GM Sheep Produce More Milk and Wool

A three-year Commonwealth Scientific and Industrial Research Organization (CSIRO) Livestock Industries' research project has concluded that genetically modified (GM) sheep grow bigger and faster, produce double the amount of milk, can grow more wool, but require more care.

The project monitored generations of sheep genetically modified with an extra copy of growth hormone gene and found expression of the gene varied between sheep and in offspring.

The study found that these particular GM sheep required more attention than non-GM sheep. Excess growth hormone can cause the GM sheep's hooves to overgrow and so require regular clipping. GM sheep were also leaner, which can result in health problems, and some were susceptible to diabetes.

Project leader Dr. Norm Adams said that his research indicates the extra growth hormone gene impacts on sheep differently.

A sheep milk study revealed that GM-growth hormone ewes experience a prolonged lactation period, producing on average twice the amount of milk as control sheep, and continued to produce milk after weaning.

Dr. Adams said, “The gross composition of the GM milk appears to be the same as normal sheep milk. The effect of extra growth hormone on sheep milk production was not unexpected — injecting growth hormone into lactating cows to make more milk is commonplace in the US dairy industry.”

An unforeseen finding is that GM sheep indicated a lower tolerance to parasites than control sheep. More research is required to understand the impact of an additional growth hormone gene over the lifespan of a GM sheep.

Tender Beef Gene Test Developed

A consortium comprising the Cattle and Beef Quality Cooperative Research Center, CSIRO Livestock Industries and Meat and Livestock Australia has developed an Australian-patented technology, a DNA test which identifies cattle carrying a tenderness gene.

Brisbane-based company, Genetic Solutions, has won the global race to bring the test to the market.

Genetic Solutions’ scientific director, Dr. Jay Hetzel, said, “There is keen interest in using this tool to selectively improve the quality of beef herds in Australia as well as in the Americas and South Africa.”

The new test, known as GeneSTAR Tenderness, will complement GeneSTAR Marbling — the world’s first commercial DNA test for identifying animals with the desirable trait of fat distributed through the muscle.

Dr. Hetzel said that beef consumers have clearly identified inconsistency in tenderness as a major deficiency. Research shows that tenderness is more important than juiciness and flavor factors to their eating experience.

CSIRO Livestock Industries Chief, Mr. Shaun Coffey said, “The tenderness link to the naturally occurring enzyme, calpastatin, was identified in a major study led by Dr. Bill Barendse and a team from the Beef Quality CRC using more than 5000 beef carcasses from seven breeds.”

Cattle and Beef Quality CRC CEO, Prof. Bernie Bindon, said, “Genetic improvement of tenderness has proved very difficult because the trait is hard to measure and is influenced by many pre and post-slaughter environmental factors. While the GeneSTAR test accounts for only a part of the variation in tenderness, the effects are permanent and cumulative.”

Researchers discovered two variants of the calpastatin gene — one associated with increased tenderness and another with increased toughness.
Cattle are given a rating — 2-STAR, 1-STAR or 0-STAR — indicating how many copies they have of the tender form of the gene.

Dr. Hetzel said that a bull and cow, both with 2-STAR ratings, would pass on the desirable traits to 100 percent of their progeny.

The presence of the tender form of the gene varies across breeds with British-type breeds recording the highest frequency and the Brahman breed the lowest.

Cytokine as Antibiotics Alternative for Poultry

A CSIRO Livestock Industries’ research team has developed a way of delivering antibiotic alternatives — natural proteins called cytokines — into chickens.

CSIRO researcher, Dr. John Lowenthal said that the use of antibiotics in animal industries has raised some concerns about the potential spread of antibiotic-resistant bacteria.

In 1990, CSIRO began an ambitious research program to find alternatives to antibiotics for the poultry industry. The focus was on using cytokines to enhance disease resistance in poultry. A significant advantage with this approach is the ability of the cytokines to provide protection against a range of different infectious diseases.

