# 2022 The 6th Fatty Pig International Conference · Taiwan

# CONFERENCE MANUAL

Oct 26th (Wed) - 28th (Fri), 2022

Tainan City, Taiwan (R.O.C.)


Organizer Livestock Research Institute, COA

Co-organizer Tainan City Government

Implementer Taiwan Institute of Economic Research

Chinese Society of Animal Science

Sponsor Department of Animal Industry
Department of International Affairs
Council of Agriculture, Executive Yuan

Sponsor NSTC National Science and Technology Council

2022 The 6th Fatty Pig
International Conference · Taiwan

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# The 6th Fatty Pig International Conference Agenda

3F, ICC Tainan, No. 3, Guiren 12th Rd., Guiren Dist., Tainan City, Taiwan (R.O.C.)

Oct 26 - 28, 2022

https://www.icctainan.com

□**Organizer =** Livestock Research Institute, COA

https://www.tlri.gov.tw/

□**Co-organizer =** Tainan City Government

https://www.tainan.gov.tw/

□**Co-organizer =** Chinese Society of Animal Science

https://www.csas.org.tw

□**Implementer =** Taiwan Institute of Economic Research

https://english.tier.org.tw/

□**Language =** English (Simultaneous interpretation will be provided)

| DAY 1 Oct 26, 2022 (Wed) | | |
|---|---|---|
| Time (UTC/GMT +8) | Agenda | Speakers |
| **08:30-09:00** | Registration | |
| **09:00-09:20** | Opening Remarks | |
| **09:20-09:30** | Group Photo | |
| Session 1<br>Indigenous Pigs Species and Current Challenges | | Chairperson<br>Dr. Ming-Che Wu<br>(Taiwan) |
| **09:30-10:10** | Keynote 1<br>Social-Cultural Value of Black Lanyu Pig Breed and Prospect of Biomedical Application of White Binlang Pig Breed | Dr. Chia-Chieh Chang<br>(Taiwan) |
| **10:10-10:30** | Topic 1<br>Characteristics and Improvement of Jeju Native Pig | Dr. Byoung-Chul Yang<br>(South Korea) |
| **10:30-10:50** | Topic 2<br>The Origin and Conservation Importance of Native Taiwanese Liudui Black Pigs as Inferred from Molecular Genetics | Dr. Yu-Ten Ju<br>(Taiwan) |
| **10:50-11:05** | Moderated Discussion | Chairperson<br>Speakers of Session 1 |
| **11:05-12:00** | Refreshment Break<br>Poster Presentation | |
| **12:00-13:00** | Lunch | |

| | | |
|---|---|---|
| Session 2<br>Genetics, Breeding and Preservation | | Chairperson<br>Dr. Shao-Yu Peng<br>(Taiwan) |
| **13:00-13:40** | Keynote 2<br>Pork Quality Requirements and Fatty Pig Production in East Asia | Dr. Noboru Manabe<br>(Japan) |
| **13:40-14:00** | Topic 3<br>Identification of Nucleus Boar Semen Quality to Ensure the Sustainable Conservation of Taiwan Native Lanyu Minipigs | Mr. Ting-Yung Kuo<br>(Taiwan) |
| **14:00-14:20** | Topic 4<br>Application of Assisted Reproductive Techniques for the Preservation of Indigenous Pigs | Dr. Tamas Somfai<br>(presented by Dr. Kazuhiro Kikuchi)<br>(Japan) |
| **14:20-14:35** | Moderated Discussion | Chairperson<br>Speakers of Session 2 |
| **14:35-15:00** | Refreshment Break | |
| Session 3<br>Physiology, Reproduction and Development | | Chairperson<br>Dr. Lih-Ren Chen<br>(Taiwan) |
| **15:00-15:40** | Keynote 3<br>The Pig as a Model for Nutrigenomic Studies | Dr. Maria Oczkowicz<br>(Poland) |
| **15:40-16:00** | Topic 5<br>The Population Genetic Structure Analysis of Pin-Pu Black Pig in Taiwan | Dr. Chi-Sheng Chang<br>(Taiwan) |
| **16:00-16:20** | Topic 6<br>Utilization of Porcine Testicular Tissues after Cryopreservation and Grafting into Nude Mice | Dr. Kazuhiro Kikuchi<br>(Japan) |
| **16:20-16:35** | Moderated Discussion | Chairperson<br>Speakers of Session 3 |
| **16:35** | End of Conference Day 1 | |
| **18:00-20:30** | Welcome Gala Dinner<br>Poster Excellent Award | |

| DAY2 Oct 27, 2022 (Thu) | | |
|---|---|---|
| Time (UTC/GMT +8) | Agenda | Speakers |
| **08:30-09:00** | Registration | |
| Session 4<br>Nutrition, Management, Biosecurity and Production Systems | | Chairperson<br>Dr. Yih-Fwu Lin<br>(Taiwan) |
| **09:00-09:40** | Keynote 4<br>Deep Frozen Semen and Embryo Backup of Hungarian Native Pig Breeds in Pandemic Situation | Dr. József Rátky<br>(Hungary) |
| **09:40-10:00** | Topic 7<br>Study on the Dietary Nutrition of TLRI No.1 Black Pig | Dr. Fang-Chueh Liu<br>(Taiwan) |
| **10:00-10:20** | Topic 8<br>Formosa Black Pig in Taiwan Breeding Swine Auction Web with Selection Traits on Growth Performance, Body Conformation and Total Sperm Count | Dr. Ming-Che Wu<br>(Taiwan) |
| **10:20-10:35** | Moderated Discussion | Chairperson<br>Speakers of Session 4 |
| **10:35-11:00** | Refreshment Break | |
| Session 5<br>Industry, Environment and Marketing | | Chairperson<br>Dr. Jen-Wen Shiau<br>(Taiwan) |
| **11:00-11:40** | Keynote 5<br>Native Pig Genetic Resources Improvement and Utilization in the Context of Industry Building, Product Development and Environmental Protection | Dr. Synan S. Baguio<br>(Philippines) |
| **11:40-12:00** | Topic 9<br>Introduction of Black Pig Industry in Taiwan | Chief of Livestock Industry Section<br>Yi-Chain Lee<br>(Taiwan) |
| **12:00-12:20** | Topic 10<br>The Application of Minipigs for Preclinical Development | Head of Dept. of Animal Resource<br>Jihn-Shiun Alexander Chao<br>(Taiwan) |
| **12:20-12:35** | Moderated Discussion | Chairperson<br>Speakers of Session 5 |
| **12:35-13:40** | Lunch | |

| | | |
|---|---|---|
| Session 6<br>Meat Quality, Products and By-Products | | Chairperson<br>Dr. Fa-Jui Tan<br>(Taiwan) |
| **13:40-14:20** | Keynote 6<br>Iberian Pig Production: Genetic Background, Finishing Systems, Carcass Traits and Product Quality | Dr. Mercedes Izquierdo Cebrián<br>(Spain) |
| **14:20-14:40** | Topic 11<br>Breeding, Products Development, and Industrial Promotion of KHAPS Black Pigs (K) | Dr. Chin-Bin Hsu<br>(Taiwan) |
| **14:40-15:00** | Topic 12<br>Quality Attributes of Pork and Processed Products from Fat Breeds – Examples of Local French Breeds | Dr. Bénédicte Lebret<br>(France) |
| **15:00-15:15** | Moderated Discussion | Chairperson<br>Speakers of Session 6 |
| **15:15-15:45** | Refreshment Break | |
| Session 7<br>Open Forum and Closing Remarks | | Chairperson<br>Dr. Jeng-Fang Huang<br>(Taiwan) |
| **15:45-16:15** | Open Forum<br>African Swine Fever: Global Disease Control and Prevention | Invited Speakers |
| **16:15-16:30** | Closing Remarks | |
| **16:30** | End of Conference | |

| DAY3 Oct 28, 2022 (Fri) | |
|---|---|
| Time (UTC/GMT +8) | Technical Tour |
| **08:30-08:40** | Registration at THSR Tainan Station-Exit 2 |
| **08:40-09:20** | Travel Time |
| **09:20-10:30** | DaChan Great Wall Group Co., Ltd. |
| **10:30-11:30** | Travel Time |
| **11:30-11:50** | Pingtung Agricultural Biotechnology Park (Guided Bus Tour) |
| **11:50-13:00** | Lunch |
| **13:00-14:30** | Taiwan Farm Industry Co., Ltd. |
| **14:30-14:40** | Travel Time |
| **14:40-15:50** | Taiwan Sugar Co., Ltd.<br>Dong Hai Feng Agricultural Circulation Park |
| **15:50-16:30** | End of the Tour<br>THSR Tainan Station |

# Welcome to the 6th Fatty Pig International Conference

Livestock Research Institute,
Council of Agriculture, Executive Yuan, Taiwan (R.O.C.)
*Director General Jeng-Fang Huang, Ph.D*

Dear friends, we sincerely invite you to participate in "The 6th Fatty Pig International Conference". The international conference will be held on 26-28 October, 2022 in Tainan, Taiwan. Tainan is one of the core regions for animal production industry in Taiwan and is also an important historical city in Taiwan.

The so-called fatty pig refers to the local indigenous pig. Most fatty pig breeds are the special and ancient porcine breeds. They possess special economic and even cultural significance. With the emergence of modern commercial breeds such as Landrace, Yorkshire, Duroc etc., and their hybrids, the economic importance of these fatty pigs gradually fade. There are some fatty pigs in Europe such as Mangalica and Iberico. In addition, fatty pig breeds can also be found in the Southeast Asia, the Far East (Taiwan Lanyu pig), China, Latin America and South Africa. Mangalica pigs and Iberico pigs have been proven to be used to produce high-quality and well-known products, and have found their distinctive role and positioning in the international market. We believe that these regional special pig breeds possess special value for genetic diversity and market. In order to transform the characteristics of these fatty pigs into commercial production, some researchers and experts believe that it is necessary to further understand and study their physiological and genetic characteristics. Therefore, in 2009, European and Asian research fellows and experts got together in Hanoi, Vietnam to set up a "Fatty Pig Group" to discuss local pig breeds in Europe and Asia. After that, the first International Conference on Fatty Pig Science and Utilization was held in Hungary in 2011. The 2nd and the 3rd conferences were also held in Hungary in 2013 and in 2015, respectively, then the 4th conference was held in Badajoz, Spain in 2017, and the 5th conference was held in Okinawa, Japan in 2019.

The forthcoming 6th Fatty Pig International Conference will be held in Tainan, Taiwan from

October 26 to 28, 2022. Tainan is an important local pig production area in Taiwan, and is also of the most historically valuable and ancient city in Taiwan. Tainan also acts as the cornerstone for indigenous swine research. The main purpose of the 6th Fatty Pig International Conference held in Tainan, Taiwan in 2022 is to congregate fatty pig producers, meat processing and marketing personnel, technicians, researchers, policy makers and representatives of breeders associations from all over the world to discuss the current status of the fatty pig industry in various countries, so as to encourage the fatty pig knowledge dissemination and the exchange of expertise to strengthen the fatty pig production system and related industries to make the fatty pig products more popular and promoting the industry more prosperous and well-developed.

Researchers in Taiwan would like to strengthen this program and to involve more scientists and industry actors dedicated for basic and applied research on fatty pigs, so as to increase their knowledge and to exploit the new fatty pig research results in the daily food industry and business life. We are looking forward to seeing everyone in Tainan, Taiwan in the forthcoming 6$^{th}$ Fatty Pig Conference in Tainan, Taiwan with our greatest enthusiasm.

# About Fatty Pig

Fatty pigs are the ancient indigenous porcine breeds. They possess well environmental adaptability, can effectively use local natural resources, and provide good reputation food sourceas traditional local meat products. Not only for their sensorial quality is excellent, but also for being considered as part of regional heritage in the world. These breeds are the extremely valuable genetic resources. Some breeds have high market potential, such as Spanish Iberico and Hungary Mangalica. The products have won international praise and attention. Taiwan ancient Lanyu pig is used as a new model for biomedical miniature pig. Compared with modern commercial pig breeds, some fatty pig breeds are with slower growth rate so as to be neglected for some time in the past. Nowadays, global consumers' interest in high-quality local fatty pig products is increasing. However, certain fatty pigs possess some important biomedical characteristics, which also make them regain people's favor.

At present, producers of commercial pig breeds such as Landrace and Duroc often ignore pigs' physiological requirement under the highly intensive production for emphasizing economic benefits, so as to decrease the sustainability and adaptability of pig production systems. In contrast, traditional fatty pig feeding methodology not only pays attention to the products quality and pig health, but also allows their sustainable use and animal welfare, as well as protects the local ecological environment, and thereby contributing to the economy of society and rural areas, so asto increase farmers' profitability and enhance employment opportunities.

The Fatty Pig International Conference was enthusiastically endeavored by Professor József Rátky, the former chief researcher of the Hungarian NARIC-ATK Institute. He launched the Fatty Pig Group in Vietnam in 2009. The very beginning three Fatty Pig International Conference in 2011, 2013 and 2015 were all held in Hungary, follow up in 2017 and 2019 in Spain and Japan respectively. Since the first conference, the number of participants in the Fatty Pig Conference has been increasing. The last conference held in Japan was also a great success, which show that the world's interest in this field is growing.

The aim of this conference is to congregate producers, technicians, researchers, policy makers, representatives of breeder associations and related industry professionals from various countries to encourage the exchange of knowledge and expertise in order to preserve valuable fatty pig populations, to optimize their production system, so their products become more marketable, and environment and economics are more sustainable development.

# Organizing committee

| | | | |
|---|---|---|---|
| President | Jeng-Fang Haung | Livestock Research Institute (LRI), COA | Director General |
| Vice- President | Mei-Ping Cheng | Livestock Research Institute (LRI), COA | Deputy Director General |
| Vice- President | Lih-Ren Chen | Physiology Division, Livestock Research Institute (LRI), COA | Chief of Division |
| Executive-Secretary | Jeng-Bin Lin | Forage Crops Division, Livestock Research Institute (LRI), COA | Chief of Division |

| **Name of member** | **Organization** | **Title Position** |
|---|---|---|
| Yung-Yi Sung | Department of Animal Science and Technology, National Taiwan University | Emeritus Professor |
| Yu-Ten Ju | Department of Animal Science and Technology, National Taiwan University | Professor |
| Pei-Hwa Wang | Department of Animal Science and Technology, National Taiwan University | Professor |
| Ming-Tang Chiou | Department of Veterinary Medicine, National Pingtung University of Science and Technology | Professor |
| Yun-Chu Wu | Department of Animal Science and Biotechnology, Tunghai University | Emeritus Professor |
| Ming-Chung Deng | Hog Cholera Division, Animal Health Research Institute (AHRI), COA | Researcher and Director |

| | | |
|---|---|---|
| Shu-Hwae Lee | Animal Drugs Inspection Branch (ADIB), AHRI, COA | Retired Researcher and Director |
| Hsu-Chung Hsieh | Tong-Bao Taiwan | Founder |
| Jung-Chun Lee | Pin-pu Farm Corp. | Founder |
| Yu-Sung Cheng | Hsin Zeng Feng Co., Ltd | Founder |
| Yau-Kuen Hung | Fwusow Industry Co., Ltd. | Director |
| Tien-Fu Tseng | Great Wall Enterprise Co., Ltd. | Senior Vice President |
| Chia-Jung Lin | Department of International Affairs, COA | Director |
| Wen-Jane Tu | Bureau of Animal and Plant Health Inspection and Quarantine (BAPHIQ), COA | Director General |
| Ching-Wei Chang | Department of Animal Industry, COA | Director |
| Ming-Cheng Chen | Department of Biotechnology and Animal Science, National Ilan University | Professor |
| Chung-Shu Wang | Secretariat, COA | Senior Specialist |
| Jen-Hau Chen | Taiwan Sugar Corporation | Manager |
| Jen-Te Tseng | Pig Farmers Group for Pig Production and Marketing, Neipu District, Pingtung County | Group leader |
| Chieh Yang | Republic of China (R.O.C.) Swine Association | Chairman |

| | | |
|---|---|---|
| Jeng-Bin Lin | Forage Crops Division, Livestock Research Institute (LRI), COA | Chief of Division |
| Chin-Bin Hsu | Nutrition Division, Livestock Research Institute (LRI), COA | Chief of Division |
| Chia-Chieh Chang | Taitung Animal Propagation Station (TAPS), Livestock Research Institute (LRI), COA | Station Director |
| Shu-Yin Wang | Chinese Society of Animal Husbandry | Chairman |

Abbreviations: Council of Agriculture (COA),

# Fatty Pig International Advisory Group

| Name | Country |
|---|---|
| Dr. József Rátky | Hungary |
| Dr. Péter Tóth | Hungary |
| Dr. Somfai Tamas | Japan |
| Dr. Noboru Manabe | Japan |
| Dr. Kazuhiro Kikuchi | Japan |
| Dr. Takashi Nagai | Japan |
| Dr. Naomi Kashiwazaki | Japan |
| Dr. Mercedes Izquierdo Cebrián | Spain |
| Dr. Francisco Ignacio Hernández-García | Spain |
| Dr. Antonio Gonzalez-Bulnes | Spain |
| Dr. Marcus Bates | UK |
| Dr. Christopher Grupen | Australia |
| Dr. Ming-Che Wu | Taiwan |
| Dr. Synan S. Baguio | Philippines |
| Dr. Santanu Banik | India |
| Dr. Tshimangadzo Lucky Nedambale | South Africa |

# The 6th Fatty Pig International Conference Agenda

## CONTENTS

# Session 1

## Indigenous Pigs Species and Current Challenges

Session 1 – Chairperson
Session 4 - Topic 8


# Ming-Che Wu

**Fatty Pig International Advisory Group**

**Former Head**
**Livestock Research Institute,**
**Council of Agriculture, Executive Yuan**
**Taiwan (R.O.C.)**


## Introduction & Experiences

Former Head of Animal Breeding and Genetics Division at Taiwan Livestock Research Institute to conduct national data banking for animal performance improvement and smart technology development from 2004 to 2021. Previously served as the Director of DairyResearch Center at Taiwan Livestock Research Institute, overseeing the technology dairy farming and economic development activities across dairy industry from 2000 to 2004. Healso served as the theme leader at Taiwan Animal Germplasm Center for international cooperation on conservation of farm animal genetic resources from 2004 to 2021. He was appointed as Research Fellow at Taiwan Livestock Research Institute in 1990 to promote national artificial reproductive technology and web-based data networking for field application in animal breeding industry.

## Education

- PhD, University of Illionis, USA, 1987
- Master, National Taiwan University, 1981
- Bachelor, National Taiwan University, 1978


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# Formosa Black pig in Taiwan breeding swine auction web with selection traits on growth performance, body conformation and total sperm count

Mingche Wu[1], Yungyu Lai[1], Deryuh Lin[1] and Guizhu Liu[2]
[1]Taiwan Livestock Research Institute, Tainan, Taiwan
[2]Formosan Farmers Association for Swine Improvement, New Taipei, Taiwan

Formosa Black pig is in common name in Taiwan for a large body size, solid black in coat color, a meat-type crossbred. Genetic improvement on traits of Formosa Black pig was adapted with birth recording in breeding herd book and breeding swine auction web system where applicable for international breed of pigs. Seven breeding farms raised them in small scale. Litter size and number of teats were 12.6 ± 2.4 live piglets and 14.1 ± 0.9 teats, respectively. Selection traits listed their means as follows: Age at 100 Kg of body weight in 48 gilts were 156 ± 6 days old with 3-point back fat thickness of 1.49 ± 0.03 cm and age at 110 Kg of body weight in 88 boars were 155 ± 4 days old and 1.43 ± 0.04 cm thickness of back fat. During the growth performance test period from 30 to 100/110 kg (gilt/boar), average daily gain was 0.96 ± 0.04 Kg in gilts with feed efficiency of 2.17 ± 0.05; average daily gain was 1.02 ± 0.01 Kg in boars with feed efficiency of 2.21 ± 0.03. Semen of each of tested-off boars collected on 253 ± 3 days of age with 159 ± 16 ml of semen. Body conformation traits of 109 boars measured at 168 Kg of body weight on 286 days old with 1.59 ± 0.06 cm thickness of back fat, 73.9 cm in shoulder height, 146.0 cm in length from neck to tail root and 36.7 cm in rump width. Total sperm count per collection was 67.2 ± 8.8 billion sperms in 196 ± 23 ml of semen. Body conformation traits of 139 gilts at 136 Kg of body weight were measured on 238 days old with 1.54 ± 0.05 cm thickness of back fat, 66.4 cm in shoulder height, 136.0 cm in length from neck to tail root and 35.0 cm in rump width. The combination length of shoulder height, body length and rump width were 256 cm in boar and 237 cm in gilt, respectively. In comparison to combination length in Duroc (258 cm), Landrace (263 cm) and Yorkshire (260 cm) boars, the body size of Formosa Black was like that of Duroc boar. Auction price sold of tested-off boars and gilts reached the highest of 75,000 and 40,000 TWD (30 TWD=1 USD), respectively. In conformation contest auction, sold price reached 109,000 TWD in boars and 39,000 TWD in gilts. Formosa Black in multiple breeding farms served as a terminal sire breed to produce a large body size of black hog for Taiwan live hog marketing.

