

# National Swine Registry – Marker-assisted Selection – Past, Present and Future

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National Swine Registry

## Introduction

National Swine Registry (NSR) was formed in 1994 by the consolidation of the Yorkshire, Duroc and Hampshire national breed associations, with Landrace becoming a partner in 1998. The mission of the NSR is “To provide leadership and implement programs, services and technologies to enhance the value, influence and image of purebred Durocs, Yorkshires, Hampshires and Landrace in all segments of the swine industry.” NSR has several goals that provide direction to the programming, including:

- To preserve ancestry by pedigrees and maintain breed purity.
- To assist all NSR members in adding value to purebred genetics.
- To provide programs that improve the quality of all NSR breeds.
- To offer programs and opportunities to realize the full potential of youth development.
- To provide consumer-driven swine genetic improvement programs.
- To be the world leader in swine genetics.

## Past

### *Early adoption of DNA technology using Halothane genotyping*

Since 1996, when the National Pork Producers Council (NPPC) adopted the industry resolution regarding the elimination of the Hal-1843 (stress) gene, NSR has been proactive in the utilization of DNA marker-based tools. Combining the availability of the DNA test with the need to both improve the physiological quality of the breeds and the consumer concerns with PSE pork, breeders were encouraged to take a voluntary approach to eliminating the stress gene. Many breeders took aggressive actions and were successful. In 1998, NSR instituted a policy that all breeding stock exhibited at its national breeding shows and sales will be guaranteed free of the halothane gene. This effort, although not an absolute means to eliminate the gene entirely, did ensure that the predominant lines used in most programs would be Halothane-free, because many of the sires used in the breeds were derived from these shows. In addition, beginning in January 2000, all A.I. sires (those which have breeding certificates issued by NSR) were required to note the sire's stress-gene status in order to have A.I. progeny registered. Since that time, progressive steps have been taken to eliminate the gene in a majority of the population. The current rule in place requires that all animals be guaranteed free of the gene or their pedigree will be cancelled.

### ***Genotyping introduced***

To further enhance NSR's commitment to its goals and utilize more DNA technology, collaboration with universities and industry was explored. In cooperation with Geneseek Labs in Lincoln, NE, new DNA-based tools were developed and introduced to NSR breeders. Beginning January 2001, a sire database was established to serve as research bank and as a future reference for parentage and breed purity. This program utilized a set of highly polymorphic markers, and a genotype (fingerprint) was created on each animal. Due to the cost associated with this program, only A.I. sires were required to have a genotype on file prior to any of their litters being registered. This genotyping allowed for parentage determination by exclusion when comparing markers.

### ***Napole gene testing introduced***

To meet the demands of the packer/processor, the option to test for the presence of the Napole (RN) gene was made available in 2000. Hampshire breeders and A.I. centers, whose genetics were predominant in the commercial industry, took aggressive action to document their herds' RN status. NSR did not mandate a RN-free status for a variety of reasons, the most important being to maintain gene diversity.

## **Present**

### ***Genotyping replaced by banking***

The initial genotyping program did limit NSR to research only the markers evaluated. In addition, there was a desire to expand the database beyond the A.I. sire requirements, but in order to do that, newer and less-expensive methods for DNA capture needed to be explored. Blotter card technology allowing long-term storage and flexibility to capture DNA and analyze for numerous markers, was adopted. Therefore, a new policy requiring all sires to be banked was put in place for all litters born after July 1, 2002.

### ***Specific parentage testing introduced***

With the introduction of the blotter cards, the opportunity to directly confirm or exclude parents of progeny was made available. This technology is used as a system of checks and balances to confirm the ancestry of animals when a question should arise. With many of today's matings occurring through A.I., parentage testing does allow a breeder the option to sort out any discrepancies that may occur and thus protect the integrity of the pedigree. In addition, many organizers of youth swine shows, including NSR, are providing financial incentives for showing purebred animals. Parentage testing can serve as an audit to ensure that the animal is indeed progeny of the sire named on the pedigree.

### ***Hampshire breed-purity test introduced***

Since the mid-1980s, all Hampshire, Yorkshire and Landrace A.I. sires, due to their potentially higher genetic impact, are required to have documented test matings to ensure

that an animal was free of other breeds or cross-breeds. This was accomplished by specifying a required number and type of matings to accurately detect the presence of color genes. The combined challenges of locating cooperating herds with candidate test mating sows and the delay in getting results has led to performing these purity tests through DNA technology.

In early 2002, a licensing agreement was reached with PIC USA to perform Hampshire color-gene testing at GeneSeek Labs. This tool proved to be very beneficial to Hampshire breeders in economics and in accuracy as a replacement to the test-mating procedures. In addition, this test has been used in combination with sire parentage testing at major youth shows to “audit” the purity status of show animals.

## **Future**

### ***Cooperative research***

NSR has recently entered into a research agreement with USDA/MARC and North Carolina State University, with NSR providing DNA material and pedigree information. The objective of this research is to identify single nucleotide polymorphisms (SNP) in Landrace, Yorkshire, Duroc and Hampshire breeds of pigs. This is basic research with long-term objectives. Identification of SNPs will provide information necessary for developing “DNA chip s” for high throughput genotyping.

### ***Expanded breed-purity testing***

With the recent introduction and success of the DNA-based Hampshire color gene testing, interest by the other breeds has been spurred. NSR is optimistic that the cooperative research recently underway with NCSU and MARC will yield results. NSR would also welcome the opportunity to partner with others in the swine genomics field to seek these useful tools.

### ***Future breed-improvement tools***

As more information in the public and private sector is made available, NSR is poised with its extensive database of breeds, sire lines and performance documentation to capture any added value for the NSR members and their herds. NSR would welcome the opportunity to partner with interested personnel for the benefit of the swine industry.

## **Summary**

Consistent with NSR’s goals of maintaining breed purity, improving the quality of the breeds, adding value to purebred genetics and driving genetic improvement, NSR has implemented DNA marker-assisted selection where applicable and affordable. Recognizing that NSR breeds serve as a nucleus foundation for many of the genetic lines today worldwide, there remains a mutual interest to utilize the realm of DNA markers available for the continued maintenance and improvement of these pure lines. NSR has

collaborated with other industry partners and would welcome any and all inquiries into future DNA research that can be beneficial to the entire swine industry.