Dr. Lowenthal said, “Cytokines are proteins that are produced by the body. Their job is to improve the immune response during infection and help combat disease. As such, they are excellent naturally-occurring therapeutics.”

The researchers showed that when chickens were treated with cytokines, their health improved and as a consequence they gained weight more quickly. The problem was identifying how safely and effectively this treatment could be delivered to the 400 million chickens grown commercially each year in Australia.

According to CSIRO researcher, Dr. Mike Johnson, the solution involved using viruses called adenoviruses to carry the cytokines into chickens.

Dr. Johnson said, “The adenoviruses we are using are similar to vaccine strains commonly used in the poultry industry. Using these adenoviruses is ideal in terms of maintaining biosafety standards because they are harmless to the animal and only infect one species. For example, a chicken adenovirus will infect only chickens, but not humans or other animals.”

Another safety factor is that the adenovirus and cytokines remain in the chicken for only a few days while the protective effect lasts much longer. As a result, fully-grown chickens are completely free of the treatment.

A big plus is the way treatments can be delivered to animals. Needles are no longer necessary — instead treatments can be mixed in with food or water or simply sprayed on.

Dr. Johnson said, “Numerous animal trials, performed at CSIRO’s secure animal facilities, showed that treating chickens with an adenovirus carrying a cytokine — chicken gamma interferon — led to improvements in growth performance.”

Human Obesity Linked to Beacon Genes

The International Diabetes Institute’s (IDI) genomics laboratory in Melbourne has linked the Beacon gene to obesity in humans.

The discovery is based on an analysis of over 800 human genetic samples at the High Throughput Genotyping Facility operated jointly by Autogen Ltd. and the IDI.

When the human samples were genotyped, Autogen scientists identified several genetic sequence variations (called SNPs) in the human Beacon gene. These were found to be associated with eventual onset of obesity.

In addition, the presence of the Beacon “SNPs” appears to predispose individuals to depositing excess fat around the waist, a body type that has been shown to be linked to an increased risk of developing coronary heart disease and diabetes. The genetic variations in the human Beacon gene are also found to be linked to the circulating levels of triglycerides, total cholesterol and LDL cholesterol.

Autogen’s previous research into Beacon had shown that expression of the gene is strongly related to the development of obesity in the classic animal model of obesity and diabetes, the Israeli Sand Rat (Psammomys obesus). In November 2000, the Autogen-funded Deakin University Metabolic...
Research Unit published the discovery of the Beacon gene in the leading international scientific journal, *Diabetes*.

In those earlier studies, Beacon was found to be present in higher levels at an early age in animals predisposed to obesity — even before the obesity developed, strongly suggesting that the gene has a role in the development of the problem. In addition, Beacon was clearly linked to the level of fatness — the more Beacon was expressed, the fatter the animal was. Furthermore, when rats were given the Beacon protein, there was a marked increase in food intake and body weight.

**Muscles Play Role in Cholesterol Regulation**

A study of muscle tissue in mice, led by Dr. George Muscat of the Institute for Molecular Bioscience at Brisbane’s University of Queensland, has shown that muscles play an integral part in regulating cholesterol levels.

The study was part of research funded by a US biotechnology company, X-Ceptor Therapeutics, which is developing drugs that reduce cholesterol absorption.

Previous research had shown that people with a lean body mass who exercised regularly showed increased levels of HDL-cholesterol (high-density lipoprotein).

Muscle cells contain receptors called LXR (Liver X Receptors), which are associated with cholesterol clearance in the liver and intestine but, until now, no one has yet established their functional role in muscle tissue.

Scientists believe that LXR act like locks which are activated by a cholesterol key called hydroxycholesterol, which in turn triggers genes that code for proteins called ABC Transporters. These in turn help transfer cholesterol to HDL.

Researchers at X-Ceptor Therapeutics had found that drugs that mimicked the cholesterol “key” boosted clearance of LDL in rats and reduced atherosclerosis. But they were uncertain whether LXR in muscle were playing a significant role in this.

