

Livestock Gentec Centre Review 2015

Review of the Centre by the International Industry Scientific Advisory Committee

Tuesday 24 and Wednesday 25 February 2015

Committee Members Present

Wally Dixon (Chair), AVP Research
David Andrews, Lazy A Farms Ltd. and Member of the ALMA Board of Directors
Heather Burrow, University of New England Australia
Mike Coffey, Scotland's Rural College
Jay Cross, University of Calgary and Chair of the Gentec MAB
Cornelia Kreplin, Alberta Innovates Bio Solutions
Mike Lohuis, Monsanto

Apologies

Reynold Bergen, Beef Cattle Research Council
John Pollak, USDA Meat Animal Research Center
Chris Warkup, The Knowledge Transfer Network, UK (will visit Gentec early March and provide independent input to the IISAC report)

Background

A package of background information describing research that was both underway and planned at Livestock Gentec was pre-circulated to members of the Committee. Program scientists and technology transfer leaders also formally presented details of their progress and planned activities to the Committee on Tuesday 24th February. Committee members were given ample opportunity to question those program scientists and technology transfer leaders. Members of the Committee then met specifically to address each of the terms of reference of the review, which were to:

1. Assess the strategic direction and Business Plan of the Centre;
2. Assess the status of the Centre in relation to its science;
3. Assess the links to stakeholders;
4. Assess technology transfer and skills development in relation to stimulating the adoption of genomics technology; and
5. Advise on focus and future approaches to funding and international collaboration.

Each of these areas is specifically addressed below.

General Comments

There was unanimous and very strong support amongst the IISAC for the excellent progress that has clearly been achieved since the last IISAC meeting in October 2012. The CEO and Centre staff are congratulated on their strong teamwork and integrated approach to successfully

achieving, and in some cases exceeding, their milestones and deliverables. The IISAC strongly commends the Livestock Gentec team and affirms their belief that the team continues to perform at world-class levels generally, and in the areas of feed efficiency and rumen microbial genomics particularly, it is a recognized global leader.

Strategic direction and business plan of Livestock Gentec

Since the last IISAC meeting in 2012 considerable consolidation of Gentec's funding has occurred, with project-based funding being maintained at around the \$40 million mark for the past 5 years. This consolidation has allowed the tenured appointment of most of Gentec's essential staff members, as well as allowing the Centre's national and international network to grow considerably, thereby strengthening the Centre's position and improving the morale of Gentec team members. However there remains an ongoing need to secure an additional ~\$4.1 million of core funding and additional industry and market development (~\$2.4 million) and faculty (~870k) funding over the next 5 years.

***Recommendation 1.** Livestock Gentec is of high international standing and as such attracts considerable external funds and collaboration due to its reputation as a Centre of Excellence. The IISAC would like to encourage Gentec's partner organisations who benefit directly from the international prestige earned by Gentec to contribute greater core support to maintain the Centre's stability as well as increasing its capacity to win additional external funds.*

As described in the background material and also as presented to the IISAC during the review, Livestock Gentec comprises two distinct but quite separate nodes examined independently further below. The first of these is a very strong centre of strategic science focused on delivering world-class post-graduate training and high impact research publications. The second node is an industry delivery centre operating through Gentec's spin-off company, Delta Genomics, which is aimed at industry uptake of genomics technologies. Both of these nodes are performing very strongly, albeit very largely independently.

Between these two nodes though, it does not appear that any attempt has been made to create a clear and strong pipeline to ensure the research outputs delivered by Livestock Gentec's strategic science node are subsequently adapted to generate the new knowledge, practices, processes, and technologies (hereafter described as 'products') that the Canadian livestock industries, through Delta Genomics, require to achieve economic, social and/or environmental impacts.