Key words: Breeding, Marketing, Networking

Session 1 - Keynote 1


# Chia-Chieh Chang

**Associate Researcher & Manager of Department of Livestock Technology,**
**Taitung Animal Propagation Station,**
**Livestock Research Institute,**
**Council of Agriculture, Executive Yuan**
**Taiwan (R.O.C.)**


## Introduction & Experiences

- 2000.1 ~ 2003.1. Assistant, Leader of Livestock Management Department,Taitung Animal Propagation Station.
- 2003.1 ~ 2016.10. Assistant Researecher, Leader of Livestock Management Department,Taitung Animal Propagation Station.
- 2016.10 ~ 2019.5. Assistant Researcher, Leader of Livestock Technology Department,Taitung Animal Propagation Station.
- 2019.5 ~ Associate Researcher and and Manager, Taitung Animal Propagation Station.

## Education

- PhD, Graduate Institute of Clinical Dentistry, National Taiwan University, Taipei, Taiwan. 2014
- Master, Graduate Institute of Biomedical Sciences, National Taipei University, Taipei, Taiwan. 1997


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# Social-Cultural Value of Black Lanyu Pig Breed and Prospect of Biomedical application of White Binlang Pig Breed

Chia-Chieh Chang[1], Sheng-Yang Wu[1], Mnig-Che Wu[2], Hsien-Pin Chu[1], Yu-Ten Ju[3], Han-Sheng Wang[1] and Jeng-Fang Huang[2]

[1]Taitung Animal propagation station, Livestock Research Institute, Taitung, Taiwan.

[2]Taiwan livestock Research Institute, Tainan, Taiwan.

[3]Department of Animal Science and Technology, National Taiwan University, Taipei 10673, Taiwan.

Local pig breeds have their unique history, growth environment, social and cultural background. Global experts have made efforts to maintain and promote their values. Lanyu pig is a native breed located on Lanyu Island in southeastern Taiwan. Tao culture in Lanyu is closely related to pigs. The elders said, how could it be possible to become human without pigs? Every family has to raise pigs. Because Pigs are sacrificed for meat rituals, medicinal, praying, etc. Pork is not the main food source for Tao people. It is an important cultural asset linked to the local community. The program plays a central role in the preservation of the Lanyu pig species and the maintenance of the traditional culture of Tao. The study investigated the historical origin of Lanyu pigs, development and utilization of meat quality characteristics, and maintained the biodiversity of protected species and genetic resources. The use of local Lanyu pig breeds has its unique social and cultural value and to provide a plan for the sustainable use.

Pig is considered one of the suitable animal models in biomedical research. Binlang pigs, a breed of white miniature pigs, The first white individual was found from the offspring of Spotty Lanyu pig's full-sib line in 2001. The white herd was established by backcrossing and isolation breeding for three generations of full-sib mating. Thenit was registered as a new breed," Binlang pigs," in 2011 and became popular in marketing in 2020. Binlang pigs supply preclinical applications in the domestic biotechnology industry and develop suitable testing models. Taitung animal propagation station is an AAALAC International accredited unit. It promotes the 3R policy and customizes the production of high-quality products according to customer needs. Establishing the supply system of Binlang pigs ensures that the service entrusted by the industry is more conducive to the competitive advantage.

Key words: Binlang pig, Lanyu pig, Taiwan

# Byoung-Chul Yang

Session 1 - Topic 1

**Director**
**Subtropical Livestock Research Institute,**
**National Institute of Animal Science,**
**Rural Development Administration (RDA)**
**South Korea**

## Introduction & Experiences

- **Work Experence**

  1991~2013 : As a junior researcher at the National Institute of Animal Science, RDA. The field of research is livestock breeding engineering, seed industry development, and animal biotechnology research

  2013~2019 : As a senior researcher at the National Institute of Animal Science, RDA. The field of research is animal biotechnology, Korean beef breeding, and pig improvement research

  2019~Present : The director of the Subtropical Livestock Research Institute, at the National Institute of Animal Science, RDA.

- **PAPER (last 5 years, SCI)**

  The MYH3 gene variant (g.-1805_-1810, ACGT) affects endophenotypes of myoglobin oxidation–reduction states in porcine muscles. Anim Genet. 2022 Aug;53(4):532-533.

  Validation of mouse Phosphoprotein Enriched in Astrocyte 15 expressing transgenic pig as a potential model in diabetes translational research. 3 Biotech. 2020 Feb;10(2):34.

  Genome-wide analyses of the Jeju, Thoroughbred, and Jeju crossbred horse populations using the high density SNP array. Genes Genomics. 2018 Nov;40(11):1249-1258.

  Identification of lactoferrin and glutamate receptor-interactingprotein 1 in bovine cervical mucus: A putative marker for oestrous detection. Reprod Domest Anim. 2017 Feb;52(1):16-23.

## Education

- Doctor of Animal Reproductive Physiology, Seoul National University, 996.03~2002.08
- Master of Animal Breeding, Jeju National University, 1991.03~1993.02
- Bachelor of Science in Agriculture, Jeju National University, 1984.03~1991.02

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# Characteristics and Improvement of Jeju Native Pig

Byoung-Chul Yang, In-Cheol Cho
*Subtropical Livestock Research Institute, National Institute of Animal Science, RDA, Jeju 63242, Republic of Korea*

It is presumed that the breeding history of Jeju native black pigs began in the Goguryeo period when they were brought in from the mainland. Jeju Native Pigs body is small, the constitution is strong and disease-resistant, the number of pups produced is small, the growth rate is slow, but the meat quality is good. In Korea, there are many people who like the taste of native pigs, so it is an important task to produce a breed that has the same meat quality as native pigs, but with good growth and economy. Therefore, the National Institute of Animal Science has been continuously trying to improve while collecting and preserving native pigs in Korea. As a result, two varieties were developed in 2013 and 2015: 'Nanchukmacdon' and 'Wooriheukdon'. The breed of black pig 'Nanchukmacdon', which has improved growth and fertility while preserving the meat taste of Jeju native black pork, was developed (2013). We showed that a functional sequence variant (FSV) in the porcine MYH3 gene in the promoter region affects the ratios of myofibers and is associated with intramuscular fat and a*. The characteristics of this variety were excellent in terms of aroma, taste, tenderness, succulentness and palatability, and low-fat parts such as sirloin and legs are also suitable for roasting. "Nanchukmacdon'' was developed by combining the meat quality and black hair color in Jeju native pigs and the productivity traits in improved breeds. This is the world's first breed developed by fixing the meat quality and black hair color gene. Which is via selective breeding, may be used for the meeting of consumer demands.

Session 1 - Topic 2


# Yu-Ten Ju

**Professor**
**Department of Animal Science and Technology**
**National Taiwan University**
**Taiwan (R.O.C.)**


## Introduction & Experiences

I Graduated from the Institute of Biochemistry of Yangming University, mainly studies the gene regulation of nerve cells in brain. Currently three research themes in our laboratory.

- Theme one is to use miniature pigs as an animal model, induce to disease model, such as alcoholism, and then evaluate the efficacy of surgery and instruments.
- The second theme is to study the genetic evolution and genetic relationship between pigs, cattle and wild animals, such as wild boars, black bears, leopard cat, pangolins, deer and other animals.
- Study gene regulation of growth and differentiation of deer antler or mammary gland

## Education

- PhD, Institute of Biochemistry, Yung-Ming University, 1999
- Master, Department of Animal Science, Chung-Hsing University University, 1992
- Bachelor, Department of Animal Science, Chung-Hsing University University, 1988

# The Origin and Conservation Importance of Native Taiwanese Liudui Black Pigs as Inferred from Molecular Genetics

Yu-Ten Ju[11]Animal Science and Technology Department, National Taiwan University

The genetic diversity of pigs is the basis for breeding in the swine industry. Across the world, various domesticated pig breeds have been reared, displaying diverse characteristics according to their environments and human needs. Traditionally, pig breed identification was mainly based rather subjectively on body size and color, as well as growth and reproductive performances. Nowadays, given advancements in molecular biotechnology, species identification is more objective and genetic introgression between different populations can even be detected. As agricultural techniques advanced and urban development and transportation expanded, many new pig breeds were created by crossing breeds from different regions of Europe and Asia. These modern breeds display excellent economic traits but, consequently, populations of important native pig breeds around the world are now in decline, suffer genetic introgression, and even face extinction. In 2004, The Food and Agricultural Organization of the United Nations (ISAG/FAO) highlighted that native livestock are becoming inbred or eliminated, and called on all countries to conserve their native pig breeds, recommending that population genetic analyses should be conducted on pig breeds globally using the same set of genetic markers.

Domestic pigs were domesticated independently in Asia and Europe from the Eurasian wild boar (*Sus scrofa*). The Eurasian wild boar originated on the islands of Southeast Asia. Taiwan is located in Southeast Asia and thus is close to the origin of *Sus scrofa*, contributing to the unique genetic characteristics of indigenous Taiwanese wild boar and pig breeds. Analyses of the mitochondrial DNA (mtDNA) of Taiwan wild boar has revealed two groups displaying significant genetic differentiation, corresponding to the current wild boar population and the wild boar ancestor of Lanyu pigs (a native Taiwanese pig breed), respectively. The mtDNA data indicate that the Lanyu pig was domesticated from a wild boar ancestor in Taiwan.

Unfortunately, since the productive performance of both Taiwan wild boar and Lanyu pig is not ideal, neither are widely used in developing commercial pig breeds. China represents an ancient domestication center for pigs, hosting the greatest number of pig breeds that have since dispersed globally. For instance, early immigrants brought ancestral native Taiwan black pigs (NTBP) from China to Taiwan, where they were then reared and selected in isolation. According to historical documents, such breeds include Dingshuangxi and Taoyuan pigs from the north of the island, and Meinong pigs

in the south. Regrettably, among these, only one mtDNA haplotype of Taoyuan pig was conserved by the Institute of Livestock Research in 1986. Nevertheless, nowadays many pig farms in Taiwan are raising NTBP because of their good flavor profile and prolific reproductivity, accounting for 10% of Taiwan's pork market. Apart from NTBP, other pigs destined for the commercial pork market in Taiwan include the Meishan, Landrace, Yorkshire, Berkshire and Duroc breeds.

Based on historical records, Taoyuan pigs potentially arrived in Taiwan from Guangdong Province, Southern China, between 1877 and 1887, but genetic evidence is lacking. Therefore, our laboratory began researching this and other NTBP in 2009. Our research objectives include surveying the distribution of NTBP across Taiwan, as well as studying their origins, population structures and genetic characteristics. As recommended by the FAO, we are deploying mtDNA and a universal set of 19 pairs of microsatellite markers (SSRs). To date, our results have shown that breeding of NTBP is mainly limited to the Liudui area of Pintung greatly populated by the Hakka ethnic group, highlighting how Hakka culture has played a key role in the conservation of NTBP in Taiwan. We have detected a total of 21 mtDNA haplotypes from 170 NTBP. Comparing these mtDNA haplotypes with those of Eurasian wild boar and domestic pigs has revealed that most NTBP originated from the Lower Changjiang River Basin in Central China. Moreover, assignment testing and principal component analyses clearly distinguished Taoyuan, Meishan, Berkshire, Duroc, TLRI Black Pig No.1, KHAPS Black Pig, Landrace Yorkshire and Lanyu pigs. Significantly, the NTBP from the Liudui area displayed distinct genetic characteristics, both in terms of unique SSRs and mtDNA haplotypes, and thus we term them Liudui black pigs. Overall then, we argue that the conservation of Liudui black pigs is of considerable importance to Taiwan’s swine industry and cultural history, and efforts should be made to restore the population.

Key words: Native pig, Native Taiwan Black Pig, Conservation, Population genetics

# Session 2

## Genetics, Breeding and Preservation

Session 2 - Chairperson


# Shao-Yu Peng

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## Introduction & Experiences

- Chief of Research Section, Interdisciplinary Development Center, NPUST
- Chief of International Industry-Academia Section, Tropical Swine Consulting and Breeding Center, NPUST
- Area Editors, Journal of the Agricultural Association of Taiwan
- Researcher, Metal Industries Research & Development Center
- Assistant Technician, Taiwan Technical Mission in Paraguay, South America

## Education

- PhD, National Taiwan University, 2014
- Master, National Taiwan University, 2008
- Bachelor, National Chung Hsing University, 2006


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# Noboru Manabe

Session 2 - Keynote 2

**Professor and Associate President of Osaka International University (OIU)**
**Emeritus Professor of The University of Tokyo**
**Visiting Professor of Miyazaki University**
**Board Member of Japan Racing Association (JRA)**
**Member of Science Council of Japan (SCJ)**
**Director of National Livestock Breeding Center (NLBC)**
**Director of Japan Livestock Industry Association (JLIA)**
**Chairperson of Japan Food Safety Commission**
**Chairperson of Japan Ministry of Agriculture, Forestry and Fisheries Council**
**Japan**

## Introduction & Experiences

- **Occupation**
  - April 1983 to July 1988: Chief Researcher (Research Institute for Life Sciences,Nihon-Nohyaku Co., Ltd., Tokyo, Japan)
  - August 1988 to March 1992: Senior Researcher (Unit of Cellular and Molecular Pathology, Pasteur Institute, France)
  - April 1992 to June 2004: Associate Professor (Anatomy and Cell Biology, Department of Animal Sciences, Kyoto University, Kyoto, Japan)
  - July 2004 to March 2015: Professor (Research Unit for Animal Life Sciences, Animal Resource Science Center, Graduate School of Agricultural and Life Sciences, The University of Tokyo, Tokyo, Japan)
  - April 2015 to date: Professor and Vice president (Osaka International University)

- **Research experience**
  - 1983-1988: Pharmacological studies on the anti-fibrotic reagents: Inhibitors of biosynthesis of extracellular matrix components.
  - 1988-1992: Molecular and cellular pathological studies on the anti-fibrotic effects of recombinant interferons on patients with chronic viral hepatitis B and C.
  - 1992-date: Molecular regulation mechanisms of ovarian functions, selective ovarian follicular atresia and structural luteolysis.

- **Board member of scientific society**
  - President of the Society for Reproduction and Development (2009-2013)
  - Director of the Japanese Society of Animal Science (1992-2014)
  - Secretary-General of the Asian Association of Veterinary Anatomist (2004-2016)
  - Director of the Japanese Association of Veterinary Anatomists (1992-2024)

## Education

- Entered the Doctor course, April 1978, graduated March 1983, and received a Ph.D. in February 1985 from Kyoto University for a thesis entitled “Comparative histochemical studies on muscle fiber characteristics in vertebrates”.
- Entered Department of Animal Sciences, Kyoto University, April 1974, and graduated March 1978.

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# Pork quality requirements and fatty pig production in East Asia

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[1]Osaka International University, Osaka, Japan (Emeritus Professor of The University of Tokyo, Director of National Livestock Breeding Center: NLBC and Japan Livestock Industry Association: JLIA), [2]National Institute of Agrobiological Sciences, Tsukuba, Japan, [3]Department of Obstetrics and Farm Animal Medicine, University of Veterinary Medicine, Budapest, Hungary, [4]Horai Food Co. Ltd., Osaka, Japan.

The oldest pig in the world (8,000 B.C.) was produced by domesticating wild boars in Southeastern Asia (Thailand, Vietnam, Laos, southern China etc.). The oldest pig in Europe (4,000 BC) was found on the British Isles. Therefore, the history of pig farming in Southeast Asian countries (10,000 years) is older and longer than that in European countries. More than 50% of pork is produced in Far East and Southeast Asian countries, including China, according to the Food and Agriculture Organization's (FAO) recent production yearbook. In the world, 0.8 billion pigs are bred annually, 1.3 billion pigs are shipped, and more than 100 million tons of pork-meat are produced. According to the FAO, there are 1.5 billion cattle, 1.2 billion sheep and 1.0 billion goats in the world for meat.

Pig farming methods in old traditional European countries and pig farming styles in Far East and Southeast Asian countries were different. In European countries, pigs were fed forest acorns. However, in the Asian countries, the traditional way of raising pigs is to feed them with garbage (leftover food) from human living areas, agricultural land waste,and human feces. For this reason, many Asian peoples may have considered pigs to be unclean animals. Humans are omnivores, and like horses, we have the nature of herbivores that convert dietary fiber into an energy source through fermentation in the large intestine (cecum and colon). Short-chain fatty acids (acetic acid, propionic acid, butyric acid etc.) are produced from unabsorbed polysaccharides (cellulose, hemicellulose, pectin, lignin etc.). However, the human digestive system can not absorb short-chain fatty acids and polysaccharides produced in the large intestine. Therefore, human feces, which are mainly composed of bacteria and unabsorbed food components, are rich in nutrients (short-chain fatty acids, polysaccharides, proteins, vitamins etc.). Human feces can be converted by pigs into high-quality human foods such as proteins and fats. In Asian countries, moreover, traditionally farmed pigs are a valuable food stock available at all times of the year.

However, in Japan, which is one of the countries in the Far East and Southeast Asia,

with the exception of Okinawa (Okinawa was an independent kingdom for a long time), eating meat was prohibited about 1,200 years ago under the influence of Buddhist policy. Ancient Japanese stopped eating wild boar (there were no pigs in Japan at the time). In addition, the Japanese disliked traditional pig farming styles in the Far East and Southeast Asian countries, as they consider human feces to be unclean due to traditional primitive religions. Instead, in Japan, pig manure has been fermented and used as fertilizer for agriculture. There was a small revolution 150 years ago in Japan, when European pigs were introduced from the Western countries, and Western-style pig farming began.

In Far East and Southeast Asian countries, until recently, pigs were an expensive and special animal food eaten on ceremonial occasions rather than a daily food. Insects, seafood and birds (cheap animal foods) that are low in fat have been a daily diet for people, especially in the Far East and Southeast Asian countries. Asian peoples can easily get protein from insects, seafood and birds in their daily diet. That's why, in the Asian countries, pigs are a valuable livestock food, especially a special food that provides delicious fats to people who are deficient in fat, and an important offering to the gods during traditional festivals. Asian peoples preferred small and fatty pigs. In recent years, in the Far East and Southeast Asian countries, commercial breed pigs introduced from Europe and the United States has become a major practice, and Asian people are familiar with the meat of commercial pigs. Native breeds of pigs remain in remote areas of Southeast Asian countries.

The native pigs of the Asian countries will contribute to the achievement of the "Sustainable Development Goals: SDGs" advocated by the United Nations in 2015. In particular, it will contribute greatly to the achievement of goals 1 "No poverty", 2 "Zero hunger", 3 "Good health and well-being" and 15 "Life on land".

As mentioned above, 800 million commercial pigs are raised annually, 1.3 billion commercial pigs are shipped, and more than 100 million tons of pork-meat are produced. In Asian countries, native pigs have been raised on pastures such as buckwheat, clover, and gramineous fodder, as well as human food residues, farm residues, and manure. For this reason, the significance of the existence of Asian native breed pigs, which do not compete with humans for feed, is increasing in response to the food crisis that is progressing on a global scale.

In recent years, there has been a global shortage of phosphorus, potassium, and

nitrogen, which are the main fertilizer components, and the depletion of phosphorus is a particularly important problem. Livestock manure, including pig manure, is rich in phosphorus. Phosphorus in pig manure must be effectively utilized as an organic fertilizer. The ancient style of farming in Asian countries, in which each farmer raises pigs on a small scale and ferments the pig manure and supplies it to the cultivated land as organic fertilizer, is being reconsidered from the viewpoint of resource circulation and global environment preservation. Effective use of livestock manure stops the pollution of groundwater, surface water, ponds, lakes and oceans. Asian native pigs play a significant role in circular agriculture.

Epidemics such as foot-and-mouth disease, swine fever, African swine fever, influenza and so on are spreading on a global scale. The International Epizootic Office (OIE) advocates "One World, One Health". Outbreaks of swine epidemics not only take a toll on farmers economically, but some diseases can also infect humans. Controlling swine epidemics is extremely important not only for agriculture but also for maintaining human health. Asian native pigs are considered to be highly resistant to various infectious diseases, and are a valuable genetic resource for identifying disease resistance genes.

Thus, the native pigs of the Far East and Southeast Asian countries have important potential not only for food production and animal husbandry, but also for overcoming many global crises facing humankind. In my presentation, reviewing the Asian native pigs from the perspective of SDGs, and I will cover the breeds and history of native pigs in the Far East and Southeast Asian countries, as well as forecasts of pork market conditions in the Asian countries.

