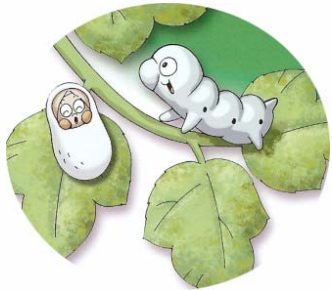


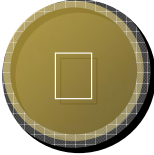
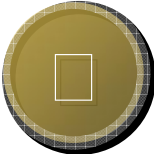
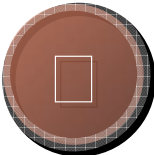
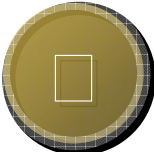
The present Status and future of Sericulture industry in Korea



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Rural Development Administration, Korea*

Kang-Sun Ryu

Contents

-  **History and Status**
-  **Genetic Resources**
-  **Silkworm Products**
-  **Mulberry Products**
-  **Bio-factory & Tourism**

DanGun(BC 1123) | Encouragement of Mulberry & Silkworm

- Chosun : “□□□□”, “□□□□□” / King SeongJong : □□□□□
- '46 Seric. Div. in Agric. Min., '61 □Law for Promotion of Seric.)

'70~'80 | Important Agricultural Product in Korea

- '75 Raw Silk Export 114 million\$ (52% whole Agric. Export)



Early '90's | Increased labor wage and importation

- Rapidly Decline, Abolition of Division in Min.('94) & Seric. Law ('99)

Mid '90's | Silkworm powder's effect Reported

- a Momentum of transition to Functional Sericulture

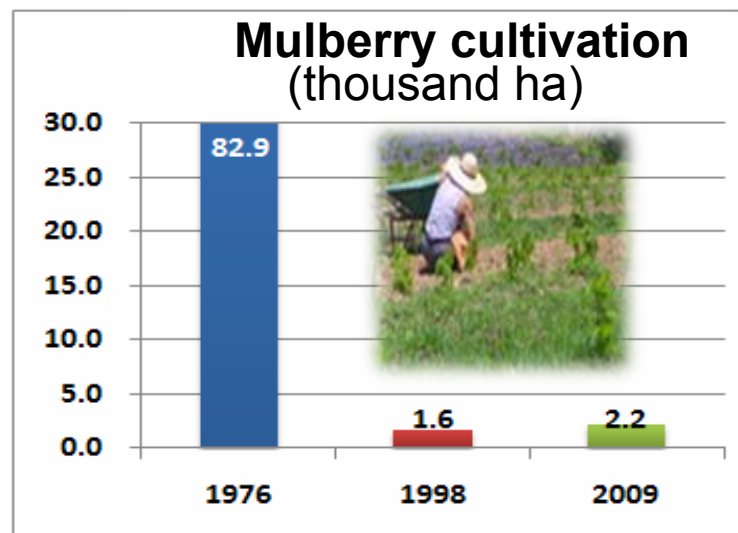
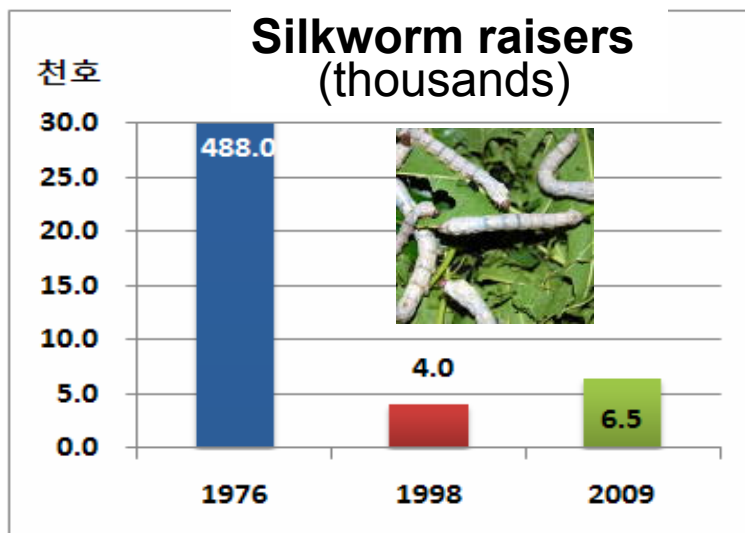


'09, Nov. | □Law & Plans for Promotion of Functional Seric.□

- Enactment 2009.5.27 , Law No.9726 ,Enforcement 2009.11.28]

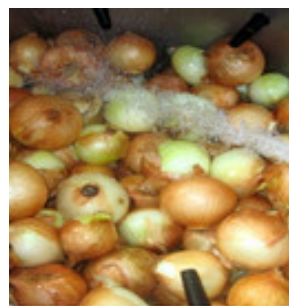
Overview | Total Production Value : 70 million \$
6,900 Farmers ; 2,300ha Mulberry & 17,000box silkworms