Without a 'translational research' team to provide the pipeline that creates those 'products', Livestock Gentec is at very strong risk of failing to deliver on its mission of '*providing economic benefits to the livestock value chain*'. Currently, Delta Genomics relies almost entirely on 'products' developed by research groups other than Livestock Gentec. Therefore, unless suitable arrangements can be negotiated between Delta Genomics and other relevant research groups to ensure the flow of their 'products' for use by Delta, there is no guarantee that Delta Genomics will be able to access the 'products' it needs to achieve industry impact in the short, medium or longer term. There is also the danger that, as Delta develops commercial links to other companies providing the essential 'products', their future business will become more reliant on

those new companies and less dependent on Livestock Gentec. Hence, when ‘products’ do become available through Livestock Gentec they may have less impact.

The most desirable option would be for Livestock Gentec to develop a ‘translational research’ group which is responsible for adapting the strategic research outputs delivered by Gentec researchers into industry-relevant ‘products’ that are then delivered to industry through Delta Genomics to achieve the industry impact promised in Gentec’s mission statement.

The following recommendations relating to formation of such a ‘translational research’ group are designed to overcome the deficiencies of a lack of a pipeline between Gentec’s existing strategic research node and Delta Genomics. However during any implementation processes, Livestock Gentec will need to ensure such ‘translational research’ does not compromise project funding applications that might require scientific publications rather than industry ‘products’ as research outputs.

Recommendation 2. *The IISAC recommends that efforts be made to secure new funding that would allow creation of a ‘translational research’ group that works with Gentec’s strategic science node and Delta Genomics to adapt Gentec’s strategic science outputs into industry-relevant ‘products’ of direct use to the Canadian livestock industries.*

Recommendation 3. *Formation of the recommended ‘translational research’ group could commence on a part-time and short-term basis by having a specialist commercialization expert work with Gentec’s research scientists to identify new industry-relevant ‘products’ that could be developed from their past and planned research outputs and providing recommendations to Gentec on the research that would then be needed to develop and deliver those ‘products’ for industry use.*

Recommendation 4. *In future, all new project funding applications should be developed with industry ‘products’ and a ‘path to adoption’ in mind from the outset of the research, unless such an approach directly compromises the funding agency’s guidelines. A relatively straight-forward and low-cost approach to achieving this type of changed focus could be to initially contract an independent consultant with expertise in impact assessments to undertake a realistic assessment and modeling of Gentec’s current research and industry delivery portfolio as described in the section related to Centre KPIs below.*

Livestock Gentec’s Vision and Mission Statements

Livestock Gentec’s vision (‘to be the world leader in providing genomic solutions across the livestock value chain that improve the global competitiveness of Canada’s livestock industry’) and mission (‘to provide economic benefits to the livestock value chain through technological leadership’) statements focus very largely on economic benefits, with no mention of sustainability, including the environmental and social benefits that are also being targeted by existing Gentec research projects. This deficiency needs to be rectified by re-wording of these statements.

Recommendation 5. *The IISAC recommends that Centre Management consider re-wording both the vision and mission statements to better reflect the range of economic, environmental and social benefits being targeted by Gentec.*

Livestock Gentec's KPIs

Whilst highly commending Livestock Gentec's efforts to establish KPIs to measure Centre progress on a routine basis, the IISAC believes the current KPIs describe unrealistic potential benefits, assuming all research currently being undertaken is successful, has been fully translated to create industry-relevant 'products' and that 100% adoption has occurred across industry, all in an inappropriate and unrealistic timeframe.

In particular, the path to adoption of Gentec's research outputs and timelines to delivery of those products is not obvious in the Centre's current KPIs. Those KPIs fail to recognise that translation and adoption of research outputs will take considerable time and in greatest probability, only partial adoption of most 'products' will ever be achieved. They also fail to recognise the timelines required to achieve research results, then to implement the results in industry-relevant delivery mechanisms prior to implementation through mechanisms designed to achieve uptake.

Recommendation 6. *The IISAC recommends that Livestock Gentec develops new KPIs that simultaneously reflect the:*

- i) current state and timelines of research being undertaken by Gentec;*
- ii) the planned research outputs and outcomes;*
- iii) effort and timelines needed to 'translate' those research outputs into industry-relevant 'products';*
- iv) realistic adoption rates and levels of adoption over time to achieve genuine impact in Canada's livestock industries; and*
- v) impacts of the knowledge transfer activity based on 'products' originating outside Gentec's own research activities.*

Development of these KPIs could occur through engagement of an independent consultant to undertake a modeling exercise that assumes the existence of translational research and industry-relevant 'products' with a realistic 'path to adoption' in mind from the outset of the research. This modeling exercise could be developed through a relatively low-cost funding application and in future, its outputs could be used to underpin most or all new project funding applications.