Session 2 - Topic 3


# Ting-Yung Kuo

**Assistant Researcher**
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## Introduction & Experiences

1. Administrative Officer, Institute of Biological Chemistry, Academia Sinica, Taiwan. (2002)
2. Administrative Officer, the Research Center for Tuberculosis Control , Center for Disease Control, Taiwan. (2003~2004)
3. Contract-based Employee, Division of Physiology, Livestock Research Institute, COA, Executive Yuan, Taiwan. (2005~2008)
4. Associate Technical Specialist, Department of Agriculture, Ping-Tung County Government, Ping-Tung County, Taiwan. (2008~2010).
5. University Lecturer , Department of Animal Science, National Chiayi University, Taiwan. (2020)
6. Breeding Farm Manager, Animal Breeding and Genetics Division, Taiwan Livestock Research Institute, COA, Executive Yuan, Taiwan. (2016 to date)
7. Assistant Researcher, Division of Breeding and Genetics, Livestock Research Institute, COA, Executive Yuan, Taiwan. (2010 to date)
8. Awards-Journal of Skin Research and Technology Award of Top Downloaded Article 2017-2018.

   Awards-Journal of Biomaterials and Tissue Engineering (JBT) Best Paper Award for the year 2015.

- Animal Breeding and Conservation
- Animal Reproductive Biotechnology
- Germ Cell Cryopreservation
- Biomedical and Regenerative Tissue engineering

## Education

- Ph.D. candidate, Department of Biotechnology and Bioindustry Sciences, College of Bioscience and Biotechnology, National Cheng Kung University, Tainan, Taiwan . 2021.

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# Identification of nucleus boar semen quality to ensure the sustainable conservation of Taiwan native Lanyu minipigs

Ting-Yung Kuo [1], Yeh-Ying Lee[2], Hsin-Hung Lin[3], Lin-Liang Peng [1], Yi-Long Chen [4], Chia-Chieh Chang[4], Cho-Chen Yang[2], Ming-Che Wu[1], Der-Yuh Lin[1]
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Lanyu pig is a native breed origin from Lanyu island of Taiwan. It is characterized by small body size and small erect ears and in addition to the traditional black Lanyu pigs (Lanyu 200), it can be further subdivided into different pig strains such as Lanyu 100 (Spotty pig), Lanyu 400 (Binlang pigs) by their hair coat and Lanyu 50 (Mitase pig) a cross mating with commercial pig breed. Lanyu pigs have now drawing much attention on biomedical experiments for its greatly physiological tolerance during and after surgical operation, therapy and easily manage. For stabilizing the supply of sufficient healthy laboratory animals and for maintaining provenance diversity, the nucleus boar semen quality was naturally important for laboratory animal supply chain and population conservation with so much at stake. Therefore, the purpose of this study is to ensure optimal fertility of nucleus boars and major advances in the selection of young boar to guarantee their semen fertility before get into nucleus herd.Experiment results showed an incidence of ejaculates with a sperm DNA fragmentation index (DFI), a damaged sperm DNA can lead to early embryonic or fetal death and can have a dramatic impact on health of the offspring, higher than 20%has been observed in Spotty pig and Binlang pig suggest that adding sperm DNA fragmentation as a new parameter to the routine assessment of every ejaculate may be beneficial to the field and the sperm DFI values could be an useful reference in extrusion of subfertility breeding animals. In conclusion, by further and routinely identification of nucleus boar semen quality to ensure the sustainable conservation of Taiwan native Lanyu minipigs could be expected.

Key words: Lanyu pig, Conservation, Semen quality, Fertility

Session 2- Topic 4


# Tamas Somfai

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## Introduction & Experiences

He graduated from Pannon University of Agriculture in 1999. Dr Somfai has been living in Japan since 2005. His research field is the development of gamete cryopreservation and *in vitro* embryo production systems in pigs and cattle.

## Education

- PhD, University of West-Hungary, 2005


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# Application of assisted reproductive techniques for the preservation ofindigenous pigs

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Indigenous pig breeds are still frequently used for human consumption at certain regions of the world or utilized as model animals for medical research. Therefore, they represent a considerable economic and scientific value. Recent epidemies of African Swine Fever threaten the existence of many native pig breeds worldwide which underlines the importance of in vitro gene banking. Cryopreservation of porcine gametes and somatic cells requires the application of assisted reproductive techniques (ART) such as in vitro embryo production (IVEP; employing in vitro maturation (IVM) of oocytes, in vitro fertilization (IVF) or intracytoplasmic sperm injection (ICSI) and subsequent embryo culture), or somatic cell nuclear transfer (SCNT). Nevertheless, reports on the application of these techniques for the preservation of native pig breeds are very scarce.

In the last decades, our laboratory established reliable protocols for sperm freezing,ART and oocyte/embryo vitrification in modern pigs. In recent years, we applied many of these techniques for the preservation of some indigenous Asian pig breeds. Boar sperm has been frozen for gene banking in several native Vietnamese breeds and in the Japanese Agu pig. We applied IVEP, oocyte vitrification, and zygote vitrification techniques in the native Vietnamese miniature Ban pig with efficacies similar to thoseof modern breeds [1-4]. Furthermore, production of blastocyst-stage embryos by SCNT has also been applied in native Vietnamese breeds [5]. Nevertheless, the difficulty of surgical embryo transfer under sterile conditions limits the application of these technologies for offspring production. In the Agu pig, IVM of oocytes and IVF with frozen sperm have been applied and, after the transfer of zygotes into recipients, live piglets could be obtained for the first time an indigenous pig breed [6]. Furthermore, neonatal Agu testicular tissue segments could be vitrified then grafted into immunodeficient mice to obtain spermatozoa which were utilized by ICSI to produce blastocyst stage embryos [7]. Cryopreservation of oocytes and zygotes is in progress in this breed.

In conclusion, the preservation of porcine genetic resources is an urgent task and gametecryopreservation combined with ART is an efficient tool for this purpose. (Supported byJSPS KAKENHI 21K05912).

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# Session 3

## Physiology, Reproduction and Development

Session 3 - Chairperson


# Lih-Ren Chen

**Research Fellow**

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## Introduction & Experiences

- Animal Reproductive Physiology
- Animal Cloning
- Stem Cell Technology

## Education

- PhD, Davis, University of California, USA, 1997
- Master, National Taiwan University, 1985
- Bachelor, National Chung- Hsin University, 1983


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Session 3 - Keynote 3


# Maria Oczkowicz

**Associate Professor**
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**Poland**


## Introduction & Experiences

- Assistant Professor in Genetics and Animal Production Department in National Research Institute of Animal Production since 01.07.2006
- Assistant Professor in Laboratory of Genomics, (currently-Departament of Genomics and Molecular Biology of Animals) in the National Research Institute of Animal Production since 01.07.2011
- Associate Professor in Laboratory of Genomics, (currently-Departament of Genomics and Molecular Biology of Animals) in the National Research Institute of Animal Production since 01.03. 2016

Area of Expertise: pigs breeding, pigs genetics and genomics, nutrigenomics, genomic imprinting, next generation sequencing, RNA-sequencing

## Education

- University of Silesia in Katowice, Poland, Faculty of Biology and Environmental Protection, Biotechnology of Crop Plants and Micro-Organisms - Master's degree - dissertation titled "Anatomical and cytogenetic analysis of Marchantiophyta *Pellia borealis*". Supervisor: Prof. Jolanta Małuszyńska, Ph.D, 2002
- National Research Institute of Animal Production in Cracow, Doctor of Agricultural Science - PhD dissertation titled "Associations between polymorphism of microsatellite DNA sequences linked with insulin-like growth factor II *(IGF2)* gene and meatiness in pigs" Supervisor: Prof. Barbara Rejduch, Ph.D, 2006


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# The pig as a Model for Nutrigenomic Studies

Maria Oczkowicz[1]

Nutrigenomics is the study of the effects of nutrients on the expression of genes in various tissues of the organism. Nutrigenetics, in turn, deals with the genetic differences between people, which translate into the fact that each of us reacts differently to the same dietary components. It turns out that most chronic diseases are not caused by monogenic mutations orindividual food ingredients, but by complex interactions between a very large number of different gene variants and different dietary components. Most nutrigenomic experiments are carried out on rodents (mice, rats). However, recently it has been increasingly said that the pigis a better model animal for humans due to its similar physiology, body size and omnivorousness. At our institute, we have been conducting nutrigenomic experiments on pigsfor about a decade, because we see a number of advantages of this approach. Firstly, it makes it possible to obtain information from two different areas: by using various feed additives, we evaluate their impact on the characteristics of the fattening performance (gains, length of fattening), slaughter performance (carcass weight, percentage of meat in the carcass) or meat quality. On the other hand, by testing additives also used in the human diet, we can assesstheir impact on the molecular processes taking place in the body and thus assess theirpotential impact on health. Moreover, after the experiment is over, most often pig meat can beused for consumption, which gives the whole experiment a different ethical meaning than in the case of experiments on rodents. The first nutrigenomic experiment conducted at our institute concerned the analysis of the effect of feeding pigs with various types of fat (rapeseed oil, coconut oil, beef tallow) on gene expression in the liver, muscle and fat by RNA-seq (RNA- Next Generation Sequencing). We have observed that the addition of beef tallow to pigs' diets causes changes in the expression level of genes related to cholesterol biosynthesis and has a pro-inflammatory effect in the liver. At the same time, we observedthat the fatty acid composition of the pigs' diet had a very strong influence on the fatty acid composition of the back fat of pigs. We are currently working on assessing the effect of supplementation with vitamin D3 in pigs' diet on gene expression in the liver, fat and muscles,as well as on growth characteristics and blood parameters. We are also testing the possibilitiesof enriching pork with vitamin D through dietary supplementation. So far our research has been carried out on commercial breeds of pigs; however, the fatty indigenous breeds seem to be an even better model in terms of examining the impact of nutrition on the prevention of civilization diseases such as diabetes or cardiovascular diseases.

Session 3 - Topic 5


## Chi-Sheng Chang

**Assistant Professor**
**Department of Animal Science,**
**Chinese Culture University**
**Taiwan (R.O.C.)**


## Introduction & Experiences

Dr. Chi-Sheng CHANG is an assistant professor in the department of animal science, Chinese Culture University (CCU). Before starting his work at CCU, he was a postdoctoral researcher at the Microarray Core Laboratory in the National Taiwan University Center of Genomic Medicine. He conducted research with high-density arrays and next-generation sequencing technology. Currently, his research focuses on population genetics and animal breeding with molecular tools for genetic characterization, identification, and application.

- Assistant Professor, Department of Animal Science, Chinese Culture University, 2019 – current.
- Postdoctoral Research Fellow, Microarray Core Laboratory, National Taiwan University Center of Genomic Medicine, 2015–2018.
- Postdoctoral Research Fellow, Institute of Statistical Science, Academia Sinica, 2011–2014

## Education

- PhD, INRA / AgroParisTech, UMR 1313 - Animal Genetics and Integrative Biology, France. National Chung-Hsing University, Department of Animal Science, Taiwan. 2011.
- Master, National Chung-Hsing University, Department of Animal Science, Taiwan. 2002.
- Bachelor, National Chung-Hsing University, Department of Animal Science, Taiwan. 2000.


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# The Population Genetic Structure Analysis of Pin-Pu Black Pig in Taiwan

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The pig industry produced the highest value (about NT 50-60 billion) of livestock animal products in Taiwan. Most commercial pork production are from LYD or LD crossbred pigs (about 85%), but the pork from Taiwan black pigs have better meat quality and flavor, Taiwan black pigs became the popular breeds in the pork production system. However, the Taiwan black pigs breeding systems are diverse and complex, the performance of uniformity, growth traits, and carcass traits are different by Taiwan black pig breeds. Pin-Pu black Pig is one of famous black pig breeds in Taiwan, with the systematic breeding program. It refused using kitchen waste as pig feed, but it has switched to commercial feed and by-products now. Therefore, it is necessary to characterize and identify Pin-Pu black Pig with other Taiwan black pig breeds with advanced molecular technology. In this study, we extracted gDNA from the following black breeds: Pin-Pu black Pig, Liu-Dui, New Zeng-Feng black pig form commercial pig farms; Taoyuan, Meishan, TLRI Black Pig No.1, KHAPS BlackPig from Livestock Research Institute. The 640 K SNPs array was used for genetic structure analysis. The results showed we can identify and reveal the genetic structure of Pin-Pu black Pig and other Taiwan black pig breeds and could provide information for breeding and management.

Key words: Population genetic structure, Pin-Pu black Pig, SNPs array.

Session 3 - Topic 6


## Kazuhiro Kikuchi

**Deputy Leader at Animal Model Development Group, Division of Biological Materials Development Research, Institute of Agrobiological Sciences, National Agriculture and Food Research Organization (NARO)**
**Japan**


## Introduction & Experiences

- **Position**
  - 1989-1998, Researcher at National Institute of Agrobiological Resources.
  - 1998-2001, Chief Researcher at National Institute of Agrobiological Resources.
  - 2001 September-October, Visiting Scientist, supported by the Swedish government, Swedish University of Agricultural Sciences, Uppsala, Sweden: Dr H. Rodriguez-Martinez.
  - 2001-2009, Chief Researcher at National Institute of Agrobiological Sciences
  - 2008-2021, Visiting Professor, The United Graduate School of Veterinary Science, Yamaguchi University
  - 2009-2016, Senior Researcher at National Institute of Agrobiological Sciences
  - 2016-2020, Advanced Principal Researcher and Unit Leader at Institute of Agrobiological Sciences, NARO
  - 2022-: Present position
- **Academic Awards**
  - 2003 Scientific Award from the Japanese Society of Animal Reproduction (the Society for Reproduction and Development)
- **Professional Organizations**
  - Vice President (2015-), Japanese Society of Animal Science (JSAS)
  - Board of Governors, International Embryo Transfer Society (IETS)
  - Director, Society for Reproduction and Development (SRD)
  - Director, Japan Embryo Technology Society (JETS)
  - Director, Japan Society of Reproduction Engineering (SRE)
  - Editor in Chief, Animal Science Journal
  - Editor in Chief, Journal of Reproduction Engineering
  - Editorial Board Member (2004-), Theriogenology
  - Editorial Board Member (2013-), Reproduction in Domestic Animals
  - Member, Society for Reproduction and Fertility (SRF)
  - Member, The Japanese Society for Swaine Science

## Education

- 1987, BSc from Azabu University
- 1989, MSc from Azabu University
- 1989, D.V.M.
- 1999, PhD from The University of Tokyo

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# Utilization of Porcine Testicular Tissues after Cryopreservation andGrafting into Nude Mice

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In pigs, freezing of sperm is the most reliable and well-established method for the conservation or preservation of genetic resources. On the other hand, cryopreservation of female gametes (oocytes) and gonadal (testicular and ovarian) tissues usually by vitrification has been conducted, however, resulted in very low efficacies. Recently, our laboratory conducted some research themes related to these issues. In this session, we introduce recent progress on the vitrification of testicular tissues for producing sperm cells and finally living piglets.

One approach for inducing spermatogenesis in isolated testicular tissues is ectopic (into another site in the body) grafting into immunodeficient host animals (xenografting). Ectopic xenografting has been reported in mammals including pigs (Kaneko et al. 2008, Nakai et al. 2009, Nakai et al. 2010). It is preferable to graft testicular tissue under the skin of the back of commercially available severe combined immunodeficiency mice (nude mice). A series of studies has been conducted in our laboratory (Kaneko et al. 2008, Nakai et al. 2009, Nakai et al. 2010, Kikuchi et al. 2011) to evaluate whether boar spermatogonia can develop into sperm in testicular tissues grafted into nude mice, and whether live piglets can be produced after intracytoplasmic sperm injection (ICSI) into oocytes. We firstly confirmed the oocytes developed into blastocysts; of which quality is similar to that of the oocytes from prepubertal gilts after in vitro maturation/fertilization (Kikuchi et al. 2002, Nakai et al. 2009). When the oocytes at the pronuclear stage were transferred to oviducts of estrous-synchronized recipients, we were able to obtain both male and female piglets (Nakai et al. 2010), which showed normal reproductive abilities when developed to the adulthood (Kaneko et al. 2012).

For more advanced utilization of this technique, we have investigated for the possibility of vitrification of testicular tissue fragments before xenografting. This method enables long term storage in liquid nitrogen of the tissue and the production of sperm whenever the need arises. Sperm can be obtained after the recovery from the tissues and were applied for ICSI, and the oocytes were transferred to recipients. We could obtain live male and female piglets (Kaneko et al. 2013). Both themale and female pigs showed normal reproductive abilities (Kaneko et al. 2014). It can be suggested that cryopreservation of testicular tissues is one of the conservation methods for boar genetic resources.

Key words: Pig, Cryopreservation, Vitrification, testicular tissue, Gene bankReferences:
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Nakai et al., Theriogenology 2009; 72:2-9. doi: 10.1016/j.theriogenology.2008.10.020.Nakai, et al., Reproduction 2010; 139: 331-335. doi: 10.1530/REP-09-0509.

# Session 4

## Nutrition, Management, Biosecurity and Production Systems

Session 4 - Chairperson


# Yih-Fwu Lin

**Former Chief of Nutrition Division**
**Livestock Research Institute,**
**Council of Agriculture, Executive Yuan**
**Taiwan (R.O.C.)**


## Introduction & Experiences

- **Professional Experience**
  - ■ Technician, Taiwan Provincial Government (1985~1988).
  - ■ Researcher, Livestock Research Institute (1988~2022).
  - ■ Passed National High Level of Professional Technician Examination in 1988.
  - ■ Passed National High Level of Civil Service Examination in 1989.
- **Further Studies Abroad**
  - ■ Studied on “Feed manufacture techniques” at Kansas State University, USA in 1991.
  - ■ Studied on “Application of immune response in poultry selection” at Institut National de la Recherche Agronomique, France in 1998.
- **Society Membership**
  - ■ The World’s Poultry Science Association-Taiwan Branch.
  - ■ The Chinese Society of Animal Science.
  - ■ The Agriculture Association of Taiwan.

## Education

- PhD of Biology, National Cheng Kung University, 2005.
- Master of Animal Science, National Taiwan University, 1995.
- Bachelor of Animal Science, National Chung Hsiung University, 1982.


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# József Rátky

Session 4 - Keynote 4

**Professor**
**Department of Obstetrics and Farm Animal Clinic**

**Professor**
**Head of Department,**
**University of Veterinary Medicine Budapest,**
**Hungary**

## Introduction & Experiences

- Hungarian Society of Animal Reproduction, Board member, 1993 – present
- Hungarian Scientific Research Fund, Jury of Agriculture 2, Chairman, 2006 – 2009
- Hungarian Academy of Sciences, Committee of Animal Genetics, Breeding and Nutrition, 1993 – present
- European Embryo Transfer Association, Board Member, 2000 – 2009
- European Embryo Transfer Association, Vice president, 2001 – 2009
- European Association for Animal Production, Comission of Physiology, Vice president, 2000 – 2008
- Journal of Reproduction and Development (journal of the Japanese Society of Reproduction), member of the editorial board, 2002 – present
- Journal of Tekirdag Agricultural Faculty, member of the editorial board -1999 - present
- Hungarian Journal for Animal Breeding and Nutrition, member of the editorial board, 2005 – present

## Education

- DVM.,PhD., Doctor of the Hungarian Academy of Sciences
- University of Veterinary Science, Budapest, 1985

### Contact Information

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# Deep Frozen Semen and Embryo Backup of Hungarian Native Pig Breeds in Pandemic Situation

J.Ratky[1], I.Egerszegi[2], D.Torok[1], F.Albert[2], Sz-T.Nagy[2], Sz.Bodo[2], Zs.Benedek[2], P.Toth[3] and B.Somoskoi[1]
[1]*University of Veterinary Medicine Budapest, Hungary*
[2]*National University of Agricultural and Life Scjences, Godollo, Hungary*
[3]*National Association of Mangalica Breeders, Debrecen, Hungary*

African Swine Fever (ASF) generated unprecedented disaster in global pig production, recently. Track of the infectious disease was documented well from East Africa via in Eastern countries and appeared in the EU. Pig breeding suffered unforeseen harm in many countries. Approximately 8 to 10,5 million pigs were culled to avoid the rapid enlargement of infected regions. Frankly it could not really stop the spread of ASF to the EU, honestly due to human and wild boar vectors. Uptill now Hungary prevented the contamination in domestic pig population nevertheless wild boar population was infected to the middle of our country. We know that international commercial restrictions are practically the same whether ASF is detected in wild boars or domestic pig population. However different bilateral agreements of seller and buyer countries enable the pork trading e.g. on the basis of so called regionalization. Concerning on the breeds it can be declared that big international companies have large enough genetic resources at different geographical locations safe from ASF till the moment thus they can replace the lost populations. Indigenous swine breeds of some countries and regions represent a special value in genetic and commercial point of view. Each of these populations represent limited number of breeding sows and boars and kept mostly in the related country or countries. If they disappear due to any pandemic disease or preventive culling the population can be hardly or cannot be replaced at all. According to good examples it is sure that apart from in vivo gene preservation in vitro gene conservation would play a key role in such a tragical case.