In order to find out, two groups of mice were treated with the drug “key”. One group carried normal LXR while the other group did not have LXR. Samples of each group’s muscle tissue were then analyzed to check for activation of ABC transporter genes. It was found that ABC transporter genes were turned on in the normal mice, but not in the mice with no LXR receptors.

As well as removing cholesterol from tissues, ABC Transporters also remove excess cholesterol that comes into the intestine via the diet.

However, the drug does have side effects — it raises the level of triglycerides, which is not desirable. Researchers at X-Ceptor Therapeutics are now trying to work around this problem.

**Chinese Scientists Develop Biochip for HCV Detection**

Chinese scientists have developed a biochip for quick detection of the virus that causes hepatitis C (HCV), a liver illness that has infected about 40 million Chinese mainly through blood contamination.

The silica-based protein chip detects HCV in blood samples more efficiently and accurately than the current method of ELISA (Enzyme-linked Immunosorbent Assay), said Mr. Wang Shengqi, who led a team of researchers from the Chinese Academy of Military Medicines (CAMM) and from Yishengtang Biological Products Co. Ltd. of south China’s Shenzhen city.

The product, officially known as the “Detection Kit for HCV Antibodies”, has been approved to enter the market by the State Drug Administration (SDA).

According to Mr. Wang, deputy director of a Beijing-based national biochip engineering center, the significance of the product goes far beyond just controlling HCV, because the country is determined to boost the whole biochip industry.

The Chinese government has invested RMB500 million (US$60 million) to launch two national biochip engineering centers and several major research programs in recent years. Some high-tech enterprises have also invested RMB1 billion (US$120 million) to develop biochips for use in medical diagnosis, new drug
development, environmental protection and many other fields.

Mr. Wang said that his biochip laboratory at the CAMM is also developing a new biochip for simultaneous detection of the viruses of hepatitis B, hepatitis C, syphilis and HIV (human immunodeficiency virus that causes AIDS). The new product is expected to get a permit from the SDA late next year.

GM Tomato as HBV Vaccine on Trial in China

A Chinese research team has produced a genetically modified (GM) tomato that may have the potential to be an oral vaccine against the hepatitis B virus.

If the trials, currently undergoing in a suburb of Beijing and expected to last one to two years, are successful and it can be proven that the tomato has neither an adverse impact on the environment nor people’s health, they will pave a smooth path for commercial application.

“We will file an application to the Ministry of Agriculture for permission to go into production and sales, if the trials are demonstrably successful and reliable,” said Prof. Liu Dehu, a biotechnology researcher with the Chinese Academy of Agricultural Sciences.

GM agricultural products are only allowed to enter the markets after they have been given a safety certificate by the Ministry of Agriculture following three-phased experimental trials.

Prof. Liu, who has led the hepatitis B tomato experiments over the past ten years, said that he believes Chinese consumers will have access to the potentially life-saving tomato in the next few years.

“No timetable is set yet. But if everything stays on track, I think after 2004, the tomatoes can be on the food shelves,” he added.

The tomato has been engineered in such a way that the antigen for hepatitis B is inserted into a tomato through gene modification technology. When eaten, the tomato will improve a person’s immunity and resistance to hepatitis B.

Study Shows Good Management Reduces Diabetic Risks

The Diabetes Care and Research Group at the Chinese University of Hong Kong (CUHK) has shown that the risks of developing major diseases in diabetic patients can be minimized to that of normal aging or less than 10–20 percent in high risk patients through early diagnosis, risk stratification, treatment to target and patient education.

A six-year follow-up by medical professionals at CUHK finds that only eight of 91 diabetic people with high blood pressure who were managed by a nurse and diabetes specialist according to a structured protocol with particular emphasis on periodic assessments, treatment to target and reinforcement of compliance, died.

By contrast, 20 of 81 diabetic people being followed up in a general clinic without an effective system to ensure treatment to target and periodic assessment died during the same time period.

