

2.4.6 Laboratory : Animal Breeding and Genetics

Member:	Professor	Iwaisaki, Hiroaki, Ph.D.
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	Assistant Professor	Taniguchi, Yukio
	Master's Program	3
	Undergraduate	1
	Other	1

A. Research Activities (2009.4-2010.3)

A-1. Main Subjects

a) Studies on the Procedures for Genomic Evaluation and Genome-Wide Association Studies
For analyses of genomic evaluation of animals and genome-wide association studies using an immense amount of SNP information simultaneously, we have developed several computing procedures, and their Fortran programs, employing best linear unbiased prediction, Bayesian, and kernel multivariate analyses methods. In addition, applying these procedures to simulated data and actual data of hetero stock mice and Japanese Black cattle, we have investigated properties of the procedures in details, and confirmed that the Bayesian methods using the Metropolis-Hastings algorithm and some methods belonging to kernel multivariate analyses methods are a promising approach.

b) Exploration of the Genes Responsible for Beef Marbling

We are exploring beef marbling genes based on profiling information of differential gene expression pattern between the two groups of the high-marbled Japanese Black and the low-marbled Holstein steers. We have showed that +166 SNP in EDG1 gene, -652 SNP in TTN gene, +22220 SNP in a novel gene MBL1 gene, and -5354 SNP in RPL27A gene are associated with the breeding values for marbling trait in Japanese Black beef cattle of the Oita prefecture, suggesting that these genes may be possible candidates for beef marbling genes. We thus performed replication study for the association of these SNPs with the breeding values for marbling trait, using three Japanese Black beef cattle populations of the Nipponfeed Inc. We found that the association of EDG1 +166 SNP, TTN -652 SNP, and MBL1 +22220 SNP with beef marbling, and genotype effects of these SNPs on beef marbling were replicated in the three general populations of Japanese Black beef cattle.

c) Study on the Molecular Mechanism Underlying Marbling in Beef

In the muscle tissue of the bADAM12 transgenic mice, which is a mouse model showing intramuscular fat deposition, the expressions of adipocyte-differentiation related genes (transcription factors and matrix proteins) were immunohistochemically analyzed, suggesting that the intramuscular adipocyte differentiation proceeded in connective tissues between muscle fibers.

In addition to expression level, the activity of membrane-type matrix metalloprotease, MT1-MMP was regulated by the localization to cell surface. To examine the process of MT1-MMP intracellular transport, the bovine MT1-MMP-GFP fusion protein was expressed in preadipocyte cell line 3T3-L1 and the intracellular distributions on the GFP signal were analyzed.

d) Acquisition of Marker Information Useful for Analysis of Genetic Diversity in Japanese Crested Ibis Population

It is desirable to perform molecular genetic studies with marker information, in order to analyze the genetic diversity in Japanese crested ibis population in Sado Island. We thus tried to acquire marker information in captive Japanese crested ibis population in Sado Island. The post-hatch eggs of captive Japanese crested ibis have been stored at room temperature for the long term in the Sado Japanese Crested Ibis Conservation Center. We first investigated the suitability of the vascularized chorioallantois membrane from the inside of post-hatch egg stored at room temperature for the long term as a DNA source for marker genotyping. We found that the vascularized chorioallantois membrane provides a reliable DNA source of offspring that had hatched from the egg possessing the membrane in the captive Japanese crested ibis in Sado Island. We then performed genotyping of microsatellite markers developed for the Japanese crested ibis and species related to the crested ibis, using the vascularized chorioallantois membrane-derived DNA. We acquired marker genotyping information on 66 microsatellite loci in captive Japanese crested ibis population in Sado Island.

A-2.Publications and presentations

a) Publications

Original Papers

- Arakawa, A., H. Iwaisaki, and K. Anada:

Investigation of Gibbs sampling conditions to estimate variance components from Japanese Black carcass field data. Anim Sci J 80;491-497, 2009

- Arakawa, A., H. Iwaisaki, and K. Anada:
Estimation of breeding values from large-sized routine carcass data in Japanese Black cattle using Bayesian analysis. *Anim Sci J* 80;617-623, 2009
- Arakawa, A., H. Iwaisaki, and K. Anada:
A Bayesian approach to the Japanese Black cattle carcass genetic evaluation. *SA J Anim Sci* 39;77-80, 2009
- Sasaki, S., T. Yamada, S. Sukegawa, T. Miyake, T. Fujita, M. Morita, T. Ohta, Y. Takahagi, H. Murakami, F. Morimatsu and Y. Sasaki:
Association of a single nucleotide polymorphism in akirin 2 gene with marbling in Japanese Black beef cattle. *BMC Res Notes* 2;131, 2009
- Watanabe, N., S. Yoshioka, M. Itoh, Y. Satoh, M. Furuta, S. Komatsu, Y. Sumio, T. Fujita, T. Yamada and Y. Sasaki:
The G allele at the c.-312A>G in the EDG1 gene associated with high marbling in Japanese Black is at a low frequency in breeds not selected for marbling. *Anim Genet* 40;579, 2009
- Yamada, T., S. Sasaki, S. Sukegawa, T. Miyake, T. Fujita, H. Kose, M. Morita, Y. Takahagi, H. Murakami, F. Morimatsu and Y. Sasaki:
Novel SNP in 5' flanking region of EDG1 associated with marbling in Japanese Black beef cattle. *Anim Sci J* 80;486-489, 2009
- Yamada, T., S. Sasaki, S. Sukegawa, T. Miyake, T. Fujita, H. Kose, M. Morita, Y. Takahagi, H. Murakami, F. Morimatsu and Y. Sasaki:
Association of a single nucleotide polymorphism in ribosomal protein L27a gene with marbling in Japanese Black beef cattle. *Anim Sci J* 80;631-635, 2009
- Wada, Y., R. Hayashida, T. Isokane, N. Katafuchi, T. Otsubo, T. Yamada and Y. Sasaki:
Association of a single nucleotide polymorphism in EDG1 gene with carcass traits in Japanese Black cattle of Saga Prefecture. *J Warm Region Soc Anim Sci* 52;37-41, 2009 (in Japanese)