Hungarian researchers and breeders do agree in this situation Red, Black and Swallow-Bellied Mangalica as well as the endangered Hungarian Large White pig can be extinguished in case of ASF contamination and no chance for replacement any more. The University of Veterinary Medicine Budapest was appointed by the Ministry of Agriculture to establish a group of experts in Hungary for creating an in vitro gene reserve of aforementioned Hungarian pig breeds together with the relevant breeding associations i.e. National Association of Mangalica Breeders and Hungarian Purebred Pig Breeders' Association. In the still ongoing project 60 to 100 boars and 20 to 30 gilts are included for collecting and deep-freezing semen and early embryos, respectively. At cc two third of the program more than 1700 straws of semen of 6 Mangalica and 25 HLW boars were deep frozen. Semen quality were checked by CASA and ejaculates of more than 80% motile sperm cells were used in the program. At the beginning it was suspected that most sensitive points would be the collection of semen from the selected boars of rare strains and the freezing ability of different ejaculates as well as the deep-freezing of the early embryos. Boar semen and porcine embryo deep-freezing had been elaborated long ago however it must be adjusted to each native breeds.

Key words: indigenous pigs, epidemic, in vitro gene reserve

Session 4 - Topic 7


# Fang-Chueh Liu

**Researcher**
**Nutrition Division,**
**Livestock Research Institute,**
**Council of Agriculture, Executive Yuan**
**Taiwan (R.O.C.)**


## Introduction & Experiences

1. From 12/24/1983 to 90.05/01/2001 Department of Livestock Nutrition, Taiwan Livestock Research Institute. Position: Assistant.
2. From 05/02/2001 to 01/18/2009 Nutrition Division, Livestock Research Institute, Council of Agriculture, Executive Yuan. Position: Assistant Researcher.
3. From 01/19/2009 to 04/30/2017 Nutrition Division, Livestock Research Institute, Council of Agriculture, Executive Yuan. Position: Associate Researcher.
4. From 05/01/2017 to04/30/2020 Animal industry Division, Livestock Research Institute, Council of Agriculture, Executive Yuan. Position: Researcher.
5. From 05/01/2020 to the present Animal industry Division, Livestock Research Institute, Council of Agriculture, Executive Yuan. Position: Researcher.

- General animal science
- Dietary protein source for weaning piglet, animal nutrition, intestinal digestion and metabolic effect.
- Using recombinant lipase for weaning piglets, study on feed additives, by-product fermentation.

## Education

- PhD, National Chung Hsing University, 2008.
- Master, National Taiwan University,1999.
- Bachelor, Tunghai University,1987.


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# Study on the dietary nutrition of TLRI No. 1 Black pig

Chueh-Fang Liu[1], A-Li Hsu[1], Zong-wen Liao[1]

[1]Taiwan Livestock Research Institute, Tainan, Taiwan

The TLRI Black Pig No. 1 (TBP) was named in 2001 and became a new breed of black pig, which contains 25% *Taoyuan* pig and 75% *Duroc* pig of blood line. The relevant nutritional studies are described below according to gestating and lactating sow, nursery pig and growing-finishing pigs: (1) For TBP gestating sows, increased the amount of daily feed from 2.0 kg to 2.4 kg or 2.8 kg during 90 - 114 days pregnancy. The results showed that increasing the amount of daily feed up to 2.8 kg/day from 90 -114 days pregnancy could raise the number of pigs born live and survival rate. (2) For TBP lactating sows, fed 15% crude protein (CP) or 18% CP or 15% CP supplemental lysine to equal the lysine content with 18% CP diet. The results demonstrated that sows fed containing 15% CP supplemental lysine of diet had a higher weight gain of suckling pigs than 15% CP diet. (3) For TBP nursery pigs, fed containing 0.85%, 0.95%, 1.05%, 1.15% and 1.25% lysine of diets, respectively. The feed efficiency of the weaning pigs were improved by increased lysine contents from 0.85% to 1.05%, but not in feed intake and daily weight gain among lysine contents. As state above estimated that feeding with 1.05% lysine level of diet could maintenance normal growth for TBP nursery pigs. (4) Nutritional studies of TBP growing- finishing pigs. TBP grower pigs fed with 0.75% and 0.85% lysine content of diets revealed that feeding 0.85% lysine had a higher feed intake and daily weight gain than 0.75% lysine excluding feed efficiency. According to results estimated 0.85% lysine content could satisfy the lysine required for TBP grower pigs. During finishing period, there was no significant difference in growth performance between 0.60% and 0.70% lysine contents while digestive energy (DE) was at 3250 kcal/kg. Based on results, indicated that 0.60% lysine and 3250 kcal/kg DE could be an appropriate lysine and energy requirement in growth performance and carcass quality of TBP finisher pigs. In the future perspective for TBP pigs will continuously improve their growth performance and carcass quality through selection, which still requires appropriate nutrition supply. Therefore, it is still necessary to continue to explore nutritional research to meet growth performance of the TBP pig.

Key words: Nutrition, Nursery pig, Gestating sow.


# Ming-Che Wu

**Fatty Pig International Advisory Group**

**Former Head**
**Livestock Research Institute,**
**Council of Agriculture, Executive**
**YuanTaiwan (R.O.C.)**


## Introduction & Experiences

Former Head of Animal Breeding and Genetics Division at Taiwan Livestock Research Institute to conduct national data banking for animal performance improvement and smart technology development from 2004 to 2021. Previously served as the Director of DairyResearch Center at Taiwan Livestock Research Institute, overseeing the technology dairy farming and economic development activities across dairy industry from 2000 to 2004. Healso served as the theme leader at Taiwan Animal Germplasm Center for international cooperation on conservation of farm animal genetic resources from 2004 to 2021. He was appointed as Research Fellow at Taiwan Livestock Research Institute in 1990 to promote national artificial reproductive technology and web-based data networking for field application in animal breeding industry.

## Education

- PhD, University of Illionis, USA, 1987
- Master, National Taiwan University, 1981
- Bachelor, National Taiwan University, 1978


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# Session 5

## Industry, Environment and Marketing

Session 5 - Chairperson


# Jen-Wen Shiau

**Researcher and Director**
**Hsinchu Branch,**
**Livestock Research Institute,**
**Council of Agriculture, Executive Yuan**
**Taiwan (R.O.C.)**


## Introduction & Experiences

Jen-wen Shiau is currently a researcher and director of the Hsinchu Branch of Taiwan Livestock Research Institute (TLRI). He has previously worked in the Breeding and Genetics Division, Technical Service Division, and Physiological Division of TLRI. His main research interests include the application of molecular biotechnology in livestock and poultry production, dairy cattle reproduction and breeding technology, smart agriculture and dairy automation applications, etc.

## Education

- PhD, National Taiwan University, 2000
- Master, National Chung-Hsing University, 1994
- Bachelor, National Chung-Hsing University, 1987


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Session 5 - Keynote 5

# Dr. Synan S. Baguio

**Director**
**Livestock Research Division**
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**Philippines**
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## Current Position and Designation:

Chief Science Research Specialist and Director, Livestock Research Division, DOST-PCAARRD, LosBaños, Laguna, Philippines.
Tasks and functions are in the areas of:

- Livestock and Poultry R&D Management (Planning, Monitoring and Evaluation)
- Technology and Science-based Information Packaging and Dissemination
- Livestock R&D Program Proposal Packaging
- Human Resource Capability Building (mentoring young researchers in R&D institutions)
- Technical consulting in private livestock and poultry farms
- Establishment and Maintenance of Local and International Linkages

**Current In-House and Interagency Committee Memberships:**

- DOST-PCAARRD Directors' Council
- DOST-PCAARRD Policy Advocacy Group
- Interagency Technical Working Group for Swine Breeder Farm Accreditation Program(DA-BAI)
- Interagency Technical Working Group for the Accreditation of Swine AI Laboratories andService Providers (DA-BAI)
- Interagency Technical Working Group for the Philippine Native Animals Development(PNAD) Program (DA-BAI)
- Regional Research and Development Coordinating Council, WESMAARRDEC andMAARRDEC (permanent alternate to the Executive Director)
- Department of Agriculture (DA) Biotech, Technical Working Committee
- Member, Board of Trustees, Philippine Swine R&D Foundation

**Relevant Trainings, Seminars and Workshops:** (in the past 5 years)

- Effective Conflict Resolution and Solving Performance Issues thru Mediation, Human Resource Innovations and Solutions, Inc. (HURIS, Inc.), Pasig City Philippines, June 27-28,2019.
- Achieving a Positive Turn-around in Employee and Organizational Performance thru Positive Discipline, Human Resource Innovations and

Solutions, Inc. (HURIS, Inc.), PasigCity Philippines, June 20-21, 2019.

- Thinking Out-of-the-Box: Embracing Innovative Leadership, Human Resource Innovations and Solutions, Inc. (HURIS, Inc.), Pasig City Philippines, May 16-17, 2019.
- Regional Workshop on Underutilized Animal Genetic Resources and their Amelioration, Malaysian Agricultural Research and Development Institute, Selangor, Malaysia. March4-6, 2019.
- Seminar on Robots for Dairy Farming and Awarding of Prolific Cows that Produce Ten Tons or More Milk in 305 days Lactation Period. Livestock Research Institute, Council ofAgriculture Executive Yuan, Tainan, Taiwan, January 24, 2019.
- e-Asia Joint Research Program (e-Asia JRP) workshop on Agriculture. PathumwanPrincess Hotel, Bangkok, Thailand on March 1-2, 2018.

**Scholarships and Awards:**

- PCARRD Research Management Fellowship Award to the Central Visayas Consortium forIntegrated Resources Research and Development, 1996-1997
- PCARRD-DOST PhD. Scholarship Award, 2008-2001
- Australian International Development Assistance Bureau Scholarship Award, 1988-1990
- UPLB Gamma Sigma Delta, Best PhD. Dissertation Award, 2006
- PCARRD Outstanding PhD. Thesis Award, 2006

**Papers Presented in Seminars and Conferences:**

- Status of Underutilized Animal Genetic Resources for Food and Agriculture in SoutheastAsia. Presented during the Regional Workshop on Underutilized Animal Genetic Resources and their Amelioration, Malaysian Agricultural Research and Development Institute, Selangor, Malaysia. March 4-6, 2019.
- R&D Directions and Strategies for the Conservation and Profitable Utilization of Philippine Native Pigs and Cattle presented during the e-Asia Joint Research Program (e-Asia JRP) workshop on Agriculture. Pathumwan Princess Hotel, Bangkok, Thailand on March 1-2, 2018.
- The Importance of Artificial Insemination to the Philippine Swine Industry presented during the International Seminar on Boar Semen Application for Pork Quality, Vietnam National University of Agriculture in Hanoi, Vietnam, on November 6-10, 2017.
- R&D Initiatives towards Designing Climate Change Resilient Domesticated Animal Genetics in the Philippines. Presented during the international seminar on coping with Adversity Climate: genetic products of selected livestock and poultry, Livestock ResearchInstitute (LRI), Council of Agriculture, Executive Yuan, Tainan, Taiwan on May 20-26, 2017.

**Publications:**

- Hughes, P. E., Pearce, G. P. and Baguio, S. S. 1992. The effects of oestradiol treatment onactivity, growth and survival in neonatal piglets. Animal Production 54: 299–304.
- Baguio, S. S. and Capitan, S. S. 2009. Motility, livability and fertility of cock spermatozoaas influenced by day of collection, dilution and cryopreservation. Philippine Journal of Veterinary and Animal Science. 45 (2).

**Membership in Societies and Organizations**

- Governing Council Member, Philippine Society of Animal Science, 2021-2022
- Member:
  - Alpha Rho Sigma Fraternity (Silliman University Chapter)
  - Silliman University Alumni Association
  - Philippine Association of Agriculturists
  - DOST-PCAARRD Graduate Alumni Association
  - PCAARRD Employees Association

# Education:

| Date | Institution | Degree Earned |
|---|---|---|
| 1998-2005 | University of the Philippines at Los Baños<br><br>College, Laguna, Philippines | Doctor of Philosophy in Animal Science (AnimalPhysiology) |
| 1988-1990 | University of Melbourne Parkville, Victoria, Australia | Master of Agricultural Science in AnimalScience |
| 1978-1982 | Silliman University, Dumaguete City,Philippines | Bachelor of Science in Agriculture (Animal Husbandry) |

# Native Pig Genetic Resources Improvement and Utilization inthe Context of Industry Building, Product Development and Environmental Protection

**Synan S. Baguio**
Director
LivestockResearch
Division
DOST-PCAARRD, Philippines

Native or indigenous pigs are among the most prominent features in small farm landscapes. Overthe years, these pigs provide economic, social and cultural benefits to rural communities. Being products of natural selection, they develop unique morphological characteristics and behavioral patterns that enhances their fitness to the natural environment. They are also known to have relative resistance to diseases and parasites, and are more resilient to extremes of weather. These characteristics enable the native pigs to survive and reproduce even with minimal management intervention. Moreover, these pigs produce meat with unique taste and texture that makes it the best raw material in the processing of ethnic delicacies that are preferred and paid premiumprices by consumers.

Owing to the native pigs' adaptation to the natural environment, cash capital and technological requirements to produce them are low compared to their commercial hybrid counterparts. Thus, small and often financially challenged farmers are able to participate in the production and build sustainable livelihood from these pigs. Furthermore, being part of the community's farming or food production culture, meat of these pigs is often used in the preparation of specialty products that are offered during festivities and cultural rituals. However, the potentials of native pigs in generating sustainable income for farmers and in building sustainable enterprises are yet to be realized.

Production of native pigs is commonly accomplished following free range or extensive management systems. This system is expected to sequester more CO2 if these pigs consume more forages and minimize carbon emission when it is returned to the soil thru the feces. This practice of native pig production fits well with the framework of "regenerative agriculture" thatis considered as environment friendly food production system.

Current R&D initiatives related to the conservation, improvement and utilization of native pigs are focused on 1) selection and breeding in favor of specific traits that enhances productivity, production efficiency and product quality; 2) assisted reproduction in support of hastening the multiplication and distribution of desired traits; 3) product development and 4) policy studies in support of marketing and sustainable native pig production.

Outputs of these R&D initiatives are expected to drive native pig production to becoming a dynamic sub- sector of swine industries in pork producing countries.

Key words: native pig production, native pig improvement and utilization

Session 5 - Topic 9


# Yi-Chain Lee

**Senior Specialist and Chief**
**Department of Animal Industry**
**Livestock Industry Section**
**Council of Agriculture, Executive Yuan**
**Taiwan (R.O.C.)**


## Introduction & Experiences

- Served in the Council of Agriculture (COA), Executive Yuan since 1994
- In January 2013, been transferred to serve in the Executive Yuan, and in January 2015, returned to serve as the chief of the poultry industry section of the Department of Animal Industry, COA
- In December 2020, been transferred to serve as the chief of the livestock industry section of the Department of Animal Industry, COA until now

## Education

- Master, Department of Agriculture Economics, National CHUNG HSING University, 1992
- Bachelor, Department of Agriculture Marketing, National CHUNG HSING University, 1990


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# Introduction of Black Pig Industry in Taiwan

Yi-Chain Lee

There about 622,000 black pigs are raised in Taiwan, accounting for 11.4% of the total 5.473 million heads. Generally, the breeding period of white pigs is about 6~7 months, while the black pigs are longer, and some local black pigs are more than 12 months, and the breeding adjustment will be made according to different types of black pigs, so that black pigs in Taiwan are individually raised Pig farms vary in uniformity, growth rate and carcass traits.

In order to prevent the invasion of African Swine Fever, Taiwan has provided guidance on measures related to the conversion of food waste to feed since 2019, and also assisted in the development of local characteristics of the black pig industry. In addition, experts in the field of industry, academia and research were invited to discuss the production and sales of black pigs, and to formulate a selection of varieties. We also focus on breeding, improving feeding patterns, strengthening nutritional needs, disease prevention and biosecurity, and researching to increase meat quality characteristics and products research and development, as well as brand building and marketing.

The breeding period of black pigs is longer than that of white pigs, and the feed meat exchange rate and growth rate are also lower than those of white pigs. Therefore, providing consumers with high-quality black pork and related products is a necessary topic in the future.

Key words: black pig, uniformity, growth rate, carcass traits, brand building and marketing

Session 5 - Topic 10


# Jihn-Shiun Alexander Chao

**Head, Department of Animal Resources**
**QPS**
**Taiwan (R.O.C.)**


## Introduction & Experiences

- Head, Department of Animal Resources, QPS Taiwan
- Attending veterinarian of Institutional Animal Care and Use Committee (IACUC) in QPS Taiwan
- Deputy Testing Facility Manager, Center of Preclinical Services, QPS Taiwan

## Education

- M.S. D.V.M., National Taiwan University, Taipei, Taiwan, 1999


**Contact Information**

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# The Application of Minipigs for Preclinical Development

Jihn-Shiun Chao, Yu-Hui Yang, Nan-Yu Su, Hsiao-Lin Chen

QPS Taiwan, Taipei, Taiwan

QPS' globally recognized toxicology scientists offer a wide range of toxicity studies, as well as other preclinical safety tests, that are essential for preclinical drug development programs. We have a long and successful track record of designing specialized *in vivo* studies. Quality and flexibility are the key factors as we work together to ensure that all regulatory studies for your investigational new drug (IND) filing are not overlooked. We will design and execute the most cost-effective development strategies for your drug candidates. Our commitment is to provide you with a fast and reliable route to clinical phase 1-2 studies.

Since early 2019, and as a next step in the development of our service offerings at QPS Taiwan CTPS, we have begun to offer studies utilizing mini pigs. Mini pig is an animal model that is widely used for preclinical research across Asia, the United States, and Europe due to anatomical, biochemical, and physiological similarities to humans. With a can-do attitude and an affinity to embrace change, QPS TaiwanCenter of Toxicology and Preclinical Services (CTPS) notices the trends in the marketplace and sets up the milestone for others. To date, we are proud to have successfully completed several studies in mini pigs, including a good laboratorypractice (GLP) repeated study.

At QPS Taiwan we view the opportunity to change, develop, and adopt new methods and systems as investments in ourselves that make us better partners and increase the value of the service that we provide to our sponsors, from small biotechs to large pharmaceutical companies.

*In vivo* animal models are the most efficient and clinically relevant approach for studying wound healing. Our veterinarians are capable of performing surgeries for testing of wound healing, with post-operation monitoring of clinical observations, body weight, and food consumption. Wounds are regularly measured for assessmentof the extent of healing. At the completion of the in-life experimentation, our board-certified pathologist (DACVP) performs histopathology examination of thewound tissues. All studies are reviewed by IACUC in compliance of animal welfare requirements.
The atopic dermatitis model in mini pigs is currently under establishing, the clinical

endpoints and scoring system includes: SCORAD index (scoring atopic dermatitis, blood samplings for circulating cytokines ELISA test, skin biomarkers via histology HE Stain/IHC stain, statistical analysis of efficacy data, clinical scoring, and histomorphometry for quantitatively evaluation.

Key words: Lanyu-400 mini pig, preclinical, wounds healing, atopic dermatitis, Taiwan

# Session 6

## Meat Quality, Products and By-Products

Session 6 - Chairperson


# Fa-Jui Tan

**Professor**
**National Chung Hsing University**
**Taiwan (R.O.C.)**


## Introduction & Experiences

- Professor of Department of Animal Science, National Chung Hsing University, Taiwan
- Major research interesting: Development and utilization of animal products (meat, egg, and byproduct), caracass and fresh meat quality and evaluation
- Committee member of the Certified Agricultural Standards Association, Taiwan.
- Reviewer of various scientific journals including Food Chemistry, British Poultry Science, Animal Science Journal, Food Bioscience, Journal of Food Science & Technology, International Journal of Agricultural Technology, Journal of Food Process Engineering, LWT – Food Scuence & Techology, and etc.
- Outstanding Young Scholar Award (2010). National Chung Hsing University.

