



Emerging Advancements in Genetically Modified Organism.: A study of Transgenic Birds for Improved Production

***Godwin Chukwudi OBI & Idris Babatunde ALLINSON**

The Federal Polytechnic, Ilaro

[*godwin.obi@federalpolyilaro.edu.ng](mailto:godwin.obi@federalpolyilaro.edu.ng)

Abstract

The increase in population has prompted the continuous increase in the demand for food. For this reason, production of cheap but nutritive foods and also the need to increase sustainability of farm animals might motivate food from genetically modified animals in the coming future. Transgenic animals have numerous applications in agriculture, medicine, and industry. Rationales for the transgenic animals include improving the nutritional value of meat, milk, and eggs; making animals resistant to veterinary diseases such as mastitis, to make vaccines, to lay eggs with anti-cancer drugs, to act as potential boost to human immune system, birds For improved egg and meat production, among others.

Keywords: genetically modified organism, transgenic, biotechnology

Introduction

The current human population of more than 7 billion is projected to reach about 9 billion by 2050. Even with the uneven distribution of food and feed resources to sustain the human population, the production of food will have to be more efficient by utilizing the limited resources that is available. Production systems need to be environmentally friendly, socially responsible and economically viable. Selective breeding of farm animals can make a major contribution to this global challenge but may be limited at the long run. Genetically modified organism is a proven way to compact the issue of food production. Genetically modified organisms are also known as transgenic birds. It can be defined as an organism that has had part of another species' genome transferred into its own through the techniques of genetic engineering.

Genetic Engineering: Genetic engineering is synonymous to genetic modification. This can be defined as the alteration of the genetic make-up of an organism. It is the basis for modern biotechnology. Mutation and crossbreeding is not genetic engineering because, engineering is all about designing, production and construction. Genetic engineering makes use of the fact that the DNA is the unit controlling expression of traits and features since the DNA codes for the RNA " s which in turn codes for proteins

Biotechnology: It is the technology that utilizes biological agents in the production of goods and services . Biotechnology is a collective term for a group of technologies that use biological matter or processes to generate new and useful products and processes and that as such, it ranges in complexity and maturity from ancient brewing and bread-making techniques to genetic modification through hybridization and interbreeding of plants and animals, as well as the manipulation of individual genes in humans, animals, plants and microorganisms.

Method for Gene Transfer in Animals

The most common method for producing transgenic animals is gene transfer by DNA microinjection, which involves the following steps:

- DNA containing the desired transgene is identified and cloned (copied tens of thousands of times in bacteria) before insertion into the animal host.
- The host animals (cows, pigs, or sheep) are induced to superovulate and their eggs are collected.
- The eggs are fertilized in a laboratory dish.
- Using a fine, hollow needle, a solution of DNA containing the transgene is injected into the male pronucleus of the fertilized egg (the nucleus of the sperm cell that entered the egg) before it fuses with the female pronucleus.



- The transgenic embryos are grown in cell culture and then implanted into the uterus of a surrogate mother, where they complete their development.
- Screening is performed to determine which of the offspring have inherited the transgene. The main drawback of DNA microinjection is its low success rate: only between 1 and 4 percent of microinjected eggs result in the live birth of a sheep, goat, or cow containing the transgene, and about 80 to 90 percent of transgenic embryos die during early development.(5)

This educational module describes some recent advances in agricultural biotechnology and assesses their benefits.

GM chickens that lay eggs with anti-cancer drugs

Scientists have genetically modified chickens that can lay eggs that contain drugs for arthritis and some cancers. The drugs are 100 times cheaper to produce when laid than when manufactured in factories. The researchers believe that in time production can be scaled up to produce medicines in commercial quantities. These chicks are fed and watered and looked after on a daily basis by highly trained technicians, and live quite a comfortable life (1) Researchers have previously shown that genetically modified goats, rabbits and chickens can be used to produce protein therapies in their milk or eggs. (1)

Potential boost to human immune system

Many diseases are caused because the body does not naturally produce enough of a certain chemical or protein. Such diseases can be controlled with drugs that contain the deficient protein. These drugs are synthetically produced by pharmaceutical companies and can be very expensive to manufacture. Scientist have managed to reduce the costs by inserting a human gene - which normally produces the protein in humans - into the part of the chickens' DNA involved with producing the white in the chickens' eggs. Researchers have focused on two proteins that are essential to the immune system: one is IFNalpha2a, which has powerful antiviral and anti-cancer effects, and the other is macrophage-CSF, which is being developed as a therapy that stimulates damaged tissues to repair themselves.(1)

Flu-resistant GM chicken

Of recent, scientists were able to introduced a tiny part of the bird Flu virus into the chicken cell by artificially inserting the gene into the chicken. Consequently, these birds became infected but rendered the virus harmless to other poultry. This GM technique has the capacity to protect a whole flock avian influenza infection which is a real challenge to poultry production.