Status of Livestock Gentec in relation to its science

Since the last IISAC meeting in 2012, it is clear that Gentec has been able to strongly focus its science on key areas where the Centre has research strength but which also address issues of high industry priority. It has also been able to significantly expand the Centre's collaborative research network across those key areas. The IISAC commends the Centre, and in particular its CEO Professor Plastow, is to be congratulated for achieving this strong turnaround.

The IISAC is also satisfied that there is no longer a priority need for appointment of a Chief Scientist as recommended in its 2012 report. The gap left by the lack of a Chief Scientist is now

being adequately filled by a range of Centre Committees and teams charged with responsibility for the quality of the science. This means the CEO no longer has primary responsibility for both management of the Centre and sustaining the quality of the Centre's research.

The major indicator of success in relation to the Centre's science is its excellent publication record, reflected in both the number of publications and the high impact journals in which many of the papers are published. This publication record attests to the world-class quality of science undertaken by Livestock Gentec. To allow an examination of the publication success of different groups of scientists, the IISAC would be interested if Gentec could attempt to develop some type of ratio or index that reported publications by the number of researchers in the team.

Recommendation 7. *Would it be possible to develop a metric that reported publications by the number of researchers contributing to a research team, to allow an easy assessment of the publication success of Gentec's various research teams (albeit noting that some research disciplines lend themselves more easily to generation of publications).*

There are two areas of concern in relation to the Centre's science. The first concern relates to the current lack of a formal relationship with the University of Guelph, because that linkage had in the past underpinned much of the Centre's success. The IISAC accepts that negotiation is continuing to formalize the ongoing relationship with that University and endorses that continued negotiation.

The second area of concern relates to the inability of the Centre to thus far secure permanent tenure for Professor Stothard's position. Professor Stothard would be in very high demand at other research organisations across the globe if he chose to explore his options and his bioinformatics expertise is critical to the success of most of Gentec's research teams.

Recommendation 8. *The IISAC is very mindful of the critical importance of Professor Paul Stothard's bioinformatics skills and expertise to the success of all of Gentec's research teams and strongly recommends that permanent tenure is secured for this position as quickly as possible.*

The IISAC also noted a number of issues that should be considered directly in relation to the Centre's science. Those issues are simply listed below, in no particular order of priority, and only to ensure the issues are documented rather than action necessarily being taken.

- Is there an opportunity to enlarge the Centre's feed efficiency datasets by combining feed intake measurements across the beef and dairy industries to maximise the number of phenotypes available?
- Although Livestock Gentec does not currently have a program of reproduction research, there is a need to recognise that reproductive performance of animals at least needs to be routinely monitored to ensure no detrimental consequences occur in reproductive performance due to selection for other economically important traits. For example, the results cited on P3. of Prof. Basarab's PI report indicate there are no associations between feed efficiency and reproduction. However subsequent verbal information indicates these data are derived from a single generation of selection, meaning it is highly unlikely that any differences in reproductive performance would have been evident at that stage. But as

is clear from the scientific literature, ongoing selection for feed efficiency, independent of fat depth, will result in leaner animals and leaner animals have poorer reproductive performance.

- Based on written reports and verbal presentations, it appears that considerable effort may be being devoted to estimation of genetic parameters from smallish research populations, rather than the data from the research populations being contributed directly to more useful parameters that should be derived as part of industry genetic and genomic evaluations. Have any of the parameter estimates published by Livestock Gentec subsequently been used for industry genetic evaluations? If not, could they be?
- If the livestock research populations are sufficiently large and data collection was feasible, there could be benefit in increasing research focused on product quality as Canada's livestock industries will never be in a position to compete globally on the basis of volume, leaving quality likely to be the primary point of competition in future.