## Education

- PhD, The Ohio State University, 2002
- Master, Purdue University, 1997
- Bachelor, National Chung Hsing University, 1991


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Session 6 - Keynote 6


# Mercedes Izquierdo Cebrián

**Swine Research Unit Coordinator**
**Center of Scientific & Technological Research of Extremadura (CICYTEX)**
**Spain**


## Introduction & Experiences

From 1998 to 2005, back in the CICYTEX research institute (Extremadura, Spain), she worked on genetic improvement of milk production of Merino sheep with the Merino Breeders Association. In 2006, Mercedes started working in Iberian pig research, and she isthe coordinator of the Monogastric Research Unit at CICYTEX since 2010, focusing herwork on the genetic improvement and production of the Iberian pig. She is a specialist in the study of carcass composition in vivo using ultrasound technology and has also worked on sustainable feeding systems and on animal welfare, especially in inmunocastration.

She has participated in many national and some international research projects, but she has also focused her work on projects with companies and pig producers. She is the scientific coordinator of the Official Program for the Genetic Improvement of the Iberian Pig and collaborates very closely with the National Association of Iberian Pig Breeders (AECERIBER). She collaborated with the University of Extremadura as a lecturer of a master's degree on livestock breeding in extensive production. She has directed 4 PhD Dissertations, has published numerous scientific publications and participated in numerous international conferences and meetings. She was the organizer of the IV Fatty Pig congress in Badajoz, Spain in 2017.

## Education

- PhD, Animal breeding and Production with a Minor in Statistics, Iowa State University (ISU), 1997
- Master, Animal Breeding and Production, Complutense University of Madrid, 1992
- DVM (Veterinary Medicine), Complutense University of Madrid, 1986


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# Iberian pig production: genetic background, finishing systems, carcass traits and product quality

M. Izquierdo-Cebrián[1]
[1]*Institute of Research, Science and Technology of Extremadura (CICYTEX), Spain*

The traditional Iberian pig production system is based mainly on the use of natural resources as feed sources in a slow growth, long life cycle to produce high-quality meat. In relation to reproductive aspects, the usual farrowing facilities can be divided into two different types; one is based on individual huts (camping type) placed outdoors and the other on conventional farrowing cages within a maternity building facility. In both systems, the numbers of piglets born (8.97), born alive (7.08) and weaned (5.8) are less than in the conventional breeds. Increasing the number of weaned piglets is one of the objectives of the Iberian pig genetic improvement program.

Regarding feeding management, the Iberian breed can be considered as an obese breed due to its leptin resistance, which is based on specific mutations of the leptin gene. In relation to this, pigs are fed-restricted from 40 to 100 kg to avoid an early excessive fattening, and then, during the finishing period (from 10-12 to 12-15 months of age), pigs are fed ad libitum, taking advantage of compensatory growth, resulting in a great increase in fat deposition. Fattening can be done in an extensive, free-range system based on acorn feeding (*montanera*) or in a semi-extensive system based on concentrate feeding. The *montanera* period goes from November to March, when the acorn is ripe and available. In relation to this, Official Quality regulations divide Iberian pig products into four categories: labeled with different color depending on genotype and finishing system, "black label" is for products of pure Iberian pigs fed in the *montanera* system; "red label" is for products of crossbred Duroc x Iberian pigs fed in the *montanera* system as well; "green label" is for products of pure Iberian or crossbred Duroc x Iberian pigs fed in extensive system with concentrates; and "black label" is for products of crossbred Duroc x Iberian pigs fed in intensive system with concentrates as conventional intensive production; Pure Iberian pigs are slaughtered with an average weight of 160 kg.

There are important differences between the *montanera* system (black label) and the extensive fattening system (green label) in relation to the quality of carcass, meat and meat products. For example, pigs finished in a *montanera* system have thicker subcutaneous fat depots, smaller prime cut yields and similar intramuscular fat content than concentrate-finished pigs. In relation to lipid metabolism, free-ranging *montanera* pigs have healthier fats, with higher percentages of MUFAs and PUFAs and better, aterogenic and trombogenic index, and therefore more healthy meat than those finished on concentrate. Hams from *montanera* pigs are cured around 1100 days lose less weight (2.7 kg.) than those finished on concentrate during 900 days (3.0 kg.). Finally, in relation to the sensorial evaluation, hams from pigs fed in *montanera* have better scores in terms of marbling, flavor and juiciness than those finished on concentrate.

Therefore, it can be concluded that the Iberian pigs finished in a *montanera* system have fresh meat and cured products of great organoleptic quality and with healthier fats than those fed concentrates.

Key words: Extensive production, acorns, carcass traits, cured meat products, Iberico

Session 6 - Topic 11


## Chin-Bin Hsu

**Chief of Nutrition Division**
**Livestock Research Institute,**
**Council of Agriculture, Executive Yuan**
**Taiwan (R.O.C.)**


## Introduction & Experiences

I have been serving in Livestock Research Institute (LRI) since 1997, and have been devoting to working on pig nutrition research and black pigs breeding and promotion. At the initial years of my career, I researched the protein and amino acids requirements of pigs. About 21 years ago, I switched to a new position and presided over a black pig breeding program. After 11 years of breeding, our team completed the breeding and naming of KHAPS black pigs (coded K). We successfully promoted K black pigs to become the famous maternal line in Taiwan, and completed 10 cases of breed and technology transfer contracts. Our contributions and achievements to the systematic breeding and brand building of black pigs in Taiwan are quite remarkable.

In recent years, I have led our department team to develop animal health feeds to reduce the use of antibiotics. We have established a good demonstration case of circular agriculture, and also transformed agricultural waste (Citrus depressa peel) into magical resources and wealth.

## Education

- PhD in Animal Nutrition, National Chung-Hsing University, 2010
- Master of Animal Nutrition, National Chung Hsing University, 1995
- Bachelor of Animal Science, Tung-hai University, 1992


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# Breeding, products development, and industrial promotion of KHAPS black pigs (K)

Chin-Bin Hsu
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In Taiwan, consumers generally have a special preference for black pork products. However, black pig breeds are disorganized, with inconsistent body conformation and poor reproductive performance. Therefore, the breed selection of black pigs with stable genetics, high fertility, and good meat quality can form the product segmentation, and keep competitive in the market. We used the prolific Meishan pig to crossbreed with high-growth Duroc pig in KHAP Station, LRI since 1997, and screened for stress-resistant gene (CRC gene) and prolific gene (ESR gene) in the entire population of subsequent 6 generations. After 11 years of selection, we had bred a new breed of black pigs, named in 2009, called **KHAPS black pigs** (codenamed **K**). That was the first black pig breed bred by genetic screen in Taiwan. The K black pigs still retain some of the appearance and characteristics of local breed, such as large and drooping ears, wrinkled forehead, short body, and slightly drooping abdomen. The body weights of K boars and gilts on 70-day and 210-day of age were 20.0, 104.9 kg and 18.8, 89.9 kg, respectively. Functionally, K black pigs can be raised as hogs, with excellent meat quality, tender and juicy; as sows, they have nice motherhood and high fertility.

In terms of promotion and application, we have signed 10 cases of technical transfer contract concerned with release of K breed. At present, some agricultural companies have developed their brands of hog products successfully, and one company has exported hybrid black pigs to Hong Kong. Due to the successful promotion of K black pigs, we have developed a more systematic cross breeding system in the production of hybrid black hogs

Key words: Black pig, genetic screen, meat quality, Meishan pig.

Session 6 - Topic 12


# Bénédicte Lebret

**Research scientist, permanent position (since 1994)**
**INRAE - French National Research Institute for Agriculture, Food and Environment**
**PEGASE (Physiology, Environment, and Genetics for the Animal and Livestock Systems), INRAE-Institut Agro, F-35590 Saint-Gilles, France**


## Introduction & Experiences

- Habilitation thesis to Supervise Research, University of Rennes-1. Quality of meat and products in the pork chain: biological bases, influence of farming conditions, and identification of quality predictors. 2016
- Scientific and administrative responsibilities
  - **Internationally**
    - Head of Work Package (18 partners), European H2020 TREASURE project (2015-2019)
    - Head of Work package (8 partners), European FP-6 Q-Porkchains project (2007-2012)
    - INRAE representative, Executive Board of European H2020 Coordinating and Support Action SLO-ACE (2017-2018)
    - Deputy Section Editor (2014-present) of the international journal Animal, section Product quality, human health and well-being
    - Reviewer of manuscripts (~ 100) for peer-reviewed journals (categories Animal science and Food science) and of projects submitted to international or national calls
    - Member of the scientific committee of the International symposium on Mediterranean pig (2007-2016)
    - Member of PhD examination committee (Norvegian University of Life Sciences, 2011)
    - Member of the European Association for Animal Production
  - **Nationally**
    - Member (1996-2015) and Head (2001-2010) of the scientific committee of the yearly French workshop “Journées de la Recherche Porcine” (Research Swine Days)
    - Co-moderator of the working group on Pork quality, UMT Porcin INRA-IFIP (2007-2016)
    - Member of the editorial team of peer-reviewed journal INRA Productions Animales (since 2013)

- Member of PhD examination (1), habilitation thesis (2) and PhD steering committees (4)

■ **At INRAE**

- Head of research team Animal growth and pork quality (15 permanent staff; MSc, PhDs, post-docs), INRA UMR SENAH (2002-2011)
- Member of the experts' group on pig production and pork chain (2004-2020)
- Co-moderator of the experts' group on pig production and pork chain (since 2020)
- Member of the collective scientific assessment on Quality of animal-sourced foods (2018-2020)
- Member of the strategic steering committee of the metaprogram INRAE SYALSA (since 2020)
- Member-elect of the scientific council of INRA Phase Division (2011-2020)
- Member of recruiting committees (research engineer, laboratory technicians)
- Member of evaluation boards for individuals (engineers) and collectives (research laboratory)

● Publications

■ 51 original publications in peer reviewed journals (including 27 as first or last author)
■ 30 review publications in peer reviewed journals and 6 book chapters (19 as first or last author)
■ 170 communications in conferences with proceedings, including 16 invited presentations
■ Detailed list on Web of science (H-index Core collection: 27) or on Hal

## Education

- Ph.D, Agrocampus Ouest, Rennes. Growth and tissue composition in growing pigs as influenced by feeding strategy: consequences on meat quality. 2009
- Master of Science's Degree, University of Nantes: Control and management of quality in the food industries. 1994
- Agronomy Engineer's Degree, Ecole Nationale Supérieure d'Agronomie, Rennes, Biochemistry and processing of animal products. 1992

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# Quality attributes of pork and processed products from fat breeds. Examples of local French breeds

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The quality of pork and processed products include several properties or attributes: safety, commercial (carcass and cuts value), sensory, nutritional, technological, convenience and image. Image covers ethical, cultural and environmental dimensions associated with the originof pork and the way it is produced and processed. Quality of pork and processed products (especially dry-cured ham) from local fat breeds has been considered using this framework, mainly focusing on commercial, technological, sensory, nutritional and image attributes.Quality is built and can be improved, but also be impaired, at all steps along the chain startingfrom pig production (breed, feeding, rearing conditions, slaughter age/weight…) through transport and pre-slaughter conditions, processing techniques (drying, salting cooking…) up toconsumption. Pig breeds that have not been selected for efficiency in lean meat production exhibit low production performance (growth rate, feed efficiency) and high carcass fatness, and usually high sensory and technological pork quality due to, among others, high intramuscular fat (IMF) content and water holding capacity. However, a wide variability of these quality traitshas been observed among European fat breeds, but also within breeds. Production system can further differentiate quality of pork from local fat breeds by allowing animals to express their genetic potential for IMF deposition, or by modifying fatty acid profile of muscles and backfat,all traits of high importance for the sensory quality and typicity of meat and processed products.Thus, genetic x environment interactions are essential in the development of quality of pork and processed products from local fat breeds. A consumers' study has shown that providing information on pig breed and production system to consumers influence their hedonic perception of dry-cured ham, illustrating the interactions between sensory and image attributes.Altogether, this work illustrates the specific quality attributes of pork and pork products from local fat breeds. It also highlights that quality of these products should be considered in a broad, farm to fork approach, including the assessment of synergies or antagonisms between quality attributes by multi-criteria analyses.

Key words: pig breeds, production system, feeding, meat, processed pork products, quality attributes

# Abstract 論文摘要

第六屆肥豬國際研討會
The 6th Fatty Pig International Conference

# Poster Presentation Excellent Award

S1 Indigenous pigs species and current challenges
S2 Genetics, breeding and preservation
S5 Industry, environment and marketing
S6 Meat quality, products and by-products

| | | |
|---|---|---|
| S50001 | Chih-Yu Lin<br>林智郁 | Study on the correlation between different black pig body conformation and auction prices in Taiwan hog auction market |
| S60001 | Meng-Ru Lee<br>李孟儒 | Comparison of pork meat quality of traditional black pigs between feeding kitchen waste and feed |

S3 Physiology, reproduction and development

| | | |
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| S30002 | Shih-Chung Wang<br>汪世崇 | Suitability of semen oxidative stress testfor predicting freezability of boar semen |

S4 Nutrition, management, biosecurity and production systems

| | | |
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| S40005 | Yu-Cheng Su<br>蘇禹丞 | Application of machine learning technology to predict reproductive performance in sows |
| S40008 | I-Heng Chang<br>張以恆 | Biomedical Research Applications of Minipigs in Different Breeds |
| S40009 | Shen-Chang Chang<br>張伸彰 | Effect of feed and food scraps on growth performance in black pig |

# Session 1

## Indigenous Pigs Species and Current Challenges

# A 14-Day Wound Healing Study in Mini-pigs

S10001

Yu-hui Yang[1], Meng-chi Li, Chia-ming Kuo, Nan-yu Su, Jihn-shiun Chao
[1]QPS Taiwan

This study aimed to evaluate the wound healing by creating different shapes of excision wounds in mini-pigs. Two shapes of wounds, circle wounds with a diameter of 3 cm and square wounds with a side of 2.5cm were created in one Lanyu 400 mini-pig and was observed for 14days. During the study period, no abnormal findings in daily clinical observation, food intake, or body weight change. Mild swelling was noted in one of the three circle wounds from Day 2 to Day 8, but not in square wound. Discharge secretion was found in all wounds from Day 3 to Day 5. All these findings were considered as part of the normal wound healing process. On Day 8 and Day 15, an average of 7% and 44% wound contraction in square wound and 0% and 42% in the circle were observed, respectively. These results indicated that the round excisions are likely to cause swelling and with the slightly slower rate of wound contraction than the square excisions.

Key words: wound healing, excisions, mini-pig

# Comparison of Growth Performance, Blood Lipids, Carcass Characteristics and Activities of lipogenic Enzymes Between TLRI Black Pig No. 1 and LYD Pigs at Different Slaughter Weight

S10002

Tein-Ming Su[1], Wei-Zhi Liu[1], Tzu-Hsuan Huang[1]
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The aim of this study was to investigate the influence of slaughter weight (SW) on chemical composition, adipocyte size, fatty acid composition, and lipogenic enzyme activities of subcutaneous fat tissue, and carcass characteristics of TLRI black pig No.1 (TBP) and compare with LYD【(Landrace♀ × Yorkshire♂)♀ × Duroc♂, LYD】 at different slaughter weights. A total of 96 TBP and 48 LYD pigs, half barrows and gilts respectively, were used in this experiment. Pigs were assigned to three groups of SW (i.e. 90, 105, and 120 kg) when their body weight (BW) was 50 kg and their blood sample was collected and analyzed in the initial and in the end of feeding period. Growth and feed conversion rate (gain/feed, FCR) were measured. Once pigs reached the SW, half of the pigs each group were randomly chosen and slaughtered. The Longissimus dorsi muscle (LM) at 10/11th rib and tenderloin muscle (TM) were collected for meat color, proximate chemical, and fatty acid composition analysis. The subcutaneous fat tissue at 10/11th rib was collected for measuring adipocyte size and lipogenic enzyme activities. The LYD had larger growth performance than the TBP. The blood lipid HDL and cholesterol of TBP had significantly different ($P < 0.01$) at final experiment than LYD pigs. The TBP had higher carcass fat percentage ($P < 0.05$) and larger backfat thickness (BFT; $P < 0.1$) than the LYD pigs, and smaller loin eye area (LEA; $P < 0.01$) and lower lean meat percentage ($P < 0.01$) when compared with LYD. The ash content of TBP's LM was lower than LYD's ($P < 0.05$). Crude fat content of TBP's LM ($P < 0.01$) and TM ($P < 0.05$) was higher than that of LYD. The LYD pigs had higher Hunter L value of LM ($P < 0.01$) and TM ($P < 0.05$) and Hunter b value, but lower in Hunter a value. The total monounsaturated fatty acid (MUFA) content of LM from TBP was higher ($P < 0.05$), while the total polyunsaturated fatty acid (PUFA) content was lower ($P < 0.01$) than the LYD pigs. The content of total saturated fatty acid (SFA) was similar for both breeds. The SFA content and lipid saturate index (SFA/MUFA+PUFA, S/U) of TM from TBP was higher ($P < 0.01$), but PUFA content lower ($P < 0.01$) than the LYD pigs. The TBP had larger adipocyte diameter ($P<0.01$) of subcutaneous fat tissue than LYD pigs. The activities of fatty acid synthetase, glucose-6-phosphate dehydrogenase ($P < 0.01$), ATP-citrate cleavage enzyme and NADH-malate dehydrogenase ($P< 0.01$) were higher in TBP than the LYD pigs. Both TBP and LYD had been inferior FCR, ADFI and ADG as slaughter weight (SW) increased. The blood lipid HDL and VLDL had significantly different ($P < 0.05$) among SW groups. The heavier SW pigs had higher dressing percentage ($P < 0.1$), longer carcass length ($P < 0.01$), thicker BFT ($P < 0.1$) and bellyfat thickness ($P < 0.1$), smaller LEA ($P < 0.01$) and higher carcass fat percentage ($P < 0.1$), but lower lean meat percentage ($P > 0.05$) in carcass characteristics were increased as the SW. The crude fat content ($P < 0.01$) in LM had increased as the SW. The Hunter L value of LM was lower ($P < 0.05$) as the SW increased, but Hunter a value and b value were very close. The PUFA content in the LM had decreased, but the SFA content and S/U of LM had increased as SW increased. The longer adipocyte diameter and higher lipogenic enzyme activities as SW increased. In conclusion, the ADG and FCR of TBP had significantly lower than LYD pigs, and TBP had thicker BFT, and higher lipogenic enzyme activities than LYD. The result indicated that TBP accumulated fat more easily than LYD during the BW 90 to 120 kg

# Session 2

## Genetics, Breeding and Preservation

# Formosa Black pig in Taiwan breeding swine auction web with selection traits on growth performance, body conformation and total sperm count

S20001

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Formosa Black pig is in common name in Taiwan for a large body size, solid black in coat color, a meat-type crossbred. Genetic improvement on traits of Formosa Black pig was adapted with birth recording in breeding herd book and breeding swine auction web system where applicable for international breed of pigs. Seven breeding farms raised them in small scale. Litter size and number of teats were 12.6 ± 2.4 live piglets and 14.1 ± 0.9 teats, respectively. Selection traits listed their means as follows: Age at 100 Kg of body weight in 48 gilts were 156 ± 6 days old with 3-point back fat thickness of 1.49 ± 0.03 cm and age at 110 Kg of body weight in 88 boars were 155 ± 4 days old and 1.43 ± 0.04 cm thickness of back fat. During the growth performance test period from 30 to 100/110 kg (gilt/boar), average daily gain was 0.96 ± 0.04 Kg in gilts with feed efficiency of 2.17 ± 0.05; average daily gain was 1.02 ± 0.01 Kg in boars with feed efficiency of 2.21 ± 0.03. Semen of each of tested-off boars collected on 253 ± 3 days of age with 159 ± 16 ml of semen. Body conformation traits of 109 boars measured at 168 Kg of body weight on 286 days old with 1.59 ± 0.06 cm thickness of back fat, 73.9 cm in shoulder height, 146.0 cm in length from neck to tail root and 36.7 cm in rump width. Total sperm count per collection was 67.2 ± 8.8 billion sperms in 196 ± 23 ml of semen. Body conformation traits of 139 gilts at 136 Kg of body weight were measured on 238 days old with 1.54 ± 0.05 cm thickness of back fat, 66.4 cm in shoulder height, 136.0 cm in length from neck to tail root and 35.0 cm in rump width. The combination length of shoulder height, body length and rump width were 256 cm in boar and 237 cm in gilt, respectively. In comparison to combination length in Duroc (258 cm), Landrace (263 cm) and Yorkshire (260 cm) boars, the body size of Formosa Black was like that of Duroc boar. Auction price sold of tested-off boars and gilts reached the highest of 75,000 and 40,000 TWD (30 TWD=1 USD), respectively. In conformation contest auction, sold price reached 109,000 TWD in boars and 39,000 TWD in gilts. Formosa Black in multiple breeding farms served as a terminal sire breed to produce a large body size of black hog for Taiwan live hog marketing.

