Diarmuid Sheehan

Diarmuid Sheehan is a Research Officer based at the Teagasc Food Research Centre, Moorepark. His research programme is specifically focused on technological and biochemical processes within cheese manufacture and ripening that will be key to enabling diversification of a predominantly Cheddar based industry. Diarmuid graduated from UCC with a BSc in Food Science, an MSc in Food Technology and a PhD in Food Chemistry, and his research group is currently investigating interactions between cheese matrix physico-chemistry, matrix microstructure and the microbial metabolic activity of bacteria entrapped within.

Other areas of interest include eye formation in continental type cheeses, microbial diversity and cheese consistency, cheese pinking, milk seasonality and development of new analytical technologies. Since 2010 he has been the programme manager for cheese in the public private collaboration between the Irish Dairy Board and Teagasc and was the technical lead for the development of Kildery cheese launched recently in Germany.

Moorepark Scientist on sabbatical

Dr. John Upton is currently on a one year sabbatical at the University of Wisonsin at Madison. He will be working with Prof. Douglas J. Reinemann, an internationally recognised expert on milking machine technology and energy usage.

IDB's innovation team at work in MTL

The pilot scale, test equipment and production capacity of Moorepark Technology Limited was recently utilised by the Irish Dairy Boards Innovation team managed by Mary Keniry. The product and process concepts will be scaled up for commercialisation where precisely controlled process results in high product quality and repeatability.

Pictured at Moorepark Technology Ltd. L to R: Nuria Costa, Ivo Piska and Mary Keniry all IDB.

Professional Dairy Farm Managers

A new group of students have commenced the Professional Dairy Farm Management diploma course at Moorepark. Pictured with the students is Dr. Marion Beecher (front row, second from left), who is co-ordinating the course. The Professional Dairy Farm Management diploma is combination of contact time in Moorepark for lectures and training plus placement experience on dairy farms.

John Murphy remembered

The sudden passing of our friend and former colleague John Murphy was a cause of great sadness to us all. John was an outstanding scientist, a prolific author of scientific papers and was highly regarded in the Irish feed industry for his expertise in dairy cattle nutrition. John was a long-serving editor of the Irish Journal of Agricultural and Food Research, and was on the organising committee of many Moorepark Open Days as well as both national and international conferences. He was also a keen sportsman; he played a range of sports and was a member of the Moorepark team that won the David O'Loughlin rugby cup. In recent years, he had become actively involved in drama and biking. Sadly, and most importantly of all, John will be missed dearly by his wife Kate, daughter Claire, son-in-law Gordon and grandchildren Hannah and Leo. We extend our deepest sympathies to them.

Research Grants

Research fellows Orla O'Sullivan and Avelino Alvarez-Ordonez secured Starting Investigator Research Grants (SIRG) from Science Foundation Ireland.

Avelino and Orla with Paul Cotter (centre) mentor.

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Moorepark News

Research, technology and innovation for the dairy industry

Issue 40
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Viewpoint

A lot done, but much more to do.

The fundamental characteristics of a profitable dairy cow post-quota are the same as pre-quota: high milk solids yield from grazed grass while achieving good reproductive performance, health, and longevity. This will ensure resilience to future milk price volatility. Therefore, the economic breeding index (EBI) will be as relevant post-quota as it is today. Crossbreeding with high EBI sires of alternative breeds can increase profit further. The EBI increases herd milk solids yield through a combination of: 1) direct genetic selection for milk solids; 2) achieving longer lactations through optimal reproductive performance facilitating earlier calving; and 3) reaching mature herd yield through greater cow longevity.

Median calving date in Irish spring-calving dairy herds is currently 3rd March, six-week calving rate is 58%, and mean calving interval is 394 days. These statistics continue to be lower than the industry targets. Sub-optimal fertility performance is eroding farm profit in Irish herds. Therefore, it is vitally important that we continue to select high EBI bulls with a high fertility sub-index.

Ninety-five percent of the elite EBI cows (EBI = €244) in the Next Generation Research Herd at Moorepark are in-calf after a 12 week breeding season compared with 78% in the identically-managed cows representing the national average (EBI = €133). The fertility sub-index of the elite animals is €169 compared to €63 for the national average experimental group; the average fertility sub-index of heifers born nationally in 2014 was €79. The elite EBI cows also produced more milk solids and maintained greater body condition score throughout lactation. Best estimates at present indicate that a fertility sub-index of greater than €130, in combination with good management, is required to reach industry targets.

Long-term genetic gain in EBI is achievable with the use of genomic information to supplement the pedigree-based genetic evaluations. Retrospective analysis (page 2) reveals that the genomic proofs are more accurate than the traditional pedigree-based genetic evaluations. If the genetic trend for fertility in the Irish Holstein-Friesian population persists, the heifers born in 2020 will have the same genetic merit as those born in 1989, but milk solids yield will have increased by 60% during this period. Selection on EBI, especially the fertility sub-index, must persist.

The suite of traits currently being researched for inclusion in future revisions of the EBI include milk quality, feed intake, and animal health and disease. All impact profit and thus must constitute any selection index breeding for profit.