- Silkworm power, *Cordiceps*, etc : 12million\$,
- Mulberry : 28, Wine, Cosmetics, Silk protein, etc : 30



Comparison of Incomes with other Crops(per10a)

| Crop | Gross Income (US \$) | Earning rate(%) | Net income (US \$) |
|-----------------|----------------------|-----------------|--------------------|
| Rice | 854 | 57.4 | 490 |
| Pear | 4,317 | 60.6 | 2,615 |
| Onion | 1,725 | 57.6 | 994 |
| Cabbage GH | 1,377 | 37.0 | 509 |
| Dried Silkworm | 3,840 | 37.0 | 1,421 |
| Mulberry Fruits | 5,000 | 54.4 | 2,720 |



11 Functional Commodities developed from Sericulture

| Commodity | Year Developed | Effect | Producer/ Manufacturer |
|----------------------------------|----------------|-----------------------------|------------------------|
| Dried Silkworm Powder | '95 | Blood sugar level | Farmer, Union |
| <i>Cordyceps</i> mushroom | '97 | Immunity, anti-fatigue, etc | “ |
| Mulberry leaf tea | '99 | Blood sugar level | “ |
| Nuegra® | '01 | Natural tonic | Geunhwa, GujiuCo. |
| Silk cosmetics | '02 | Moisturizer, wrinkle | Dongsung, Co. |
| Hair-dye | '03 | Hair damage & bleaching | “ |
| Mulberry Fruits Wine, Juice, Jam | '03, '04 | Anti-aging, etc | Farmer, Union |
| Silk toothpaste | '05 | Injury in oral cavity | Dongsung, Co. |
| Silk-peptides BF-7 | '07 | Memory, learning ability | Bioland, Co. |

Transition of Sericulture in Korea

~1980's

Textile Sericulture

Focused on Cocoon, Silk



1990's

Functional Sericulture

**Health food
Alternative medicine**



2000's ~

Bio-Material Sericulture

**Cosmetics
Medical Appliance
Theme Town, Tourism**



Conservation and Breeding



● Silkworm variety JS169×CS186 and their characteristics

- Production of golden colored silk
- DNJ content : 4.3mg/g, 14% more than control
3.8mg/g



For the special clothes and arts

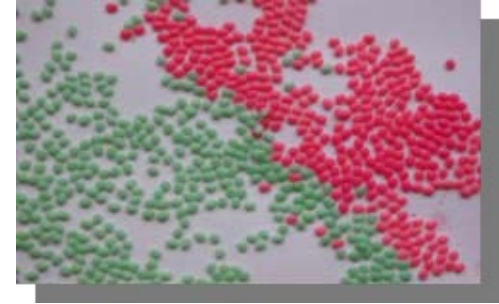
Colored silkworms in each stage



Colored larvae



Colored cocoon



Colored eggs



Art flowers from colored cocoons





Daesung



Gugsang 204 for raw fruit



Turkey – D white colored

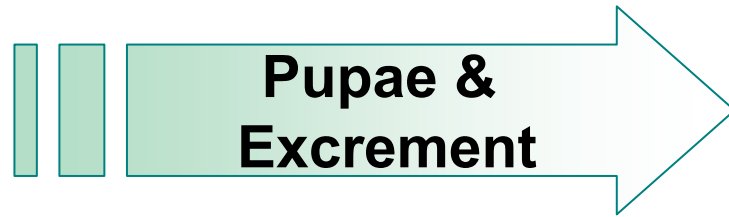
Breeding of mulberry for Jam, Juice, Wine