Good management for diabetic patients with kidney damage also proves to save life. For 55 diabetic patients who had lost more than 50 percent of their kidney function, the average time to dialysis was lengthened from two years to four years when using a protocol monitored by a pharmacist and diabetes specialist. To those with a lower degree of kidney damage, the rate of decline of kidney function was reduced to that of normal aging.

A state-of-the-art Diabetes Management and Education Center will open to provide alternative, affordable and convenient health care plans to high risk individuals, helping them manage their risk profiles, adjust their lifestyles, handle their emotions and if necessary, use appropriate medications to promote their well being and prevent deterioration of the killing disease.
One in ten Hong Kong people has diabetes and another one in ten will develop diabetes in 5–10 years’ time. However, the majority of these people remain undiagnosed, untreated or sub-optimally managed.

Diabetes is increasingly appearing in young people. The longer diabetes exists, the more likely are its complications, which are extremely costly. Approximately 30 percent of diabetic patients develop the disease before the age of 40 years. Among them, 60 percent had at least two risk factors of obesity, high blood pressure, abnormal blood fat levels and albumin urine.

The other 40 percent had inadequate insulin secretion. Young diabetic patients can avoid deterioration of their complications if they manage the disease well.

Oral Vaccine for Cholera

Indian researchers have announced that a genetically engineered vaccine for cholera has been developed, and will be ready for commercialization by 2004. It is based on the recombinant strain of Vibrio cholera.

The vaccine was cleared for human clinical trials in 1998 and was found to be safe in phase one trials.

An official release said that the phase two trials are already underway, to further assess the efficacy of the vaccine. Subsequently, it will have to undergo phase three clinical trials — in which volunteer trials will be performed and approval from the Drug Controller General of India will be sought. Only then can the vaccine be commercialized.

However, preliminary discussions for the commercialization of the vaccine have already begun.

Japan Develops Encapsulated Endoscope

Patients who need endoscopic examinations may no longer have to bear with the discomfort of having a tube eased down his throat. Researchers from RF System Laboratory, based in Nagano, Japan, have recently developed a capsule that contains an ultra-small camera that can function as an endoscope.

The plastic capsule, measuring nine millimeters in diameter and 23 millimeters in length, is called Norika. A miniature camera, as well as a light source, are built into the capsule.

All the patient has to do is to swallow the capsule like a normal pill, and then don a specially constructed vest with electrical equipment that exchanges signals with the capsule. The capsule has limited maneuverability (controlled electromagnetically) and is able to provide real-time observation of the walls of stomach and neurological functions after the graft, and it grew. It was reported that the baby rat’s mouth even moved, as if it was trying to drink milk.

The experiment was led by Dr. Nobufumi Kawai and Dr. Kuniko Shimazaki of Jichi Medical School in Tochigi prefecture. One of the purposes of this study was to find out how long can brain tissue survive after its blood supply has been cut.

The study also showed the importance of a low room temperature during transplantation. The experiment was conducted in a 29 degrees Celsius room and a 19 degrees Celsius room, and only the latter was successful.

“The finding that a transplant is possible if the brain is cooled helps add a reference to brain surgery,” said Dr. Kawai, who is a Professor Emeritus of the school.
The capsule is expected to be discharged naturally from the body seven to 48 hours after being swallowed. For safety reasons, Norika does not carry a battery. Instead, the capsule receives energy from outside the body, by a technique that utilizes microwaves.

However, improvements still have to be made to the capsule. For example, it cannot “backtrack” to an area that it has passed to take another image if the first pass was not good enough.

About 40 percent of the capsule’s interior is still empty. This space can be used to store medication to achieve a more efficient way of drug delivery inside the body.

Samples of Norika will be distributed to medical institutes for clinical applications in December 2002. The price of the capsule is projected to be approximately 14 000 yen (US$110).

Kurita Water Industries and Komatsu Ltd. have successfully developed a supercritical water oxidation unit which is able to decompose various wastes, waste fluids and sludge into harmless materials. It is also touted as the world’s first system that can handle high salt concentrations.