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Animal & Grassland Research and Innovation Programme

Food Programme

Moorepark – Centre for Membrane Applications Research

The establishment at Moorepark of a Centre for Membrane Applications Research (CEMAR) is timely in light of how membrane separation technologies are now mainstream within dairy manufacturing processes. The best known example of membrane filters is ultrafiltration (UF) which has become the industry's workhorse for production of whey protein concentrates (WPC), whey protein isolates (WPI), and milk protein concentrates (MPC) and their corresponding isolates (MPI). Early pioneering research at Moorepark in the late 1960's was marked by the first attempts at adapting reverse osmosis (RO) to dewater and concentrate whey, along with UF to recover proteins in whey. Historically whey as a by-product of cheesemaking, was all too frequently associated with environmental pollution incidents due to the then high degree of whey discharge to waste. In the decades since, expertise and extensive pilot plant facilities have been built up at Moorepark to support the development of innovative ingredients and sustainable processes for dairy product manufacture.

Fast-track screening of new ideas and concepts is now facilitated in Moorepark following the recent establishment of a laboratory crossflow membrane testing cell (Sterlitech SEPA CF II). The SEPA CF II test cell is capable of testing any flat sheet membrane using crossflow velocities comparable with industrial plants, and is also capable of operating at the high pressures typically used in nanofiltration (NF).

The far-reaching objective of pre-concentrating milk on the farm in order to reduce transport costs was first mooted in France about 25 years ago, and a limited number of such installations now operate in large scale dairy farms (~1,500 dairy cows/farm) in the USA. After profiling of the production capacity of its dairy farmers, Danish dairy interests predicted that that there are economic and sustainability benefits to be gained by applying such technology on farms with >500 cows. A Danish government-supported follow-up study involving all stakeholders is currently aiming to validate these predictions.

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Mineral nutritive value of pasture

Clinical deficiencies of macro or trace minerals in dairy cattle are rare. Subclinical deficiencies are common, however, and can manifest as poor reproductive performance and suboptimal herd health. In 2013, a survey was conducted on 44 dairy farms to examine the mineral nutritive value of grazed grass across the main dairy regions in Ireland. Grass samples were collected four times during the grazing season, and analysed for mineral concentrations. Based on the mineral requirements for lactating dairy cows, on average, a grass-only diet provided 85%, 73%, 52%, 50% and 38% of the lactating cow requirements for phosphorus, copper, iodine, zinc and selenium, respectively. Farmers should be aware that on a grass-only diet, the dietary supply of some minerals may be inadequate. Grass mineral concentrations should be analysed regularly, and appropriate supplementation strategies established to deal with any deficiencies or imbalances identified.

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Clover increases herbage yield and milk production

A new research study in Clonakilty Agricultural College is investigating the impact of tetraploid and diploid swards sown with and without clover on the productivity of spring milk production systems. Four separate grazing treatments were sown for the experiment: a tetraploid only sward, a diploid only sward, a tetraploid with clover sward and a diploid with clover sward. Four diploid cultivars (Tyrella, Aberchoice, Glenveagh and Drumbo) and four tetraploid cultivars (Aston Energy, Kintyre, Twymax and Dunluce) were chosen, and sown as monocultures with and without clover. Thirty cows were allocated to each treatment after calving in February 2014. All treatments were stocked at 2.75 cows/ha and received 250 kg of nitrogen fertiliser per ha. Three distinct genotypes (Holstein-Friesian (HF), Jersey x Holstein-Friesian (JEX) and Norwegian Red x Holstein-Friesian x Jersey (3way) are being evaluated in this study, with equal numbers of each genotype in each treatment.

The early results from the experiment highlight increased milk and grass production from the clover swards up to mid-October 2014 (Table 1). Little difference has been detected between tetraploid and diploid swards, but incorporating clover resulted in 12.2% greater milk yield and 12.8% greater milk solids yield. The JEX cows have produced 5.7% more milk solids (430 kg/cow) compared with the HF (407 kg/cow) and 3-way cross (407 kg/cow) cows. Herbage dry matter (DM) production has been approximately 17.6% greater on the grass clover swards compared with the grass only swards. This study will run for another four years.

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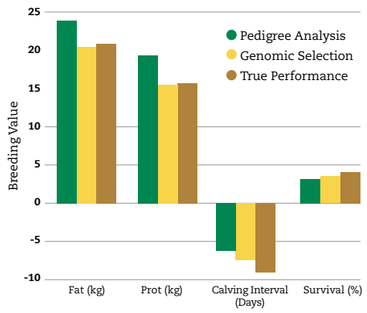
Table 1.

	No Clover		Clover	
	Tetraploid	Diploid	Tetraploid	Diploid
Milk yield (kg/cow)	4692	4687	5293	5237
Milk solids yield (kg/cow)	393	387	442	438
Herbage production (t DM/ha)	14.2	14.1	16.9	16.6

Retrospective Analysis of Genomic Selection

Bull genetic merit at birth was traditionally calculated based solely on pedigree. In 2009, pedigree information was supplemented with DNA information; this is known as genomic selection and is now used by breeding companies worldwide to identify elite bulls.