b) Conference and seminar papers presented

- The 111th Annual Meeting of Japanese Society of Animal Science : 4 presentations
- The 112th Annual Meeting of Japanese Society of Animal Science : 7 presentations
- The 59th Annual Meeting of Kansai Animal Science Society : 2 presentations

A-3.Off-campus activities

Membership in academic societies

- Iwaisaki, Hiroaki, Ph.D. : Japanese Society of Animal Science (Associate editor)
- Yamada, Takahisa, Dr. Medic. Sci. : Japanese Society of Animal Breeding and Genetics (director)

Research grants

1. Grants-in-aid for Scientific Research(KAKENHI)

- Scientific Research (C) : Iwaisaki, Hiroaki, Ph.D. : Developing a genetic evaluation system using the chromosome segment model
- Scientific Research (C) : Nomura, Tetsuro, Ph.D. (Agric.) (Part: Iwaisaki, H.) : Influence of global warming on age-change in geographical cline of elytras spots pattern genes in the multicolored Asian lady beetle *Harmonia axyridis*
- Scientific Research (C) : Yamada, Takahisa, Dr. Medic. Sci. : Polymorphism detection in bovine PNLIP gene and association analysis with beef marbling trait

2. Other Research Grants

- Research grant in collaboration with BIG Research Institute, Livestock Improvement Association of Japan, INC. and Nippon Ham Co. Ltd. : Yamada, Takahisa, Dr. Medic. Sci. : Identification of the genes associated with beef marbling and Development of technology for their application
- Research aid from Japan Livestock Technology Association : Yamada, Takahisa, Dr. Medic. Sci. : Analysis of gene networks for beef marbling development using animal model

A-4. International cooperation and overseas activities

Membership in academic societies

- Iwaisaki, Hiroaki, Ph.D. : Asian-Australasian Association of Animal Production Societies (Associate editor)

B. Educational Activities(2009.4-2010.3)

B-1. On-campus teaching

a) Courses given

- Undergraduate level: Outline of Bioresource Science II (Iwaisaki et al.), Applied Animal Genetics (Iwaisaki), Animal Breeding and Genetics (Iwaisaki, Yamada), Introduction to Foreign Literature in Bioresource Science II (Yamada et al.), Basic Laboratory Course in Bioresource Science I, II (Yamada, Taniguchi, et al.), Technology theory of Animal

Husbandry and Practice II (Iwaisaki, Yamada, Taniguchi, et al.),
Laboratory Course in Bioresource Science I, II (Yamada, Taniguchi,
Miyake et al.), Cell Biology II (Yamada, et al.), Cell Biology III
(Yamada, et al.), Seminar in Applied Animal Science I, II (Yamada
et al.), Domestic Animal Genome Science Biotechnology (Yamada
et al.)

- Graduate level: Advanced Animal Breeding and Genetics (Iwaisaki), Seminar in
Animal Breeding and Genetics (Iwaisaki, Yamada, Taniguchi),
Laboratory Course in Animal Breeding and Genetics (Iwaisaki,
Yamada, Taniguchi)

B-2.Off-campus teaching etc.

Part-time lecturer

- Iwaisaki, Hiroaki, Ph.D.: Ishikawa Prefectural University (Animal Breeding and Genetics)

C.Other Remarks

- Iwaisaki, Hiroaki, Ph.D. : Committee on wildlife conservation plan, Ministry of the
Environment (Member), Committee on research study project for utilization of genetic
diversity in Wagyu cattle, National Beef Cattle Advancement Foundation Association
(Member), Committees on the assessment (Member), on beef performance testing (Chairman),
and on promotion of breeding (Chairman), Wagyu Cattle Registry Association, Committee
on policy deliberation for “plan for promotion of producing value-added animal products”,
Agriculture, Forestry and Fisheries Department, Kyoto Prefecture Government (Member),
Advisory Committee for the Agriculture, Forestry and Fisheries Technology Center, Kyoto
Prefecture Government (Member)
- Yamada, Takahisa, Dr. Medic. Sci. : Committee on Promotion and Support of Establishment
and Maintenance for Bovine Superior Genetic Resource in Livestock Improvement
Association of Japan, INC. (Member), Committee on Promotion of Achievement and
utilization of Patent involved in Wagyu Resource in Japan Livestock Technology Association.
(Member)