Links between Livestock Gentec and its Stakeholders

Since the last IISAC meeting in 2012, Livestock Gentec's links to stakeholders have both strengthened and expanded very considerably. However, as expressed in the last IISAC report, considerable benefits would accrue to the Centre if linkages could be extended across entire industry value chains. The IISAC recognizes that efforts are already underway to develop those greater links through the MAB network, membership of the Beef Value Chain Roundtable and through focused projects and a new communication strategy. More in-depth analysis of costs and benefits of new technologies along industry value-chains may be beneficial in targeting knowledge transfer efforts.

If the efforts that are already underway prove successful, the benefits to industry are likely to increase significantly, particularly if Delta Genomics is able to capture the opportunity of early-in-life low-cost genotyping of commercial animals and link the genomic information to specific market requirements that will encourage payment of incentives for animals with particular genomic attributes. In that event, Delta might 'push' the connections to abattoirs and meat processors, assisting them to assimilate phenotypes that would be useful to commercial producers. In so doing, they would also be supporting their own business aspirations. The BIXS system was cited as a useful tool in this regard.

Livestock Gentec's technology transfer and skills development

Since the last IISAC meeting, Delta Genomics in conjunction with specialists working directly through Livestock Gentec (Tom Lynch-Staunton and John Crowley) have established a very strong and highly commendable platform of technology transfer and skills development for Canada's livestock industries. They are to be congratulated on their great efforts over the past 2+ years. The team may benefit from refreshing their communications strategy; ensuring newsletters etc. are targeted at the (previously agreed) priority audiences.

Issues of concern for the IISAC relating to technology transfer and skills development have been recorded directly in the separate section relating to Delta Genomics that now follows below.

Focus and further approaches to funding and international collaborations

The need to secure core funding for Livestock Gentec is a priority concern for the IISAC. This issue was addressed directly through Recommendation 1 above.

The IISAC is pleased to note the Centre's current focus on obtaining larger and longer-term program-level funding to generate greater long-term security for Gentec as well as reducing the administrative overheads of managing small projects.

Since the last IISAC meeting in October 2012, considerable efforts have been made to both increase and diversify the international collaborators undertaking joint research with Livestock Gentec scientists. These efforts are starting to bring considerable benefits to the Centre, with strong potential benefits (e.g. through linkages with Chinese research organisations) also evident. The IISAC strongly endorses the ongoing development of both national and international research collaborations and networks.

Delta Genomics

Delta Genomics is a national, not-for-profit company that provides biobanking, genotyping and sequencing services for Canadian livestock industries and the livestock research community. In addition, Delta also functions as a contract research organisation that can provide its clients with demonstration, validation and consulting services.

The financial information presented to the IISAC as part of Delta's business plan indicates a very real possibility that Delta may not reach a financial break-even position this year or in future, even though the initial financial objective of Delta is *'to become financially sustainable by the year 2015'*.

If that objective is not reached, it was not clear to the IISAC how any deficit will be managed. For example, would the deficit become the responsibility of Livestock Gentec, the University of Alberta, or some other organisation and if so, what are the limits of such a deficit? This issue needs to be clarified as a matter of highest priority.

Recommendation 9. *The IISAC recommends that Delta Genomics urgently develops a strategy to ensure the Company breaks even in 2015, unless it is able to negotiate satisfactory arrangements with another organisation about how a financial deficit would be managed.*

Delta Genomic's core competency is currently stated as being *'research and innovation'*. The IISAC believes a more appropriate core competency for the company would be along the lines of commercialization and implementation of research outputs.

Recommendation 10. *The IISAC recommends that Delta's Management team re-visit the description of its goals and core competencies, to ensure they best reflect the company's core business.*

Based on its written Business Case, it appears that Delta Genomics is dependent on considerable input from Livestock Gentec researchers for consultation and demonstration services as well as *'complementing the business activities at Delta'*. If such input has the potential to compromise Centre research efforts, the IISAC suggests the Delta Board should review where Delta obtains its research advice and identify alternative sources if necessary.

