# Can the U.S. Swine Industry Escape Using GPAs?

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Growth-promoting antibiotics (GPA) are a mainstay in U.S. animal agriculture. In large and small operations, across the country and across species, antibiotics are added to animal feed and water far more frequently for the purpose of boosting growth than for treating disease. Non-therapeutic feeding of antibiotics is used in over 95% of the nation's grower/finisher pigs.[1] Some estimate that 70% of the antibiotics and related drugs produced here go for non-therapeutic uses in agriculture.[2]

In absence of disease, the growth-promoting effects of antibiotics are traced to reducing the energetic costs of the constitutive, low-level inflammation associated with bacteria in the intestine.[3,4,5] Gut inflammation has a high metabolic cost, using energy and nutrients that might otherwise be used for growth and reproduction. It has long been known that animals raised in germ-free environments grow much faster than their conventional counterparts.[6] This effect can be seen even if the only bacteria present are lactobacillus, so-called "good" bacteria.[7] With this in mind, it makes sense that reducing the bacterial load with GPAs increases animal performance.

The growth benefits of giving GPAs are clear. Yet this is an area of increasing controversy. Many environmental, humane, scientific, and public health organizations hold that the benefits of GPAs do not outweigh the potential or real costs. Livestock operations are a source for antibiotics contamination in soil.[8] From soil, they've been seen to enter groundwater and be taken up by food crops.[9,10] There is a perception that GPAs allow for animals to be housed in unsanitary or overcrowded conditions. Most important is the worry that giving livestock low-level doses of antibiotics will give rise to populations of antibiotic-resistant bacteria which pose a threat to public health. There is a good possibility that these widespread public concerns will lead to restrictions on agricultural GPAs in the not-so-distant future. Marketing efforts have already keyed in to these issues to promote GPA-free pork in restaurants and groceries. Pleas to legislatively ban the use of GPA go back to 1968.[11] Use of several medically important GPAs have been banned in the European Union since 1998,[12] and similar legislation in the form of The Preservation of Antibiotics for Medical Treatment Act (PAMTA) has powerful supporters, including the American Medical Association and several high-ranking members of congress.[13] American agriculture will need to adapt accordingly.

Reducing or avoiding GPAs does not spell disaster. A possible benefit of foregoing GPAs is a healthier gut. A robust population of intestinal microbiota confers resistance to infection with pathogenic strains. Some types of bacteria even exhibit anti-inflammatory effects on the mucosa.[14] They also produce enzymes that assist in digestion.[15] The successful marketing of various kinds of probiotics to improve gut health attest to the importance of maintaining a populated digestive tract.[16]

Another alternative to GPAs to boost animal performance is a host-targeted approach to reducing excess gut inflammation. Instead of targeting bacteria in the digestive track, as GPAs do, one may design mechanisms that work on the animal's own physiology to limit the metabolic resources "wasted" on excess inflammatory responses, so that growth and production are optimized. Being directed to biochemical targets in the host itself, there is no need to identify specific pathogens, and resistance does not develop. With a completely different mode of action, this tactic can work both in conjunction with and as a replacement to GPAs.

For livestock, there is currently only one company taking this approach. Aova Technologies' BIG™ line of products employs an antibody against a host enzyme, phospholipase $A_2$ ($PLA_2$). $PLA_2$ is a major player in the inflammatory response of vertebrates. This enzyme enables one of the earliest metabolic steps in the inflammatory cascade. Thus, by targeting the host animal's $PLA_2$, these products modulate the action of key inflammation mediators in the gut, resulting in a multi-pronged suppression of excess inflammation. These products are administered as feed additives and work in the gut independently from probiotics and GPAs. Importantly, this agent does not change the immunological status of the animal, which is still fully able to mount an effective response to acute health challenges.

The BIG™ products have been featured in over 150 commercial and university trials in a wide range of species, showing significant gains in feed efficiency, growth rate, carcass yield, health, and egg production for different animals. The success of these products in the field confirms the broad applicability of the host-targeted approach. Two such trials in swine employing the BIG PIG™ product are briefly summarized here.

Eight groups of ~500 nursery pigs were raised at a commercial production facility from ~15 to ~50 lbs on standard feed rations (including GPAs), with or without 0.125% supplementation with BIG PIG.™ Feed conversion was significantly better in the supplemented compared with control pigs (1.57 vs. 1.67, $p<0.01$). The BIG PIG™ groups also had lower medication costs and a mortality rate almost half that of the control groups (1.32% vs. 2.33%), demonstrating that this host-targeted treatment achieves production gains without compromising immune function.[17]

In another study, BIG PIG™ replaced GPAs for ~700 pigs grown for the vegetarian-fed/ GPA-free market. This group was compared to the performance of ~200 pigs grown concurrently in same commercial facility and receiving conventional GPAs. After 6 months, both groups had the same average carcass weight. Higher prices were not given for GPA-free animals; however, a premium was given to pigs having a favorable back fat/weight ratio such that the price paid per head was higher for BIG PIG-fed animals than for conventional pigs ($102.30 vs. $91.80).[18] In this case a host-targeted strategy of using BIG PIG™ not only matched the growth advantage of GPAs, but resulted in increased animal performance in terms of higher carcass yield.

In the face of mounting health and environmental concerns regarding the use of GPAs, astute managers will search out and test alternative strategies to optimize their herds' performance. The American swine industry is not dependent on GPAs. Other innovative strategies, such as a host-targeted approach, can be used to achieve maximum health and growth—and economic return—for swine producers both today and into the future.

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