Key words: Breeding, Marketing, Networking

# Expression of lipid metabolism-related genes in different muscles and different breeds of Taiwan black pigs

S20002

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[3]Department of Biotechnology and Animal Science, National Ilan University, Yilan, Taiwan

The intramuscular fat (IFM) in meat can affect the tenderness, juiciness and flavor of the meat. During slaughter, it is often found that the IMF of Taiwan black pigs is higher than Duroc, while previous studies on the relationship between pig gene expression and meat quality often focus on the *M. Longissimus Dorsi* (*MLD*). Therefore, this study not only compared the expression differences of lipid metabolism-related genes in the *MLD* of Taiwan black pigs and Duroc, but also included the analysis expression of lipid metabolism gene in the *M. Semispinalis Capitis* (*MSC*) and *M. Rectus Femoris* (*MRF*), to explore IMF fat of different pig breeds and different muscles. The test pigs consisted of 10 KHAPS black pigs from LRI of the C.O.A., and 10 Duroc and 16 black pigs from private pig farm (Pin-Pu, PP). The muscle samples of the 10th to 11$^{th}$ intercostal *MLD*, scapular *MSC*, and hind *MRF* were collected to extract RNA, and real-time PCR SYBR method was used to detect the lipid metabolism related gene expression, including *SREBP1c*, *CPT1b*, *FAS*, *Leptin*, and *H-FABP* gene. The results showed that the expression levels of *SREBP1c* and *H-FABP* in Duroc were the lowest of all ($P<0.05$), and were similar in K/PP. However, the expression level of *FAS* was significantly higher in *MSC* of K than Duroc ($P < 0.05$), which suggested that the lipid synthesis and fatty acid transportation were higher in K and PP compared with Duroc. The expression levels of *Leptin* in Duroc pigs were the highest of all ($P<0.05$), and were similar in K/PP.In KHAPS Black Pigs, the expression levels of *H-FABP*, *FAS*, and *SREBP1c* were the lowest in *MRF* ($P < 0.05$); but there were no significant difference between *MLD* and *MSC*. The expression levels of *H-FABP* and *CPT1b* in *MRF* were the lowest of all ($P < 0.05$), and were similar in *MLD*/*MSC*. *FAS* in *MLD* was the highest of all ($P < 0.05$), and there were similar in *MSC*/*MRF*. The expression levels of *SREBP1c* were in following order*: MLD*, *MRF* and *MSC*; *MLD* was the highest ($P < 0.05$). *Leptin* was the highest in *MRF* ($P < 0.05$), but not significantly difference between *MLD* and *MSC*. In black pigs, *MRF* showed the highest expression levels of *SREBP1c* ($P < 0.05$), but was similar in *MLD* and *MSC*. The expression levels of *H-FABP* in *MRF* was the lowest of all ($P < 0.05$), but there were no significant difference between *MLD* and *MSC*.

In conclusion, high potential of IMF accumulation could be expected in loin, shoulder and ham in K and PP than in comparison of the expressions of lipid metabolism-related genes to exotic pigs. However, we need more information like carcass trait to analysis the association between phenotype and mRNA expressions.

Key words: Intramuscular fat, Lipid metabolism-related genes, *M. Longissimus Dorsi*, *M. Semispinalis Capitis*, *M. Rectus Femoris*, Taiwan black pig.

# Long-term Sperm Cryopreservation and bioutilization of Taoyuan breed in Taiwan native pigs

S20003

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In recent years, the international epidemic situation has been severe. To avoid the invasion of the epidemic and the disappearance of Taiwan's domestic pig breeds, *ex situ* and *in situ* conservation of the Taoyuan pig germplasm is being accelerated. Semen cryopreservation is also carried out simultaneously. The objective of this study was to find out the fertility of sperm after years of freezing. In 2005, Taoyuan pigs whose sperm were frozen and stored in liquid nitrogen tanks at -196°C. Frozen semen was thawed and analyzed in 2020. Post-thawed sperm motility and progressive motility were 81.4 ± 3.6% and 65.7 ± 5.5%, respectively. Then, Two Taoyuan sows were selected for artificial insemination. The pregnancy and kidding rate was 100% and successfully gave birth to 6 and 7 piglets, the number of does kidding as the previous natural breeding. It is successfully confirmed that the preservation and application of Taoyuan pig frozen semen. The Taoyuan pig is a medium-sized pig with a black or dark grey coat, short head, large nostrils, large front drooping ears, concave back, and plump body, with annular wrinkles on the face and body, with the characteristics of the king's face. In 1941, Livestock research institute purchased the Taoyuan breed of black pigs to research local pigs and distributed the Taoyuan pig to the Taitung animal propagation station in the 1996. Currently, The Taoyuan pig is one of the few species of black pigs that have been preserved, and it is difficult to find pure Taoyuan pigs in the community.

Key words: Taoyuan pig, Indigenous, Frozen Semen.

# The difference between KHAPS black pig and LYD commercial pig on the traits of meat quality

S20004

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The purpose of this experiment was to investigate the meat quality and sensory evaluation of KHAPS black pig (Meishan ♀ × Duroc ♂, K), crossbred black pig (Duroc♀ × KHAPS black pigs ♂, DK) and commercial pig ([Landrace ♀ × Yorkshire♂] ♀ × Duroc ♂, LYD). Six pigs each from KHAPS black pig, DK black pig and commercial pig (half barrows and half gilts) with the body weight about 105 - 120 kg were slaughtered and the *Longissimus dorsi* (LM) muscle sample between 10th and 11th rib was collected to measure meat color and chemical and fatty acid composition. The results indicated that the LM total saturated fatty acid ($P < 0.05$) of K and DK black pig was higher than the LYD pig. The meat of LYD pig with higher ($P < 0.05$) USFA/SFA ratio ($P < 0.05$) compared with K and DK black pigs. Besides, there were no difference on the *Longissimus dorsi* muscle chemical composition and color values between three groups. In conclusion, our results show that in comparison with LYD meat, meat of K or DK black pig has better meat quality traits and is superior nutritional source of monounsaturated fatty acids.

Key words: Black pig, Commercial pig, Meat quality.

# Selection of heart-fatty acid binding protein gene on growth performance in black pigs

S20005

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KHAPS black pig (K) had better reproductive performance and stable genetic composition. To achieve better growth performance, the hybrid generation (DK, genetic composition D 50% and K 50%) was produced by mating Duroc (D) sow with HHaadd (HH6) haplotype of heart-fatty acid binding protein (H-FABP) gene and K boar with MM genotype of estrogen receptor (ESR) gene. Then generation was bred in a locked population and black color, porcine stress syndrome (PSS), H-FABP and ESR gene as the final goal of breeding. This study collected the daily weight gain (ADG) of DK generations, the feed conversion rate of boars (FCR), the thickness of backfat (BF), and the body length (BL), shoulder width (SW), chest width, hip width (HW), chest depth, body height, chest circumference, and tail circumference at 180 days. The results showed that the SW and HW of DK 5 generation ( had higher than Kbred (33.4 ± 2.3 and 31.9 ± 1.7 cm vs 29.8 ± 2.7 and 27.6 ± 1.5 cm), respectively. Moreover, the boar of DK 5 generation on body weight, ADG and BF were had higher than DK 2 generation at 180 days (107.0 ± 10.7 kg, 0.80 ± 0.08 kg/d and 2.10 ± 0.30 cm vs 104.0 ± 11.2 kg, 0.74 ± 0.09 kg/d and 1.94 ± 0.39 cm), respectively. In the future, the selecting of AA-MM-HH6 genotype will complete in black pig, which improve of BL and SW of DK generation.

Key words: Black pig, H-FABP gene, growth performance

# Identification of nucleus boar semen quality to ensure the sustainable conservation of Taiwan native Lanyu minipigs

S20006

Ting-Yung Kuo [1], Yeh-Ying Lee[2], Hsin-Hung Lin[3], Lin-Liang Peng [1], Yi-Long Chen [4], Chia-Chieh Chang[4], Cho-Chen Yang[2], Ming-Che Wu[1], Der-Yuh Lin[1]

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Lanyu pig is a native breed origin from Lanyu island of Taiwan. It is characterized by small body size and small erect ears and in addition to the traditional black Lanyu pigs (Lanyu 200), it can be further subdivided into different pig strains such as Lanyu 100 (Spotty pig), Lanyu 400 (Binlang pigs) by their hair coat and Lanyu 50 (Mitase pig) a cross mating with commercial pig breed. Lanyu pigs have now drawing much attention on biomedical experiments for its greatly physiological tolerance during and after surgical operation, therapy and easily manage. For stabilizing the supply of sufficient healthy laboratory animals and for maintaining provenance diversity, the nucleus boar semen quality was naturally important for laboratory animal supply chain and population conservation with so much at stake. Therefore, the purpose of this study is to ensure optimal fertility of nucleus boars and major advances in the selection of young boar to guarantee their semen fertility before get into nucleus herd. Experiment results showed an incidence of ejaculates with a sperm DNA fragmentation index (DFI), a damaged sperm DNA can lead to early embryonic or fetal death and can have a dramatic impact on health of the offspring, higher than 20% has been observed in Spotty pig and Binlang pig suggest that adding sperm DNA fragmentation as a new parameter to the routine assessment of every ejaculate may be beneficial to the field and the sperm DFI values could be an useful reference in extrusion of subfertility breeding animals. In conclusion, by further and routinely identification of nucleus boar semen quality to ensure the sustainable conservation of Taiwan native Lanyu minipigs could be expected.

Key words: Lanyu pig, Conservation, Semen quality, Fertility

# Evaluation and improvement of reproductive performance of KHAPS and Duroc cross breed

S20007

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The growth and reproductive performance of commercial black pigs are unstable because of the complicated breeding herd. Furthermore, it affects their value and decreases the economic benefits. Now using KHAPS black pig (K) sows which contain exceptional reproductive performance and MM genotype of estrogen receptor gene (ESR) mating Duroc (D) boars with better growth performance to produce hybrid generation (KD). The progeny was controlled to mate each other within their own generation. Meanwhile, the growth and reproductive performance of each generation of KD were collected. The specific genotype of AA and MM for the porcine stress syndrome (PSS) and ESR gene was strictly selected to accelerate the fixing of hair color as black, to raise growth performance, and to retain good reproductive quality. This study collected the reproductive performance of KD in each generation including number born (NB), born alive (BA), body weight (BW) at born, body weight and survival rate at the third week. There had been 23 parities of KD 2 generation sows breeding. The results showed that the average NB, BA, BW, body weight and survival rate at the third week was 11.6 ± 2.6 head, 10.1 ± 2.7 head, 1.30 ± 0.16 kg, 4.39 ± 0.89 kg and 86.3 ± 12.8%, respectively. Besides, the rate of black hair in KD 3 generation was 93.5%. Further data collecting and analysis are still needed in the future.

Key words: KHAPS black pig, cross breed, reproductive performance

# Session 3

## Physiology, Reproduction and Development

# Investigation of physiological characteristics of TLRI Black NO. 1 pig in the hot and cool seasons

S30001

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In this study, the blood biochemistry and hematologic values of TLRI Black No.1 pigs were measured. Under Taiwan's cool season (January to March) and hot season (June to September), at least 8 pigs of each period were selected for blood testing, half barrow and half female. They were used as experimental animals and raised in traditional open pig houses. They were three stages, namely nursery, growth and the finishing period. At the periods, the pigs were fed with corn and soybean diets, with crude protein 19%, 17.5% and 13.5%, respectively. The results showed that the concentration of complete blood count of white blood cell, basophils, glucose and cortisol were significantly ($P < 0.05$) higher the whereas blood biochemical value of MCV, MCH, CREA, SGPT, TP, ALB, GLO and Alk-P were significantly ($P < 0.05$) lower in the hot season. The WBC, RBC, Hb, NET, LYM, GLU, BUN, UA, CPK, GOT, GPT, TP, TG, and cortisol were not influenced by seasons. We conclude that the cold and hot season environment will affect the blood biochemical value of TLRI Black No.1 pigs. These physiological characteristics of TLRI Black No.1 pigs in the different seasons can be used to improve the management of TLRI Black No.1 pigs in the future.

Key words: Black pig, Cool and hot season, Hematological and biochemical parameters.

# Suitability of semen oxidative stress test for predicting freezability of boar semen

S30002

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Semen cryopreservation has many benefits, including long-term preservation, long-distance transportation, reducing cost for importing, and reducing risk of disease transmission. However, the process of cryopreservation can damage boar sperm resulting in reducing reproductive performance. Studies have shown that the freezability of boar sperm can vary between boars and ejaculates. Therefore, finding sperm with good freezability might be the key for better application of boar semen cryopreservation. Oxidative stress has been shown to be one of the main damages during sperm cryopreservation. In this study, we established $H_2O_2$-induced oxidative stress test mode to analyze the correlations between fresh or oxidative stress test semen with the boar frozen semen quality, and to evaluate the applicability of oxidative stress testing as a predictor of freezability of boar semen. The fresh semen collected from 64 adult boars were applied an oxidative stress test by 50 μM $H_2O_2$ for 3 hours. After the boar semen was frozen and thawed, the semen quality was evaluated respectively afterthawing short-term (30 minutes) and long-term (3 hours) incubation at 37 °C in order to analyze the correlations with those of fresh and oxidative stress semen before cryopreservation. The results showed that the coefficients of variation of all semen quality parameters increased after oxidative induction. Several sperm parameters of fresh and oxidative stress test semen were positively correlated with those of short-term thawed semen. All sperm parameters of oxidative stress test semen were significantly positively correlated with mitochondria activity (LMA) of thawed short-term semen ($P<0.05$), but not found in fresh semen. Also, several oxidative stress test sperm parameters were positively correlated with those of long-term thawed sperm and the LMH parameter had the highest positive correlation coefficient (0.43, $p<0.01$) with that of long-term thawed sperm. It was easier to recognize the boar semen freezability by oxidative stress test. The total motility and LMH of oxidative stress test were good indicators for assessing short and long term thawed sperm freezability, respectively. The results suggested that the oxidative stress test may be feasible for assessing the freezability of boar semen.

Key words: semen cryopreservation, oxidative stress test, freezability

# The diabetic miniature pig as a model for human chronic wound healing

S30003

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According to the International Diabetes Federation (IDF), there were 537 million people in the world suffering diabetes in 2021. The most common complications of this disease are proteinuria, vision loss, hand, and foot paralysis. Eventually, long-term of diabetes caused disabling or even life-threatening like amputation. Therefore, it is necessary to establish an animal model of diabetes to study the chronic wound healing of it. In this study, we used Lanyu pigs as an animal model for diabetic wound healing. First, we verify the dosage of Alloxan with 100, 125, and 150 (mg/kg) to induce diabetes in Lanyu pigs. Next, we created and compared 3 × 3, 6 × 6, 12 × 12 (cm) size of the wound in diabetes and healthy Lauyu pigs to evaluate parameters associated with wound healing process. Experiment results showed that the level of blood glucose was consistently higher than 400 mg/dl after 24 hours of induction by 125 mg/kg Alloxan. Time for completing wound re-epithelialization was significantly much longer in diabetic pig than healthy pig. In diabetic pig the 3 × 3 small wound was re-epithelialized at day 42 about 14 days delayed than healthy pig. In larger wound of 6 × 6 and 12 × 12 (cm) were remaining about 6.0% and 26.5% wound un-epithelialization at the end of observation (day 77) compared to non-diabetic wound which complete re-epithelialization at day 42 and day 70. Considering the limitation of dorsal-lateral space and more number of wounds demand in one pig, the diabetic wound size of 6 × 6 cm was suggested for chronic wound study. These results establish a preclinical platform enabling better optimization of diabetic chronic wound therapies increasing bench-to-bedside translational achievement.

Key words: Lanyu pig, Alloxan, Diabetic, Chronic Wound

# Medical imagological assessment in hind limb of lanyu pigs after ligation of femoral arterial

S30004

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At present, most of the imaging medical instruments are used in the human body. However, in recent years, due to the development of drugs and disease research needs in experimental animals, it is also necessary to use imaging medical instruments for monitoring. Hence, the apply imaging medical analysis to the animal model of sustained limb ischemia aim in providing accurate and timely data to enable researchers to correct and improve different drugs or biomedical materials, thereby accelerating the development of new drugs and related research processes, has become the biggest issue at present. The object of the study was to leading-in Angiography (AG), Computed tomography (CT) and Doppler ultrasound to assess of vascular perfusion, arteriogenesis, collateral development and lower extremity systolic and diastolic blood pressure before and after ligation of pig femoral artery. Immediately after ligation the femoral arterial was no longer present the blood flow by confirming through the AG and CT. Depressed limb blood pressures were also observed. Results of arteriogenesis and collateral development were quantifiable and visible in limb femoral arterial ligated 4 weeks post-ligation. The existed collateral development after ligation may explain that the operated hind limb still have normal behavior. We demonstrate a technique for non-invasive and tracking via AG and CT and these tools provide validation for further improving and developing a more success limb ischemic animal model.

Key words: Lanyu pig, Medical imaging, Hind limbs, Femoral ligation

# The influenceof different diets on growth and hematological characters in Lanyu pigs

S30005

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This study was conducted to evaluate the effect of different diet sources on growth performance, feed efficiency and hematological parameters of weaned Lanyu pigs. Sixteen weaned Lanyu pigs (eight barrows and eight gilts) with 6.4 kg of body weight and were assigned to one of the dietary treatments in a 2 x 2 factorial design (two diet sources from different protein ingredients and two sex). Two different diets, the commercial Laboratory Mini-Pig Grower Diet 5081 (Labdiet 5081, Crude protein 14%, Metabolizable energy 2,410 kcal/kg and Lysine 0.65%) and the treatment formula (Crude protein 14%, Metabolizable energy 2,400 kcal/kg and Lysine 0.64%) were used in this study. Pigs were fed restrictively by their body weight and free to water. The results showed that the average daily gain (ADG), average daily feed intake (ADFI) of total period and final backfat thickness (BF) were not significant different between treatments. The Gain/Feed (G/F) of the treatment formula group was significantly higher than that of the Labdiet 5081 group ($P < 0.05$). In hematological parameters, the mean corpuscular hemoglobin (M.C.H.) of the Labdiet 5081 group was higher than the treatment formula group significantly ($P < 0.05$) at 20 weeks of the test. The red blood cell (RBC) of the treatment formula group was higher than the Labdiet 5081 group significantly ($P < 0.05$) at 33 weeks of the test. And there were no significant differences in other hematological parameters found between treatments. In conclusion, the treatment formula has better feed efficiency and it reduced the cost of feed compared to the Labdiet 5081. Meanwhile, the results could provide as reference data for the growth pattern
of Lanyu pigs.

Key words: Lanyu pigs,growthperformance, physicalperformance.

# Low-voltage electro-ejaculation technique for semen collection from Lanyu Pigs

S30006

Yu-Hsin Chen, Jane-Fang Yu, Yu-Jia Chang, Feng-hsiang Chu, Hsiu-Lien Lin

Lanyu miniature pig is a native species in Taiwan, and their germplasm conservation and improvement of genetic diversity are very important. The germplasm conservation relies on the storage of semen. However, the success rate of lanyu miniature pig semen collection by hand is very low, and therefore we tried to collect sperm by electrical stimulation. Firstly, the semen was collected with different voltages and the effects of different voltages on its physiological condition, semen quality, and frozen-thawed semen traits were examined. The results showed that the collection success rate was 81.3% when 2-3 V of low-voltage and the maximum current of 500 mA were performed. The survival rate, vitality, linear motility, deformity rate, and acrosomal integrity were 84.3%, 75.7%, 63.7%, 10.3%, and 82.9%, respectively. The low-voltage electrical stimulation of semen collection effectively stimulated the ejaculation of lanyu miniature pigs, and this method caused less stress to the animals during the operation. Thus, the application of low-voltage electrical stimulation to the semen collection of lanyu miniature pigs is a feasible method.

# Evaluation of classical swine fever vaccine efficacy in Lanyu pig

S30007

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Classical swine fever (CSF) is notifiable disease in Taiwan since it is an important, high-contagious and fatal disease in pigs. Control strategies are vital in epidemic area. In general, massive CSFV vaccination is a normal and major strategy in such area and Taiwan is no exception. Lanyu pig is one of the most important indigenous miniature pig in Taiwan. Nowadays, the studies of the Lanyu pig are focused on molecular genetics, conservation and nutrition and there is few research on the immunization and disease transmission. However, the researches of immune status on the Lanyu pig are necessary for monitoring its health status and establishing a vaccine program. Therefore, the objectives of this study was to investigate the dynamic trend of the classical swine fever serology on Lanyu pigs with vaccination. Thirty-six piglets with CSF vaccination at the age of 9 and 12 weeks were randomly selected and collected blood samples at the age of 9, 12, 15, 18, 24, 36 and 48 weeks. The serum concentration of CSFV antibody was evaluated by a commercial ELISA (CSFV antibody ELISA test kit, IDEXX, ME, USA). The results showed that the average CSF ELISA blocking percentage at the age of 9, 12, 15, 18, 24, 36 and 48 weeks were 35.3 ± 25.0% , 75.2 ± 5.2%, 81.7 ± 4.3%, 85.9 ± 4.1%, 89.8 ± 4.5%, 86.7 ± 4.0% and 79.7 ± 7.1%, respectively. In conclusion, the CSF vaccine was still effective in preventing disease at the age of 48 weeks under this experimental condition.