Transgenic Birds For Improved Egg And Meat Production

Biotech Companies are presently seeking to Bridge the Gap between Egg Laying and Meat Production in Chickens. Traditional breeding techniques are starting to hit some limits. For instance, when breeders select birds that grow fatter faster, these birds tend to be duds at laying eggs. But what if there was a way to have the best of both worlds, to create a breed that reached market weight in record time, but also had a high egg-laying potential, so breeders could quickly supply farmers with billions of these new super-birds. India has developed a transgenic chicken variety that is fleshier than normal breeds, and can reportedly also be used in the treatment of diseases. This breakthrough research could help boost production in a country where the annual domestic consumption of poultry and poultry products is worth more than 300 billion rupees (US\$6.8 billion.)The tool used to genetically modify the chicken was developed by a team of 3 scientists at the Hyderabad-based Project Directorate on Poultry after 2 years of research using a gene of jellyfish and spermatozoa of a specific variety of chicken from the institute. Bhattacharya, T.K., the head scientist said it is ready for commercial use. These chickens can enhance productivity and give a huge quantity of flesh. Also, the transgenic birds can produce up to 300 eggs over 72 weeks, which is more than twice the number of eggs produced by normal varieties of chickens. The institute hatched 263 chicks in its study group, of which 16 were found to be transgenic. The efficiency of the institute's method of producing transgenic varieties is about 6 percent.

Alternative to vaccination

Although, Agricultural selective breeding has made huge improvement on productivity of many livestock, it may reach a point where it will be limited. GM technologies has the tendency to allow introduction of novel genes that can specifically target these viruses to prevent them from replicating," (2) there-by creating a virus free poultry production system. Recently, Researchers at the University of Edinburgh's Roslin Institute have genetically modified chickens so they lay eggs containing human proteins, which could then be used as drugs.

This new approach for drug production is said to be cheaper compared to manufacturing in factories. During the research, the team observed that the new type of drugs worked similarly to the same proteins produced using existing methods.

The researchers noted that high quantities of the proteins can be recovered from each egg using a simple purification system. The researchers hope that the drugs could potentially be used in patients in the future. Roslin Institute professor Helen Sang said: “We are not yet producing medicines for people, but this study shows that chickens are commercially viable for producing proteins suitable for drug discovery studies and other applications in biotechnology.” Eggs have been used previously for growing viruses that are used as vaccines. However, the new method involves genetic modification of a chicken to encode therapeutic proteins in its DNA. The drugs are produced as part of the egg white.(1)

Other GM contributions in Egg

- To produce antibodies in eggs that are added to pig feeds to fight off bacterial infections such as E. coli.
- To produce growth-promoting antibodies in egg yolks to be fed to farmed animals to increase their growth rates by disrupting their normal peptide and gut processes, thus, for example, tricking animals who are already full to continue eating.
- To produce recombinant lactoferrin and lysozyme as alternatives or supplements to growth-promoting antibiotics and/or antibodies in poultry diets.

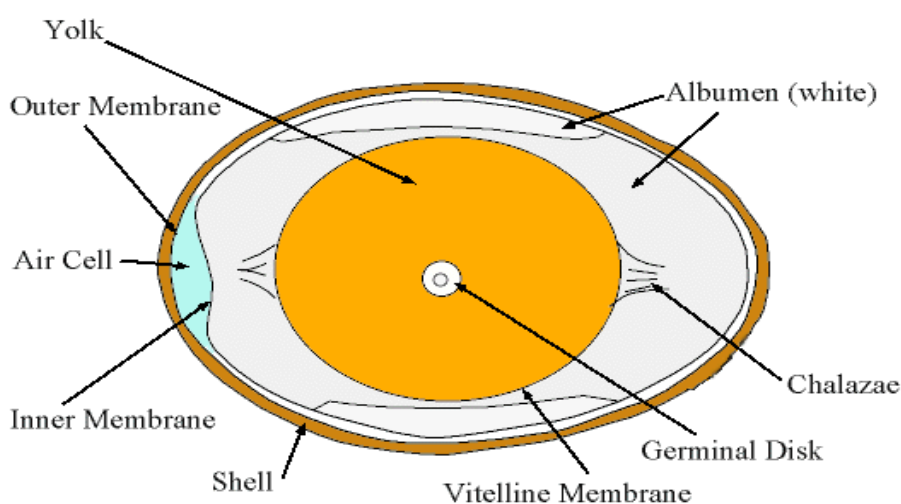


Fig.1. An Avian egg and its parts. Source: [3].

Conclusion

The use of genetic technology for improvement in livestock production dates back only a few decades. Advances in biotechnology have led to the development of “transgenic” animals incorporating snippets of DNA from other organisms that endow them with new traits, such as resistance to infectious diseases or the ability to produce human proteins of medicinal value. This has assist to increase productively and help in the mitigating of food security and sustainability in recent times and should be considered as a potential tools in the poultry industry.

Reference

https://www.google.com/amp/s/www.bbc.com/news/amp/science-environment_46993649?espv=1

<https://www.bbc.com/news/science-environment-12181382>

Wikipedia, Bird flight, Page 1, 2011.

https://fas.org/biosecurity/education/dualuse-agriculture/2.-agricultural_biotechnology/index.html

J. Love, Transgenic birds by DNA microinjection, Bio/Technology, Volume 12, Page 60, 1994.