality being worth around £5/litter, anything that reduces pre-weaning mortality is essential for the farmer. Approximately one third of all pre-weaning mortality that occurs after day four is largely due to starvation and farmer feedback shows that offering an accelerator from day four reduces these starvation-related deaths.

KILLING OUT %

Accelerators 'change' the piglet and trials show a significant improvement in killing out % where the only difference is an accelerator offered pre-weaning. Quite a remarkable discovery for something that is only offered in the first few weeks of life.

A TRANSFORMATIONAL GROWTH CURVE

Conventional practice shows that an improved weaning weight will deliver a slaughter weight in the ratio of around 3:1 (0.25kg at weaning gives 0.75kg at slaughter). Whereas accelerators increase slaughter weights by 2.5-5.0kg without any prior improvement in weaning weight, transforming the thinking behind what drives growth from weaning to slaughter.

TRIALS AND ADOPTION

Perhaps my biggest disappointment (and realisation) of the year has been the number of poorly run farm trials. Some producers can be sceptical of large amounts of trial results from another country (academic and commercial) leading them to run their own farm trial but then to make basic errors and fail to complete the trial. A well run farm trial makes a significant contribution to any farm business and so should be a basic skill. This year has shown me that it is a lost skill in too many farms and where trials are run correctly, they see the clear business case and adopt the highly cost effective accelerator technology for themselves.

MODE OF ACTION

This time last year I was expecting some of our mode of action studies would be beginning to explain how accelerators are weaving their magic and levels of belief would rise as new solid science was revealed. Cutting edge science takes time and it looks like we will have a definitive mode of action revealed to us all next year. I take heart however as I know that we are working with others on the science to explain the mode of action and next year several independent science groups will also report on different scientific aspects of how accelerators work. It is a real thrill to me to see at first hand how pig farmers around the world are seeing the accelerator effect in their own stock, and 2016 promises to be a significant year when we will be able to announce the mode of action behind this novel technology.