Recommendation 11. *If Livestock Gentec research efforts are being or have potential to be compromised due to the need for researchers to contribute to provision of Delta Genomics' services or if Livestock Gentec provides services to Delta at no charge (thereby compromising Gentec's financial position), the IISAC recommends the Delta Board reviews the source of the Company's research inputs and advice and where necessary identifies alternative sources of expertise and finances to allow Gentec's researchers to primarily focus on their research efforts and to ensure Delta's financial records accurately reflect all cash and in-kind contributions.*

From the written reports, the IISAC found it difficult to differentiate services provided to industry and the research community. To allow development of a sustainable strategy for Delta Genomics into the future, it is important that these be distinguished for all routine reporting.

Recommendation 12. *The IISAC recommends that Delta Genomics establishes methods of tracking the numbers of samples from industry and research animals and routinely reports these (and the income derived from their testing) separately.*

The IISAC spent a considerable amount of time discussing Delta's business model and possible options to ensure the Company's sustainability and possibly even generate a revenue flow to Livestock Gentec at some time in future. It appears to the IISAC that there should be ways of creating a revenue stream for Delta by adding a service fee for reporting and consulting in addition to routine genotyping and parentage testing. Such fee-for-service charges would need to be transparent to livestock producers to ensure they do not simply chase lowest-cost genotyping. A range of options were considered and are mentioned in this report for consideration by Delta Genomics' Management and Board during a recommended review of the Company's strategic directions. They include:

- Fee-for-service options to support genotyping and parentage testing results - NB since the IISAC meeting an email has originated from Interbeef about an international service for parentage checking using genotypes but not yet parentage discovery. Delta might consider acting as the Canadian delivery agent for this service and may even begin offering parentage discovery services in Canada.
- In future, Delta Genomics might decide it is not viable to offer a genotyping service, thereby representing a radical change of its current core business. The reason for this suggestion is that genotyping platforms have changed frequently in the past and, given the high cost of purchasing these platforms and the short time to redundancy, it may be more feasible for Delta Genomics to outsource its genotyping to a specialist company like GeneSeek, thereby changing its focus to service delivery around the use of the genotype data.
- Growing Delta's commercial beef business for both breeding and management purposes, but recognising that use of genomics information for management purposes will need a

substantially different delivery system than that applying to breeding decisions because of the need for very rapid turn-around of genomic predictions.

- An alternative approach to using genomic information in commercial production systems could simply involve low-cost genotyping for all calves a.s.a.p. after birth and then linking the genotype information to the livestock identification schemes with the aim of thereafter allowing individual animals to be specifically targeted to particular markets based on knowledge of their genotypes.
- To differentiate itself from existing genotyping services and industry genetic evaluations, Delta could consider focusing its initial efforts on cross-bred and composite animals that are most typical of Canada's commercial production systems with the aim of developing a full service delivery model (including genomic predictions) for those animals. This means Delta would **not** be competing with breed societies and therefore would not attract competition or criticism.
- Offering a low-cost genotyping service through use of pooled DNA from sire progeny groups or related animals etc.
- Providing an imputation service that imputes low density SNPs to high-density or even full-sequence information, but also noting that use of high-density vs. sequence data is likely to differ (and hence requires different usage methodologies), with full sequence data likely to exclude information on common SNPs and hence comprising only those SNPs that vary across the population being studied (whereas high-density SNPs are still likely to retain data from all SNPs).
- Developing apps that assist practical usage of genomic information.

Recommendation 13. *The IISAC recommends the Board of Delta Genomics convenes a summit of a small panel of 'thought leaders' to review the Company's strategic directions aimed at achieving the Company's financial sustainability.*

In addition to discussing additional opportunities to ensure Delta's sustainability, the IISAC also examined the composition of Delta Genomics' Board and suggests there is a need for additional Board skills if the Company is to change its strategic directions and ensure financial sustainability in future.

Recommendation 14. *The IISAC recommends a review of the skills required by the Board of Delta Genomics, suggesting additional livestock industry knowledge as well as skills in commercialisation and market development could be valuable additional skills for Board Members.*