The Supercritical Water Oxidation (SCWO) technology oxidatively decomposes organic matter into water as well as carbon dioxide in the aqueous phase above the critical point of water.

Although this technology has been receiving considerable attention as because it can detoxify substances such as dioxins and PCB, practical application has been delayed due to technical problems. Accumulating of salt and unit corrosion are two of the main problems.

The two Japanese companies obtained the basic technologies from General Atomic of the US, and began joint development in 1997. Consequently, they succeeded in developing an unit which can remove accumulated salt and has anti-corrosion features at the same time.

The unit was tested for 1000 hours using a demonstration plant and its performance stability was confirmed. This processing system will be manufactured and marketed under the product name “AquaFlame”.

Kurita Water Industries is a water and environment management company that provides a wide range products and services.

Komatsu Ltd is a provider of industry products and services. An international leader in the field of construction and mining equipment, the company is trying to expand its business in electronics and other solutions-based operations.

New Zealand researchers have shown that for a virus to reproduce itself in the body, its genetic material must be “read” in a particular way by human cells, and interrupting that process could lead to a new class of HIV/Aids Drugs.

Test-tube trials by Prof. Warren Tate and his colleagues from New Zealand’s Otago University involving extracts of rabbit cells have already produced promising results. Two chemical compounds derived from existing antibiotics are involved. Similar trials are under way to test 30 to 40 more compounds.

If a drug proves successful, it would add dramatically to the pharmaceutical attack on HIV, but any human trials would be years away.

Modern drugs control the disease in many people, but there can be severe side effects. The HIV virus is developing resistance to some drugs and many are too expensive for Third World countries, including those in Africa, where the epidemic is worst. In New Zealand, drugs can cost NZ$1200 (US$602) to NZ$1600 (US$803) a month per patient.

Prof. Tate said that his team used low concentrations of active chemicals in the drugs it was testing. This put them below the level that caused side-effects and would, he hoped, make them cheap enough for the Third World.
His group — some of whom are applying the same findings to hepatitis B — is one of few in the world investigating this virus-reading mechanism of human cells.

Others also operates with a particular infection in chickens and then with HIV in humans.

The way in which human immune cells read the genetic code of HIV allows the virus to make two proteins, one for its viral coat and one for replication in the exact proportions needed.

If scientists could disturb those proportions enough, HIV’s infection capability would drop dramatically.

### Needle-free Blood Test Discovered

Scientists at New Zealand government-owned HortResearch have accidentally discovered a device that can test blood without using a needle to take a sample. The device, originally developed for sheep, has the potential to replace most medical blood tests — a market worth billions of dollars worldwide.

The hand-held, gun-like device uses sound waves above the limit of human hearing and an electric current to draw chemicals from blood into the skin and then, through a special membrane, into a recording instrument.

HortResearch scientist Dr. Christian Cook said, “You position it on the forearm of the subject, leave it there for 15 seconds, take it off and you have a sample.”

The system can measure more than 20 factors in the blood, such as the hormones testosterone and cortisol, which measure strength, muscle growth and stress, and creatine kinase, which is a good predictor of muscle breakdown.

Dr. Cook, who works for HortResearch at Ruakura, near Hamilton, discovered the new technique while investigating whether high-frequency sound could be used to measure fat levels in sheep.

HortResearch is working with Waikato Hospital to test the system on selected patients, and has been in touch with overseas interests about commercializing the technique for medical blood tests. However, it might take five to ten years to complete the trials required for widespread use.

Dr. Cook said, “In a ten-year span, there is the potential to replace many, perhaps most, of the conventional blood tests.” In the meantime, HortResearch hopes to develop the niche markets of testing athletes and animals.

### Singapore Hospital Conducts Cervical Cancer Vaccine Trial

Singapore’s KK Women’s and Children’s Hospital has recently embarked on a trial for a cervical cancer vaccine as part of a worldwide trial to protect women from a cancer-causing virus.