Key words: Lanyu pig,classical swine fever vaccine,ELISA blocking percentage.

# Case study: The effect of using phase contrast microscopy on the reproductive efficiency of breeding sows in Taiwan black pigs

S30008

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This study aimed to determine whether phase contrast microscopy could enhance the reproduction efficiency of breeding sows in Taiwan black pigs. A commercial farm at Eastern Taiwan raised around 2,000 Berkshire * Duroc pigs, with 190 breeding sows. Using phase contrast microscopy for semen examination, the number of inseminated sows remained unchanged ($P > 0.05$). There was a significant increase in conception rate of 13.6% (86.4 vs. 72.8%, $P < 0.05$). Farrowing sow numbers increased significantly by 7.3 heads (36.4 vs. 29.1, $P < 0.05$). In each breeding, the farrowing rate increased by 17.3% (78.3 vs. 60.9%, $P < 0.05$). Return sow numbers for each breeding significantly decreased by 6.4 heads (6.5 vs. 12.9 heads, $P < 0.05$). The number of abortion sows for each breeding significantly decreased by 2.6 heads (2.7 vs. 5.3 heads, $P < 0.05$). The abortion rate for each breeding significantly decreased by 5.7% (5.8% vs. 11.5%， $P < 0.05$)。In summary, phase differential microscopy can be used in commercial black pig farms to increase conception rates, farrowing rates, and reduce abortion and return rates. Increasing the efficiency of breeding management can reduce costs for farmers and increase their income.

Key words: Taiwan black pig, Phase contrast microscopy, Reproductive efficiency

# Case study: The effect of using ultrasonic scanning to reduce sow's feed cost in Taiwan black pig

S30009

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This study was conducted to determine whether ultrasonic scanning could reduce sow feed costs in Taiwan black pigs. The farm raised around 2,000 Taoyuan * Duroc pigs, with 200 breeding sows located on a commercial farm in Eastern Taiwan. A pregnancy was previously diagnosed by determining whether an inseminated sow returned after being inseminated. Following the introduction of an ultrasound scan, a pregnancy test was conducted 25 to 35 days after breeding. A pregnancy test using ultrasound imaging resulted in 2.7 heads and 1.1 heads of non-conception sows being reduced after 42 and 63 days following breeding, respectively ($P < 0.05$). There was a significant decrease in non-conception sows detected after 42 and 63 days of breeding by 28.9% (5.4 vs. 34.3%, $P < 0.05$) and 11.6% (0.0 vs. 11.6%, $P < 0.05$), respectively. In the period of 21-42 days and 43-63 days, feeding costs for non-conception sows significantlydecreased by 2,510 NTD (2,520 vs. 4,140 NTD, $P < 0.05$) and 3,595 NTD (6,641 vs. 10,236 NTD, $P < 0.05$). Overall feed costs for non-conception sows significantly decreased by 3,545 NTD (6,641 vs. 10,236 NTD, P 0.05). As a result, ultrasonic scanning for pregnancy tests could reduce feed costs for non-conception sows and assist in identifying non-conception multiparous sows.

Key words: Taiwan black pig, Ultrasonic scanning, Sows feed cost

# Analysis of different parities on reproductive performance in Taiwan black pigs

S30010

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The purpose of this study was to compare the effects of different parity intervals on the reproductive performance in Taiwan black pigs. A total of 260 breeding data of Taiwan black sows were collected from January 2019 to June 2022in a commercial farrow-to-finish farm that located at central Taiwan. The data were including parities, number of live born piglets, number of stillborn piglets, number of mummified piglets, number of total born piglets, gestation period, the number of weaned piglets and the age of weaning. The proportion of live born piglets, stillborn piglets and mummified piglets in each litter were calculated. The reproductive data were divided into three parity intervals (A, B and C) for analysis. A was the first parity, B was the 2thto 5th parity and C was 6th to 9th parity. The results showed that parity C had a significantly lower number of weaned piglets than that of parity B and A ( 8.6 vs. 9.3 and 9.9, $P < 0.05$).There were no significant differences in other traits among the groups. In conclusion, Taiwan black sows with parity of 6 or more may reduce the number of weaned piglets.

Key words: Taiwan black pig, Reproductive performance, Parity

# Application of Lanyu pigs as the animal model in osteoporosis study

S30011

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Lanyu pigs, the local miniature pig in Taiwan, have been widely used in various biomedical studies. Here we introduced how to generate the Lanyu pig model of osteoporosis and utilize porcine induced pluripotent stem cells (piPSC) to ameliorate their bone loss. The mature female Lanyu pigs were subjected to bone loss inductions for 12 months. Micro-CT images revealed that the combination of ovariectomy + 0.5% calcium diet + 1 mg/kg of prednisolone induced the lowest trabecular bone parameters such as trabecular bone volume, thickness, number, and total porosity, and the lowest proportions of cortical bone in the proximal metaphysis, proximal diaphysis, and distal diaphysis. Next, we designed a protocol to induce piPSC differentiation into osteoblast-like cells, and then they transplanted into the left tibiae of Lanyu pigs for 6 months to implement iPSC-based cell therapy. Results showed that transplantation of piPSC-derived osteoblast-like cells significantly improved trabecular bone structures at transplanted sites and maintained cortical bone structures in the proximal metaphysis. Taken together, these findings reveal the proper combination of ovariectomy, calcium restriction, and prednisolone administration to induce bone loss in Lanyu pigs, and confirm the therapeutic potential of piPSCs to locally recover bone loss in a Lanyu pig model.

Key words: Lanyu pigs, osteoporosis, porcine induced pluripotent stem cells, iPSC-based cell therapy

# Application of Lanyu pigs as the animal model in Parkinson's disease

S30012

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Lanyu pigs are the local miniature pig in Taiwan and have been widely used in various biomedical studies. Here we introduced how to generate the Lanyu pig model of Parkinson's disease (PD) and utilize porcine induced pluripotent stem cells (piPSC) to recover their defective walking behaviors. The mature female Lanyu pigs were subjected to the PD induction with subcutaneously injecting 5 mg/kg of 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine hydrochloride (MPTP) for 3 months. This treatment induced PD symptoms of the pigs with behavior scores of 5–6 points, revealing moderate to severe muscle rigidity, motility defects, and abnormal positions of the legs or head. Next, we designed a protocol to induce piPSC differentiation into D18 neuronal progenitors (D18 NPs), and they were transplanted into the striatum of Lanyu pig brains for 17 weeks to evaluate their therapeutic effects of PD. After 8 weeks of cell transplantation, the defective behavior was significantly ameliorated and fully recovered at the 14th week of cell transplantation. The number of dopaminergic neurons was also significantly improved at the end of the experiment although the number was still about 50% lower than that in the control group. Taken together, our findings suggest that 5 mg/kg of MPTP can induce moderate to severe PD syndromes, and piPSC- derived D18 NPs exhibit a potential for the treatment of PD in a Lanyu pig model.

Key words: Lanyu pigs, Parkinson's disease, porcine induced pluripotent stem cells, iPSC-based cell therapy

# Session 4

## Nutrition, Management, Biosecurity and Production Systems

# Effects of reducing dietary lysine levels on growth performance, carcass characteristics and meat quality of Duroc x KHAPS crossbred black pigs

S40001

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This study was conducted to evaluate the effect of dietary reducing lysine (LYS) on the growth performance, carcass characteristics and meat quality of Duroc x Kaohsiung Animal Propagation Station (KHAPS) black pig in finishing period. Trials used fifty-four Pigs with 80 kg of weight and were assigned to one of the dietary treatments including High (LYS 0.75%), Medium (LYS 0.60%) and Low (LYS 0.45%) lysine. Each diets contained the same levels of crude protein (CP 10.5%) and metabolizable energy (3,250 kcal/kg). Pigs were slaughtered at about 120 kg. The results showed that weight at 8 weeks of trial, final backfat thickness on $10_{th}$rib, average daily gain, average daily feed intake, gain/feed and feeding days to 120 kg were not significantly different ($P > 0.05$) in treatments. The carcass weight, dressing percentage, backfat thickness of carcass, lean percentage and fat percentage were not significantly different ($P > 0.05$) in treatments. The bone percentage of L group was higher than H group ($P < 0.05$). Futhurmore, the moisture, crude protein, crude fat and ash of *Longissimus dorsi* were not significantly different ($P > 0.05$) in treatments. But the crude fat levels of *Longissimus dorsi* tended to be higher in L group. In addition, the color, marbling, firmness, loin area and cooking loss of *Longissimus dorsi* were not significantly different ($P > 0.05$) in treatments. While the firmness of *Longissimus dorsi* tended to be lower in L group. The results indicated that reducing dietary lysine levels did not affect growth performance and meat quality of *Longissimus dorsi* but it increased bone percentage of carcass. Meanwhile, the crude fat of *Longissimus dorsi* increased from 3.4% to 4.2%.

Key words: duroc, KHAPS black pigs, carcass characteristics, meat quality

# Research of feeding low nutrient concentration feed on the growth performance, carcass traits, and muscle quality of TLRI Black Pig No.1 at the finishing stage

S40002

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In order to response and prevent African swine fever (ASF), the development of low nutrient concentration feed with similar nutritional value to the food waste diet to replace traditional feeding method is important for hog industry. In this experiment, 24 TLRI Black Pig No.1 (TBP) (half barrows and half female) with the body weight about 75~90 kg were selected. According to body weight and gender, 24 pigs were divided randomly into low nutrient concentration feed (containing crude protein 10%, crude fiber 8% and metabolizable energy 2,676 kcal/kg) group and normal feed (containing crude protein 14.4%, crude fiber 3% and metabolizable energy 3,180 kcal/kg) group. The experiment was finished when the body weight of pigs reached about 130 kg. The results showed that TBPs fed with low nutrient concentration feed slow down the growth rate and put off the slaughter date (the body weight was reached about 130 kg) about 21 days. Besides, the feed cost of low nutrient concentration feed group was higher than normal feed groups by 255 NT dollars per pig. However, the TBP fed with low nutrient concentration feed were improved the body type without affecting the slaughter rate, muscle color, free amino acid, fatty acid content, sensory evaluation, the marbling and muscle firmness score of NPPC and carcass grading. On the other hand, the lean of carcass percentage, muscle protein content, and muscle hardness and toughness of the low nutrient concentration feed group were significantly lower ($P < 0.05$) than the normal feed groups, and the percentage of carcass fat and muscle fat contents of the low nutrient concentration feed group were significantly higher ($P < 0.05$) than the normal feed groups. These results can be referenced by pig farmers to replace the food waste diet or use low nutrient concentration formulas to prevent uninfected pigs overweight due to delayed marketing if ASF outbreak.

Key words: Finishing stage, low nutrient concentration feed, TLRI Black Pig No.1

# Effects of substitution with graded levels of sweet potato (TNG NO. 57) in diets on carcass characteristics of Lanyu pigs

S40003

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This study was conducted to investigate the effect of substitution with sweet potato (TNG No. 57) in diets on the carcass characteristics of Lanyu pigs. A total of 24 Lanyu pigs with the age of180 days, well-balanced sex ratio and at the average weight of25 kg, were randomly divided into three groups including the control group with no sweet potato substitution (ME 3,104 kcal/kg), and the treatment groups with sweet potato replacing 25% (ME 3,058kcal/kg) and 50% (ME 2,952kcal/kg) of diets. Pigs were fed ad libitum and free to water until the age of 253 days. The results showed that there was no significant difference in carcass weight, dressing percentage, carcass length, backfat thickness, loin-eye area, lean percentage, fat percentage, proximate composition of the *Longissimus dorsi* muscle, pH, marbling score, CIEL*a*b* and sensory evaluation (flavor, juiciness, tenderness and total acceptability). In the analysis of fatty acid composition of the *Longissimus dorsi* muscle, there were no significant differences in saturated fatty acids among the groups. Monounsaturated fatty acids were greater in the 50% group than the control group significantly ($P<0.05$) and polyunsaturated fatty acids were greater in the control group than the 25% and 50% groups significantly ($P<0.05$). The amino acid composition of *Longissimus dorsi* muscle showed that there were significant differences in eight amino acids including aspartic acid, glycine, arginine, alanine, phenylalanine, isoleucine, leucine and proline, and all of them were highest in the 25% group ($P<0.05$). Inconclusion, dietary substitution with 25% of TNG No. 57 sweet potato did not produce any adverse effects and showed better performance in carcass characteristics.

Key words: Lanyu pig, sweet potato, carcass characteristics.

# The effects of feed and Napiergrass intake on growth performance and carcass characteristics of Lanyu pigs

S40004

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The aim of this study was to investigate the effect of Napiergrass (*Pennisetum purpureum*) intake on growth performance, feed efficiency (F/G) and carcass characteristics of Lanyu pigs. A total of 24 Lanyu pigs were allocated into 4 groups which were daily provided 0.4 (L-0.4), 0.7 (L-0.7), 1.0 kg (L-1.0) feed and fed *ad libitum* (L-Ad). Besides, 4 LYD hybrid pigs were fed *ad libitum* as control. The first 3 groups were also provided with fresh Napiergrass (Taishiu No. 2) *ad libitum*. Experiments were started when body weights (BW) for Lanyu pigs were 30 kg and 50 kg for LYD pigs, and slaughtered when Lanyu pigs' BW reached 50 kg and 100 kg for LYD. Results showed that there was o difference in average daily gain (ADG) and feed conversion (F/G) between L-1.0 and L-Ad. The ADG significantly ($P < 0.05$) decreased in L-0.4 and L-0.7. The feed intake in L-Ad was increased for 0.3 kg/d than the L-1.0 and the backfat thickness was larger and intramuscular fat was reduced. The L values of meat color in L-1.0 and L-Ad were larger than other groups. The crude fat of loin in L-1.0 was significantly ($P < 0.05$) higher than the other groups. In conclusion, daily provision of 1.0 kg of feed and Napiergrass fed on *ad libitum* basis to Lanyu pigs could obtain better growth and carcass performance.

Key words: Lanyu pig, napiergrass, growth performance, carcass characteristics.

# Application of machine learning technology to predict reproductive performance in sows

S40005

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This study applied a series of data science technologies (i.e. data mining and machine learning) to analyze the reproductive performance in sows. Data, including growth and reproductive performance of sows, collected from a commercial pig farm in Taiwan were utilized to build a machine learning model for the prediction of reproductive performance in sows, allowing producers to accordingly make decisions of keeping or culling sows. In total, 150 sows' records were used in this study. Prediction performance was validated by using a test set extracted from the records prior to model training. Results showed that the best accuracy of predicting the live-born of third parity was 79%. Through the application of variable importance analysis, which is capable of explaining the feature contributions to the accurate prediction, some top predictive features were 1st parity liveborn, 1st parity weaning number, 1st parity total born, 1st parity litter size, 1st parity high total born and gilt ages at first mating. The results revealed that the application of machine learning was able to improve the selection of sows, helping the decision making on management.

Key word: artificial intelligence, machine learning, data mining, reproductive performance.

# Characterization of Micrococcus porci sp. nov., isolated from pig feces

S40006

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An aerobic bacterium, designated as strain KD337-16T, was isolated from the fecal samples of a black pig. It exhibited spherical, non-motile and non–spore-forming, Gram-positive cells. KD337-16T was identified as a member of the genus *Micrococcus* through 16S rRNA gene sequencing, and its closest relatives were found to be *Micrococcus endophyticus* YIM 56238T (99.6% similarity), *Micrococcus luteus* NCTC 2665T (99.1%), *Micrococcus yunnanensis* YIM 65004T (99.1%), *Micrococcus aloeverae* AE-6T (99.1%), *Micrococcus antarcticus* T2T (99.0%), and *Micrococcus flavus* LW4T (98.8%). Phylogenomic trees were constructed, and strain KD337-16T was found to form its own cluster as an independent lineage of *M. flavus* LW4T. Between KD337-16T and its close relatives, the average nucleotide identity, average amino acid identity, and digital DNA–DNA hybridization were below the respective species delineation thresholds at 82.1%–86.6%, 78.1%–86.1%, and 24.4%–34.9%. The predominant isoprenoid quinone was MK-8($H_2$), and the major fatty acids were anteiso-$C_{15:0}$ and iso-$C_{15:0}$. Taken together, the results indicate that strain KD337-16T is a novel species of the genus *Micrococcus*, for which the name *Micrococcus porci* sp. nov. is proposed. The type strain is KD337-16T (= BCRC 81318T = NBRC 115578T).

Key words: gut microbiota, *Micrococcus porci*, new taxa, polyphasic analysis

# Differences in the microbiome and metabolome of Duroc x KHAPS black pigs with heavier and lighter bodyweight

S40007

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Duroc x KHAPS black pigs (DK) is a new cross-bred black pig with high meat quality. However, animal phenotypes needed to identify the connection with genomic research. Omic approaches have emerged as powerful tools for better understanding of physiological mechanisms in organisms with different phenotype. The aim of this study is to establish growth-promoting related bio-information of Duroc x KHAPS Black pigs via omic approaches, such as metagenomics, culturomics and metabolomics. To characterize differences in the composition of the fecal microbiota and serum metabolome of DK, fecal and blood samples of 70-day-old piglets with lighter body weight (LBW) and heavier body weight (HBW) were collected from approximately one hundred individuals based on their body weights. The 16S rRNA gene amplicon-based metagenomics and culturomics analyses of fecal samples were conducted. The metabolite analysis was performed using ultra performance liquid chromatography and comparative metabolomics to identify specific metabolites. The results showed the microbiota of the HBW group had significantly higher Firmicutes-to-Bacteroidetes ratio and higher levels of *Dorea*, *Lactobacillus*, *Roseburia* and *Solobacterium*. The isolates include facultative and strict anaerobes that were isolated from black pig feces samples under different culture conditions. Nearly 400 isolated colonies were identified using MALDI-TOF MS combined with 16S rRNA sequencing, and successfully cultured 22 different bacterial species. In serum metabolomic analysis, 78 peaks showed significant differences between pigs with high and low weight grouping. Among them, 10-17 high-reliability compounds can be identified by mass spectrometry,most of which are related to energy and amino acid metabolism. In this study, we characterized differences in the composition of the fecal microbiota and serum metabolome on different growth rate of DK swine. These data can be used as a reference for evaluating the growth prediction of black pigs. In the future, the isolated strains associated with the body weight of DK, were be evaluated through the pig growth model.

Key words: KHAPS black pig, omics, microbiome, metabolome, culturomics

# Biomedical Research Applications of Minipigs in Different Breeds

S40008

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Experimental minipigs are an important animal model for biomedical research. In common non-primate experimental animals, minipigs are most similar to humans in evolutionary level, therefore they have better potential to successfully establish and accurately simulate the animal model of human diseases. Common breeds of experimental minipigs are Göttingen, Yucatan, Sinclair and Hanford established in Germany and the US. Taiwan has established several domestic minipigs, Lanyu lines, from 2003 to 2011. This study analyzed the status of biomedical research used minipigs in different breeds, based on analysis of literatures published on PubMed using minipigs for experiments. PubMed is the most representative web-based retrieval system for biomedical related literature, developed by the National Center for Biotechnology Information of the US National Library of Medicine. The results showed that 3,478 "minipig" publications were found in PubMed in last 10 years, Göttingen and Yucatan were the most popular breeds with 422 and 323 publications, and Sinclair and Hanford had 35 and 11 publications, respectively. According to the publication in last 1 year, the research fields of early established minipig breeds covered various systems of organisms. The most published research areas of Göttingen minipig were pharmacology, cardiovascular pathology, neurodegenerative disorder and emerging disciplines epigenetics; and bone defect, neurological deficits, immunoreactivity and blast loading were published most in Yucatan minipigs. It was worth notice that 10 studies had been published on PubMed of the "Lanyu minipig" established in 2000s. Current registered breed "Pannon minipig" were found 1 result with anatomical reference atlas research, indicated the newly established breed. Minipigs are considered large laboratory animals. Due to geographical and import quarantine reasons, it is very important to develop regional suitable experimental minipigs to promote global biomedical research.

Key words: Experimental minipigs, biomedical research, PubMed, Lanyu minipig.

