

Ten transgenic animal research conferences and counting

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The most recent Transgenic Animal Research Conference (TARC), the 10th such conference, was held at the Granlibakken Resort and Conference Center in Tahoe City California in August 2015. The stated objective of the TARC conferences is “to bring together representatives from the leading laboratories worldwide doing cutting edge work on transgenic research in non-murine animals, including livestock, fish and poultry species”. The first conference, held in 1997, was inspired by the earlier Nethybridge, Scotland Conference organized by Ian Wilmut, John Clark, and Rick Lathe in 1986 around the newly evolving field of genetic engineering (GE) mammals.

The first conference was principally focused on the application of GE for use in agriculture and was appropriately called Transgenic Animals in Agriculture. Like the 10th conference, presentations were a mixture of review and research papers. Our original intentions

were to organize a single conference, like Nethybridge. However, at the end of the first conference the participants voted to establish a biannual conference to be held at Granlibakken in odd numbered years and thus the Transgenic Animal Research Conferences were initiated. While the papers from the first conference were published as a book (Murray et al. 1999), only the abstracts from succeeding conferences were published, all in *Transgenic Research*.

TARC X was special, in part because it was the 10th such conference and partly because technology has developed to remove most of the original limitations on the application of the technology (see Ward et al. 1986). Over the years the TARC conferences have consistently been a forum to show-case new and developing technologies. At the first conference in 1997 there were two presentations on the development of somatic cell nuclear transfer-based cloning, a break-through that allowed the production of an animal following the use of homologous recombination in vitro, and thus gene targeting, in livestock. Each succeeding conference started with sessions that documented the technology evolution over the past 18 years, including the development of lentiviral vectors, RNAi, transposons, ZFNs, TALENs, and ultimately CRISPR/cas 9, all before they were employed in livestock. Additional break-throughs were reported on improved approaches to produce GE chickens, including lentiviral vectors, primordial germ cell (PGC) culture, and most recently direct injection targeting circulating PGCs.

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Over the years the TARC conference also shifted from having an agriculture focus to having more of a biomedical research focus, largely because the scientists involved could obtain funding for biomedical-focused research, but not for agricultural based applications. The initial biomedical focus was on the production of pharmaceuticals in livestock and poultry, which slowly shifted to the modification of swine for use in xenotransplantation, and more recently to the production of large animal models of human disease for use in research.

The initial planning for the first TARC conference approximately coincided with AquaBounty Technologies Inc. initial application to the United States Food and Drug Administration (US-FDA) for approval of the AquaAdvantage salmon, an Atlantic salmon genetically engineered to express the Chinook salmon growth hormone gene. At that time the US-FDA had not outlined a regulatory pathway for GE animals. Considering the first GE livestock (Hammer et al. 1985) and fish (Zhu et al. 1985) were reported in 1985, it took until 2009 for the US-FDA to issue an Industry Guidance (FDA 2009). The world-wide regulatory dysfunction around GE animals for use in agriculture to produce food for human consumption has effectively limited advancement in this field, a sentiment widely expressed at the TARC X conference and reflected in a number of the review articles published here. At the time the review papers were accepted for publication in this issue, the US-FDA had still not issued a decision concerning the AquaBounty application; however that has now changed.

On November 19, 2015 the US-FDA approved AquaBounty Technologies application for the use of the AquaAdvantage salmon for human consumption, the first approval of the use of a GE animal for human food anywhere in the world. While this is certainly an important regulatory action, the implication of this decision to the entire field of developing GE, and possibly gene edited, animals for use in agriculture remains to be seen.

In this special issue of *Transgenic Research* you will find reviews across most of the main fields of scientific activity concerning the genetic engineering and gene editing of livestock and poultry. This will include multiple papers presenting suggestions and comments on the need to review and alter the various approaches for regulating GE animals.

In addition to the scientists and regulators who have regularly attended the Transgenic Animal Research Conferences over the past 18 years and those who have accepted our invitations to present their work, we would like to thank those members of our fraternity around the world who have advised us on each conference's program. We appreciate the financial support provided by various companies over the years and particularly want to single out the US Department of Agriculture (USDA), which through the Biotechnology Risk Assessment Research Grants Program (USDA-NIFA-BRAG) have consistently supported the TARC conferences.

References

- FDA (2009) Guidance 187: regulation of genetically engineered animals containing heritable recombinant DNA constructs. www.fda.gov/RegulatoryInformation/Guidances/default.htm
- Hammer RE, Pursel VG, Rexroad CE Jr, Wall RJ, Bolt DJ, Ebert KM, Palmiter RD, Brinster RL (1985) Production of transgenic rabbits, sheep and pigs by microinjection. *Nature* 1985(315):680–683
- Murray JD, Anderson GB, Oberbauer AM, McGloughlin MM (eds) (1999) Transgenic animals in agriculture. CAB International, Wallingham, p 290
- Ward KA, Franklin IR, Murray JD, Nancarrow CD, Raphael KA, Rigby NW, Byrne CR, Wilson BW, Hunt CL (1986) The direct transfer of DNA by embryo microinjection. In: *Proceedings of 3rd world congress genetics applied to livestock breeding*, vol 12, pp 6–21. Lincoln, Nebraska
- Zhu Z, Li G, He L, Chen S (1985) Novel gene transfer into the fertilized eggs of goldfish (*Carassius auratus* L. 1758). *J Appl Ichthyol* 1:31–34