The cervical cancer vaccine acts against the human papilloma virus, or HPV, which is found in as many as 99.7 per cent of cervical cancers.

Dr. Tay Eng Hseon, head of the hospital’s gynecological oncology unit, explained that synthetic viral particles that mimic HPV are injected into the body. This tricks the body into thinking it has been infected, so it produces an immune response to fight the virus. It also remembers the virus and will be resistant to it in future.

The hospital plans to vaccinate a few hundred women, aged 16 to 26. Volunteers will undergo a Pap smear test to detect abnormal cells at the neck of the womb. They will get three doses of the vaccine within a six-month period, and yearly checkups thereafter till the trial is over in a few years.

Worldwide, cervical cancer is one of the deadliest cancers in women, behind lung and breast cancer. It affects 471 000 each year and kills about half of them. An estimated 230 new cases are diagnosed in Singapore each year, and 40 percent are fatal.

It is the fourth most common cancer among women in Singapore, with 14 new cases per 100 000 a year, much higher than in the US, which sees 7.88 per 100 000, or Europe, which has an average of ten per 100 000.
High-intensity Ultrasound to Kill Tumors

A team of Singapore researchers has achieved a potential breakthrough in treating cancer patients by using sound waves to kill tumors.

Shining high-intensity waves of ultrasound through the skin is similar to focusing the sun’s rays through a magnifying glass on a dry leaf, raising the temperature of the cancerous cells and killing them effectively.

Dr. Sunita Chauhan of the Robotics Research Center, School of Mechanical and Production Engineering, Nanyang Technological University, the leader of the research team, said that this is a completely non-invasive treatment. As it is not cutting into the body, there is little risk of infection, patients experience less pain and recover faster.

The research team is working with the medical school of the University of Heidelberg in Germany to perfect the technique.

Dr. Chauhan has developed robotic techniques to pinpoint the beams over very specific areas, so that they target only the cancerous cells without harming the healthy tissue around them. Her team is also working on equipment to remove breast tumors. The German partners are also carrying out clinical trials on kidney tumors.

Ultrasound is a popular medical imaging technique and is commonly used on pregnant women to check on the developing fetus. But scientists have also recognized its potential in combating certain cancers and internal bleeding, without anesthesia, chemotherapy, radiation or surgery.

Scientists at Indiana University in Indianapolis have devised the Sonablate 500, which could be the first high-intensity focused ultrasound device approved for use in the US.

The device is awaiting approval from the Food and Drug Administration for the treatment of enlarged prostates. It could also be used to remove various types of benign and malignant tumors.

General Information & Statistics

Australia

Innovative Food Center Launched

The Innovative Foods Center at Food Science Australia’s facility in Werribee, Victoria was launched recently to produce safer, more nutritious foods.

The center is an investment in the latest minimal and non-thermal technologies including high-pressure processing, ultrasonics, ultraviolet light and pulsed electric field.

These technologies inactivate food microbes such as yeasts, bacteria and moulds to produce food products that are free of additives, retain their fresh taste and have extended shelf life.

Non-thermal technologies are innovative alternatives to heat treatment or chemical preservatives, which can sometimes adversely affect food flavor, color and composition.

The facility has been established with the support of a A$3 million (US$1.68 million) Science and Technology Initiative infrastructure grant from the government. Its facilities include a 35-litre, high-pressure processing plant, and the latest ultrasonic, pulsed electric field and ultraviolet light equipment.

The center’s director, Dr. Kees Versteeg, said, “Steadily, minimal and non-thermal technologies are becoming accepted by consumers and food industries.”

Dr. Versteeg said, “Several products have already been successfully commercialized in Japan, Europe and the US and researchers at Food Science Australia are investigating these innovative technologies to fulfil consumer demands for fresher, safer, nutritious foods that are affordable and convenient.”

Food Science Australia’s scientists are currently working on R&D projects to determine the affect of non-thermal processing technologies on juices, fruits, vegetables, fish, milks, dairy products and ingredients. These projects are carried out in collaboration with Australian and international food science organizations.