# Effect of feed and food scraps on growth performance in black pig

S40009

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This study was to investigate the effects of feed and food scraps (FS) on growth performance of commercial black pig. A total of96 commercial black pigs weighing about 47 kg were randomly allocated into three groups, barrows and gilts were kept in separate pens, with 6 pens and 16 heads per pen. The dietary treatments comprised of the following: 1) FS group (food scraps), 2) 15-13%CPgroup (feeding diet content 15%and 13% crude protein (CP) during growing and finishing period).3) 13-11% CP group (feeding diet content 13%and 11% crude protein (CP) during growing and finishing period). Each group of 32headswas treated for 28 wk. The results showed that the body weight and body weight gain didn't differ among treatments at 28 week. The feed consumption of FS group was lighter than15-13%CPand 13-11%CPgroups.The feeding period of week at FS group is defined as X (week/head) and withers height is defined as Y (cm), then Y = 47.5 + 5.11X -0.56X2 + 0.03X3 -0.0004X4 (R2 = 0.8217, P = 0.05) for the entire experimental period. 15-13% CP group and 13-11% CP group were Y = 56.2 + 1.07X (R2 =0.8451, P = 0.05) and Y = 42.5 + 6.97X -0.81X2 + 0.04X3 -0.0006X4(R2 = 0.9004, P = 0.05), respectively. The total feed costs of individual groups were NT$ 3,494, 3,772 and 3,528 during entire period, respectively. The study concluded that 13-11% CP in the feed did not adversely affect the growth performance. It could decreased total feed cost per body weight gain.

Key words: Black pig, food scraps, growth performance

# The effects of two-stage fermented feather meal-soybean meal product on growth performance, blood biochemistry, and immunity of nursery pigs

S40010

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Although microbial fermentation provides biodegradation of poorly digestible feed ingredients increasing bioavailability, efficiently achieving fermentational production is often time-consuming. This study aims to improve fermentional quality in two-stage fermented feather meal-soybean meal product (TSFP) with five selected *Bacillus* strains and *Saccharomyces cerevisiae* Y10, as well as investigated the effects of TSFP on growth performance, blood biochemistry, and immunity of nursery pigs. In trial 1, one hundred hybrid piglets (Duroc x KHAPS black pig) with equal numbers of both barrows and females were randomly assigned into five dietary supplementation treatments, including 5% fish meal or 5% TSFP prepared with 0, 32, 40, or 48 hrs in the first-stage fermentation. The results showed that the body weight (BW), average daily gain (ADG), and feed conversion ratio (FCR) of fermented groups were significantly better than the unfermented group ($P < 0.05$) at weeks 0 to 3 and 0 to 5. The ADG of 32-hr and 48-hr TSFP groups were better than unfermented group ($P < 0.05$) at weeks 3 to 5. Blood biochemical analysis revealed no significant difference in each group ($P > 0.05$). In trial 2, eighty hybrid piglets (Duroc × KHAPS black pig) with equal numbers of both barrows and females were randomly assigned into four dietary treatments, including 5% fish meal or three different supplementation levels of TSFP (32-hr first-stage fermented time) at 0, 2.5, or 5%. As the dietary levels of TSFP increased to 5%, this result of ADG was significantly better than 0% group ($P < 0.05$) at weeks 0 to 3. Furthermore, 5% TSFP group had better BW, ADG, FCR, and production efficiency factor (PEF) than 0% group ($P < 0.05$) at weeks 0 to 5. The *ex vivo* mitogen- induced lymphoblastogenesis and the interferon-γ production of 5% TSFP group were higher than the fish meal group ($P < 0.05$). Moreover, the oxidative burst activity and the IgG production of 5% TSFP group were higher than 0% group and fish meal group ($P < 0.05$). In conclusion, the first-stage fermentational time can be shorten from 48 hrs to 32 hrs using selected *Bacillus* strains in TSFP production when it supplemented at 5% of diet for nursery pigs, that shows the best growth performance and immunity.

Key words: Nursery pig, Growth performance, Immunity, Blood biochemical, Feather meal

# Study on the dietary nutrition of TLRI No. 1 black pig

S40011

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The TLRI Black Pig No. 1 (TBP) was named in 2001 and became a new breed of black pig, which contains 25% *Taoyuan* pig and 75% *Duroc* pig of blood line. The relevant nutritional studies are described below according to gestating and lactating sow, nursery pig and growing-finishing pigs: (1) For TBP gestating sows, increased the amount of daily feed from 2.0 kg to 2.4 kg or 2.8 kg during 90 - 114 days pregnancy. The results showed that increasing the amount of daily feed up to 2.8 kg/day from 90 -114 days pregnancy could raise the number of pigs born live and survival rate. (2) For TBP lactating sows, fed 15% crude protein (CP) or 18% CP or 15% CP supplemented lysine to equal the lysine content with 18% CP diet. The results demonstrated that sows fed containing 15% CP supplemented lysine of diet had a higher weight gain of suckling pigs than 15% CP diet. (3) For TBP nursery pigs, fed containing 0.85%, 0.95%, 1.05%, 1.15% and 1.25% lysine of diets, respectively. The feed efficiency of the weaning pigs were improved by increased lysine contents from 0.85% to 1.05%, but not in feed intake and daily weight gain among lysine contents. As state above estimated that feeding with 1.05% lysine level of diet could maintain normal growth for TBP nursery pigs. (4) Nutritional studies of TBP growing- finishing pigs. TBP grower pigs fed with 0.75% and 0.85% lysine content of diets revealed that feeding 0.85% lysine had a higher feed intake and daily weight gain than 0.75% lysine excluding feed efficiency. According to results estimated 0.85% lysine content could satisfy the lysine requirement for TBP grower pigs. During finishing period, there was no significant difference in growth performance between 0.60% and 0.70% lysine contents while digestive energy (DE) was at 3250 kcal/kg. Based on results, indicated that 0.60% lysine and 3250 kcal/kg DE could be an appropriate lysine and energy requirement in growth performance and carcass quality of TBP finisher pigs. In the future perspective for TBP pigs will continuously improve their growth performance and carcass quality through selection, which still requires appropriate nutrition supply. Therefore, it is still necessary to continue to explore nutritional research to meet growth performance of the TBP pig.

Key words: Nutrition, nursery pig, gestating sow.

# Session 5

## Industry, Environment and Marketing

# Study on the correlation between different black pig body conformation and auction prices in Taiwan hog auction market

S50001

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Most of the sales methods of pigs in Taiwan are live auctions. When the pigs reach the listed weight, they are transported to the auction market at an auction sale, the buyer will evaluate the quality of the auctioned pigs on the spot, and immediately make an auction price for the pigs. In Taiwan, black-haired pigs (black pigs) account for about 13% of all meat pigs, and the auction unit price in the market is generally higher than that of white-haired pigs (LYD or LD pigs). Previous research have shown that black pigs could been divided into three types: meat type, bacon type and lard type according to their appearance and body conformation in auction market. The purpose of this study was to investigate and analyze the correlation between different black pig body conformation and auction prices in Taiwan auction market (hog-market). The experiment randomly collected3,546auction weights and auction data of black pigs on eleven auction days. For the collected data, a preliminary analysis of the body conformation and size, and price of the black pigs was been conducted, among which the meat type, and the bacon type accounted for 33.64%, 66.36%, and the lard type was not observed, respectively. The results showed that the auction weight of bacon type was significantly higher than that of meat type ($p < 0.05$). The auction weight of bacon type and meat type were 146.08±17.99and 128.78±12.63 kg, respectively. After the auction price of black-haired pigs was been corrected with the average price of black-haired pigs (on that day), the unit price of bacon type was 0.32% higher than the average auction price ($p < 0.05$). The unit price of meat type is 0.64%lower than the average auction price ($p < 0.05$). The results show that black pigs of bacon type were more preferred by buyer than meat type during the auction process in the hog auction market. It means that consumers may prefer black pigs with a higher proportion of fat in Taiwan.

Key words: Black hogs, Body conformation, Auction price, Auction market

# A survey of nitrogen of wastewater from pig farm in Taiwan

S50002

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The purpose of this study was to survey the total nitrogen (TN) concentration of wastewater from pig farm in Taiwan to establish data on farmland irrigated by wastewater. The wastewater sample from six pig farms located in northern, central, and southern Taiwan was surveyed during hot and cool season. The pig farms was divided into three scales according to the raising number, i.e, big scale (> 10,000 heads), middle scale (5,000-10,000 heads) and small scale (< 1,000 heads). The wastewater sample collected from preliminary sedimentation tank (PST), activated sludge tank (AST)and final sedimentation tank (FET)of three-step wastewater treatment system in pig farms for the analysis of total nitrogen (TN). Results revealed that the TN was not significant difference in PST, AST and FET amongst different scale of pig farms. The TN concentration of FET (822 ± 346 mg/L) had43.0 ± 17.0% reduction compared to that in the PST (1439 ± 720 mg/L). The TN concentration of the FET in the southern region was significantly lower than that in the northern and central regions by 18.7%. The TN concentration of PST in the cool season was significant high than hot season by 41.7%. The TN concentration in pig wastewater is an important nutrient for plants. This survey data can provide reference data for the reuse of pig wastewater in fertilization plans.

Key words: Nitrogen, Pig wastewater, Taiwan

# Session 6

## Meat Quality, Products and By-Products

# Comparison of pork meat quality of traditional black pigs between feeding kitchen waste and feed

S60001

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The meats of black pigs were widely recognized as having good flavor in Taiwan because the black pigs grew slowly and their muscle fibers were getting mature during the long-term feeding period. In the past, the black pigs were fed low-cost and low-nutrition feed such as kitchen waste in Taiwan, and this was also another reason for the slow growth rate. However, African swine fever was outbreaking in recent years in Asia, and kitchen waste feeding was considered to be a high-risk way of infection. Therefore, replacing kitchen waste with feed was an important control method to prevent the pandemic of African swine fever. In order to understand the effects on the meat of black pigs feeding feed and kitchen waste, the local black pigs were fed different crude protein content of feed namely CP13% (C13), CP15% (C15) and kitchen waste (KW) respectively. This experiment was conducted to analyze the proximate analysis, meat quality traits, free amino acid contents, fatty acid contents, and sensory evaluation. The results showed the KW had lower moisture content (68.43%) and higher crude fat content (9.03%) than C13 (71.07%, 6.40%) and C15 (70.23%, 7.86%), but had no significant differences. The KW had higher fatty acid content such as C18:2, C18:3, C22:4, C22:5 and C22:6, and resulted in significantly higher polyunsaturated fatty acids content (13.70%) than C13 (7.76%) and C15 (7.06%). Besides, C13 (51.93%) and C15 (50.07%) had significantly higher monounsaturated fatty acids content than KW (44.86%). Although other analysis items had no significant differences among the three groups, this experiment could be continued to compare other low-cost feed to affect the meat of local black pigs, and reduced the impact of change of the black pig feeding model in Taiwan.

Key words: Black pig, meat quality, kitchen waste

# Carcass lean content estimation of Taiwan Pin-Pu black hog by optical probe

S60002

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The aim of this study was to investigate the application of Fat-O-Meat'er II optical probe instrument (FOM II) in Taiwan Pin-Pu black hog carcass evaluation. Sixty hog carcasses from a commercial slaughter plant were measured by optical probe and carcass traits were recorded. The results showed that average live weigh, carcass weight and dressing percentage were 122.57±13.38 kg, 105.68±11.17 kg and 86.20±1.30 %, respectively. The correlation between carcass dissectible lean percentage and carcass lean percentage which estimated by FOM reading of the third and fourth to last lumbar vertebrae was r=0.301 ($p<0.05$). The carcass lean percentage estimated by FOMreading of the tenth rib which related to dissectible lean weight and lean percentage were r=0.507 ($p<0.01$) and 0.785 ($p<0.001$), respectively. The utilization of carcass weight and backfat depth of the third and fourth to last lumbar vertebrae measurementto serve as estimators could explain 43.5% of variation (RMSE=2.67) for carcass dissectible lean weight prediction. The utilization of carcass weight and loin depth of the last rib measurement to serve as estimators could explain 49.8% of variation (RMSE=2.46) for carcass dissectible lean weight prediction. The utilization of carcassweight and backfat depth of the tenth rib measurement to serve as estimators could explain 82.5% of variation (RMSE=1.44) for carcass dissectible lean weight prediction.In conclusion, the carcass dissectible lean weight prediction of Pin-Pu black hog, the tenth rib might be an appropriate detection site for optical probe measurement.

Key words: Pin-Pu black hog, Optical probe, Carcass lean

# Effects of animal fat and vegetable oil feeding on meat quality of black pig carcasses

S60003

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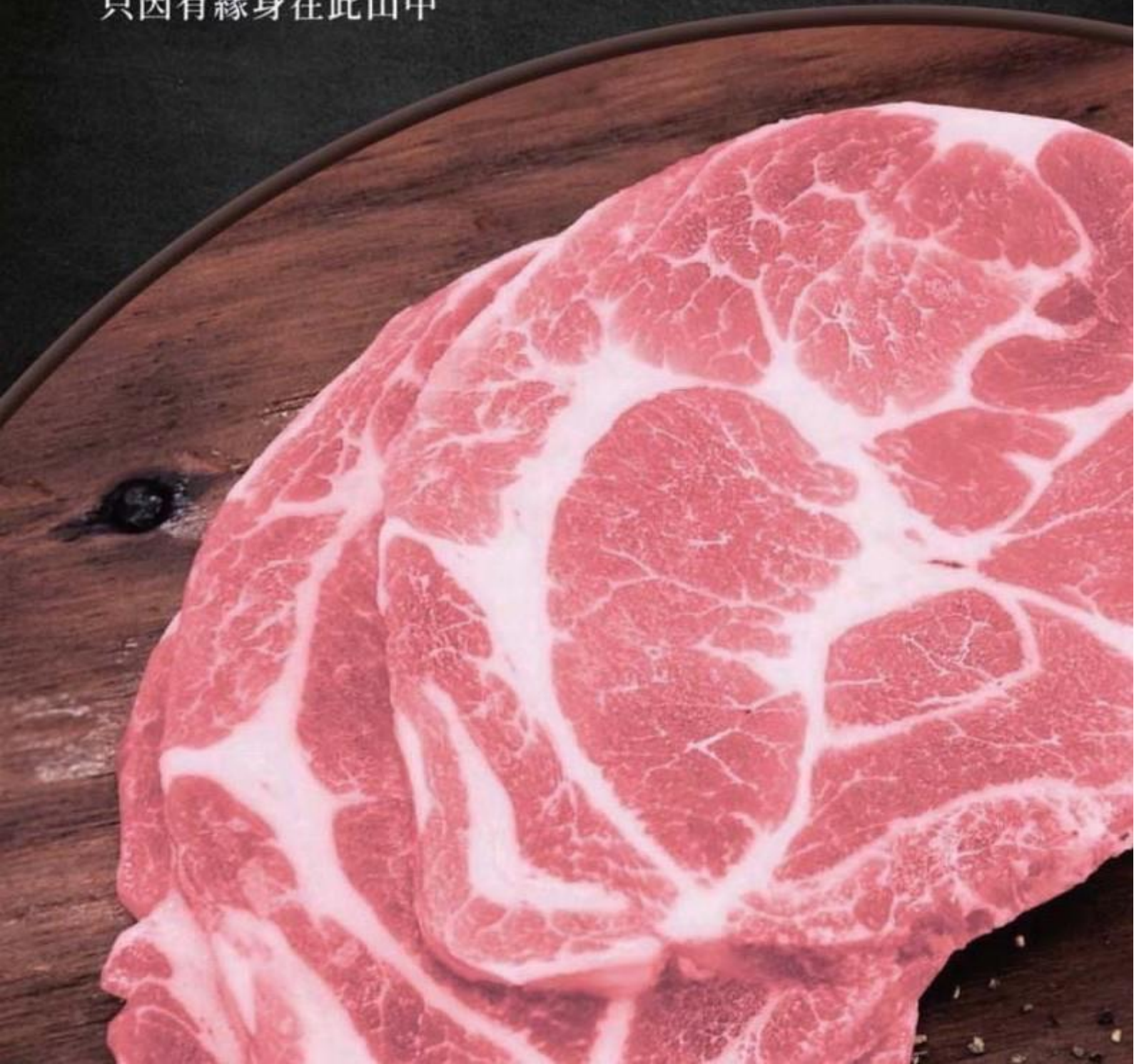
Dietary fat or oil influences the fatty acid (FA) composition and physico-chemical properties of pork meat and may have implications on our health. The purpose of the experiment was to investigate FA partitioning and the effect of feed fat or oil source on local black swine tissue FA composition. Approximate composition (moisture, crude protein, crude fat and ash), shear value, pH value, drip loss, cooking loss, meat color (L, a, b value), thiobarbituric acid value (TBA value), total plate count, fatty acid composition and sensory evaluation were evaluated in this experiment. Thirty local black pigs (about 80 kg BW average), each sex 15 pigs were fed one of five treatments: a diet containing 3% tallow (3% TW) and four oil-supplement diets namely 3% and 6% camellia oil (3% CO and 6% CO), 3% and 6% sunflower oil (3% SO and 6% SO). All pigs continue raise to body weight of nearly 125 kg for slaughtering, and determining the carcass quality. The result showed that there no significant different in the crude protein content between the treatments, and the content was about 22.6~23.4%； The crude fat content was up to 3.0% with 3% CO and 2.9% of the 3% SO group. The fatty acid composition in pork fed with various fats showed that oleic acid with the highest content, followed by palmitic acid, steric acid, etc. Among them, linolenic acid and arachidic acid were only found in muscle samples fed with SO and CO. The difference among all fat treatments sowed that the myristic acid of the 3% TW was significantly higher than that of the other vegetable oils added group. In black pork with vegetable oil diet, the content of total unsaturated fatty acid was significantly higher than that of tallow. The results of flavor evaluation showed that the 3% CO had a higher flavor preference, but there no significant difference between the treatments.

Key words: Black pig, tallow, sunflower oil, camellia oil

DONG BAO TAIWAN 東寶

# 怡然彘得

食自慢的完美心境
品味心無掛礙的健康彘在
堅持自然 拒絕激進
慢譜一首十五個月天然熟成的彘創曲
如此怡然彘得
只因有緣身在此山中



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台灣水鹿冷凍精液製作及人工授精技術

台灣水鹿茸加工技術

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## 對位，即對味

平埔黑豬育種開始，篩檢DNA序列，加強品種純化，專注DNA排序比對，建立黑豬基因庫。把源頭的基準做好，一如箭靶瞄準了靶心，方向與力度對了，就能射中消費者挑嘴的味蕾。


提供充足空間及乾淨飼養環境，並且以最適當的方式分別飼育幼豬、小豬、公豬及母豬，讓每隻豬都能健康成長。


利用天然穀物調配健康飼料，讓豬隻能提高自身抵抗力，減少用藥並降低感染病菌風險。


台灣黑豬種原混亂，歷經十年努力，透過抽血採樣、篩選化驗DNA，終於找回原生黑豬種原，並建立基因庫。

完美 Perfect　優質 Premium　專業 Profession　承諾 Promise

平埔黑豬種原清晰、肉質甘甜、油花分佈均勻，高品質經海內外肯定，突破黑豬出口紀錄，讓台灣黑豬首次站上國際舞台！


US Patent Pending: US20220000145;Taiwan Patent No. I706724

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期許吃豬肉是件安全無虞與開心歡喜的事

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結合安全農法和科學管理方式，以安全無毒的植物性原料來餵養：胡蘿蔔及地瓜，再輔以香草精油、益生菌、綜合維他命等自然營養補充。

「講究的豬飲食」

無毒胡蘿蔔來自VDS雲林東勢果菜生產合作社通過日本國家安全檢驗並外銷至日本的優良農產品。這樣的肉質相對減少因緊迫所產生的不良分泌物，低腥羶味。

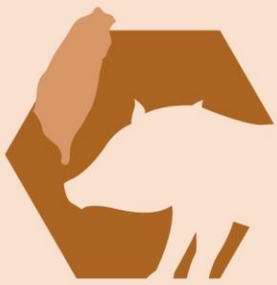
急速冷凍，夠鮮

低腥羶味，夠甜

肉質軟Q，夠嫩

原味料理，夠簡

定期SGS，夠安



# 2022 The 6th Fatty Pig

## International Conference · Taiwan

1.行政院農業委員會畜牧處-黑豬能量及纖維需求研究暨舉辦第六屆肥豬國際研討會(111救助調整-牧-01(05)(2))

2.行政院農業委員會國際處-舉辦「第6屆肥豬國際研討會」(111農科-1.2.3-畜-L1)

3.行政院國家科學及技術委員會(前身為科技部)-舉辦2022年第6屆肥豬國際研討會(111-2916-I-061-001-A1)

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