Bull breeding values (an indicator of genetic merit) predicted using **1.** pedigree analysis and **2.** genomic selection and compared to current (true) performance

A retrospective analysis was undertaken to determine if genomic selection is more accurate than traditional pedigree analysis at predicting genetic merit. The genetic merit of bulls that entered the breeding programme between 2009 and 2012 was calculated based on pedigree, genomic proofs and current daughter performance. Daughter performance is a truer representation of bull genetic merit and was compared to what was originally predicted for those bulls on the basis of 1) traditional pedigree analysis and 2) genomic selection.

Genomic selection more accurately predicted daughter milk production and fertility performance than pedigree analysis. Hence, genomic selection is superior to traditional pedigree analysis for identifying young bulls for breeding programmes. Nonetheless, it is recommended to use a minimum team of 5 genomic bulls across your herd.

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The Irish Rugby Team has Exceptional Guts

Alimentary Pharmabiotic Centre scientists at Teagasc Food Research Centre, Moorepark and University College Cork have published a study with the Irish Rugby Football Union in the leading international journal 'Gut' that has revealed that exercise and associated dietary changes influence gut microbial diversity.

The importance of our gut microbes to health is becoming ever more apparent. In particular, high microbial diversity has been associated with increased health whereas a low diversity of gut microbes has been associated with several diseases and syndromes, including obesity.

To investigate the impact of exercise and diet, the researchers studied a group of "elite" athletes – the Irish Rugby football team. The study was carried out with 40 male elite professional rugby players (mean age 29; mean BMI = 29.1) immediately prior to the last Rugby World Cup. Because of the physical size of modern rugby players, two groups of healthy male controls of similar age but with BMIs of >28 and <25 were used.

This study highlighted that the gut microbiota of the professional athletes had a very high diversity relative to the Irish general public.

The athletes are an exceptional group in terms of their dietary intake, fitness/ endurance and now we know, in relation to their gut microbiota! This high diversity was

associated with exercise and protein consumption and suggests that eating specific proteins and/or exercise could provide a means of increasing microbial diversity in the gut.

This is the first report that exercise may increase microbial diversity in humans. While these researches and others have previously shown that diet influences microbial diversity, they have now reported that protein consumption, in particular, positively correlates with microbial diversity.

The study poses new questions and the Cork team is now prospectively testing the impact of exercise on the microbiota in amateurs of various degrees of fitness and will distinguish the effects of exercise from associated dietary changes.

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IDF Parallel Symposia

Teagasc through its membership of Irish National Committee of International Dairy Federation (IDF) is pleased to have secured a major international Dairy Science & Technology event to be held in Dublin during 11th -13th April 2016. For the first time, two symposia themed as Concentration and Drying of Dairy Products along with Cheese Science & Technology will run concurrently at the same venue - Double Tree by Hilton Hotel Conference Centre.

The 2016 parallel symposia are very timely for several reasons. Opportunities in emerging markets are currently stimulating investment in milk production and processing capacity in line with the lifting of the EU milk quota system in 2015. Projected global nutritional needs based on continued population growth are relying on the multidisciplinary nature of dairy science and technology as an engine of development that can respond with innovative and sustainable

solutions. The interconnectivity between cheese and ingredient processing sectors is timely since cheese manufacture is also the powerhouse for whey generation - a supply line that is crucial to meet the ever-growing demand for dried nutritional ingredients and formulations.

The double-billed symposia will be an ideal opportunity for all engaged in dairy processing including equipment manufacturers and other service providers to refresh on the latest scientific and technological developments.

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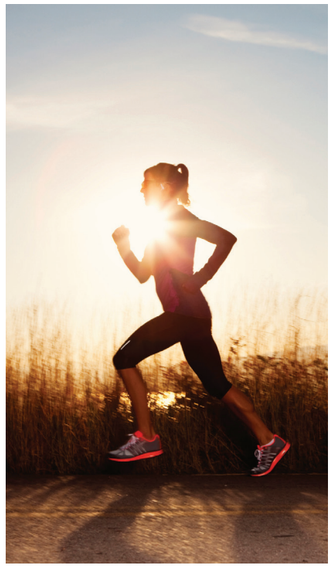

'Whey' to improve body composition

With the abolition of milk quotes in 2015, the Irish dairy industry will have the opportunity to expand their product range developed for the health and wellbeing markets globally.

As whey is a by-product of cheese manufacture, we assessed the health benefits of consuming whey associated proteins by undertaking animal feeding trials.

Our data shows that whey proteins increase lean mass and reduces fat mass in obese animals and that increasing the protein content and simultaneously reducing the carbohydrate content in the diet further improved body composition.

The data provides the basis for creation of whey protein-enriched food products that could benefit obese humans, athletes and elderly, who are in need of improving muscle mass and reducing fat mass. Adding (a health) value to milk in this way will also benefit the milk producers to improve profit margins, which is important for the sustainability of the sector.

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