Functional effect of sericulture products in oriental medicine



- Diabetes
- Cough
- Brain disease
- Hypertension

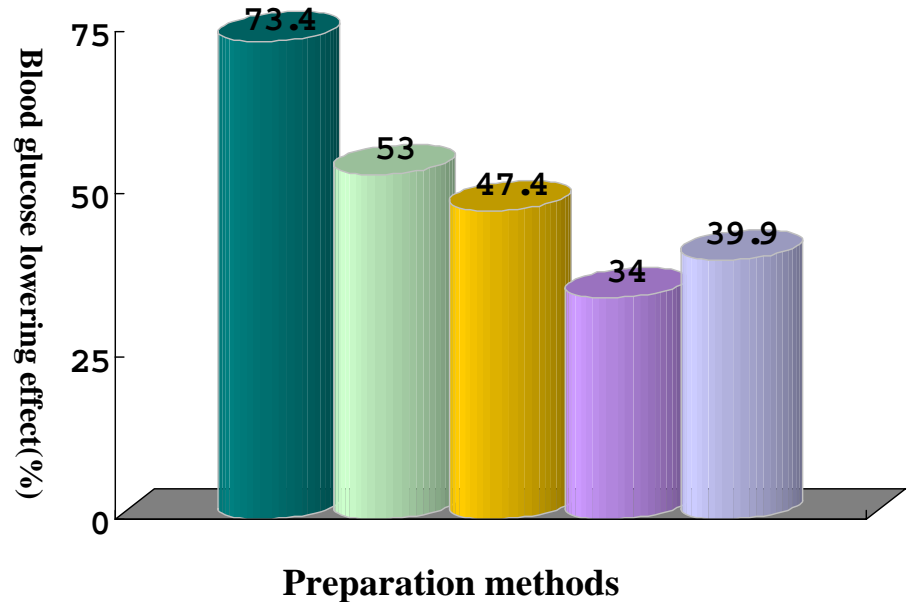


- Diabetes
- Palsy
- Allergy

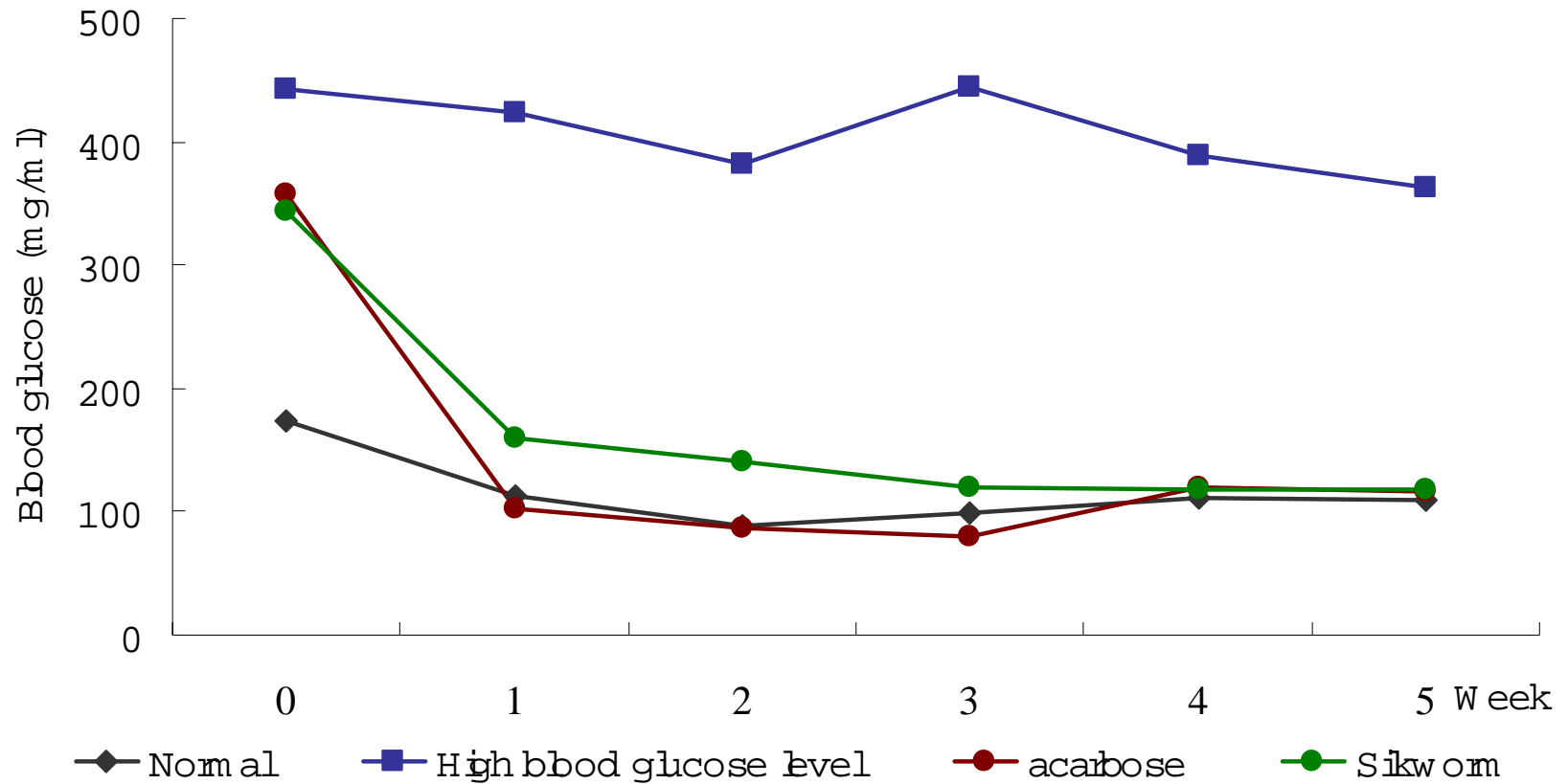
Pupae + Excrement + Mulberry



- 5th instar 3 days freezing dry : 73.4%
- 5th instar 3 days heating dry : 53.0%
- Fasting for 24 hours : 47.4%
- Artificial diet : 34.0%
- During molting : 39.9%



Change of blood glucose levels with long term feeding



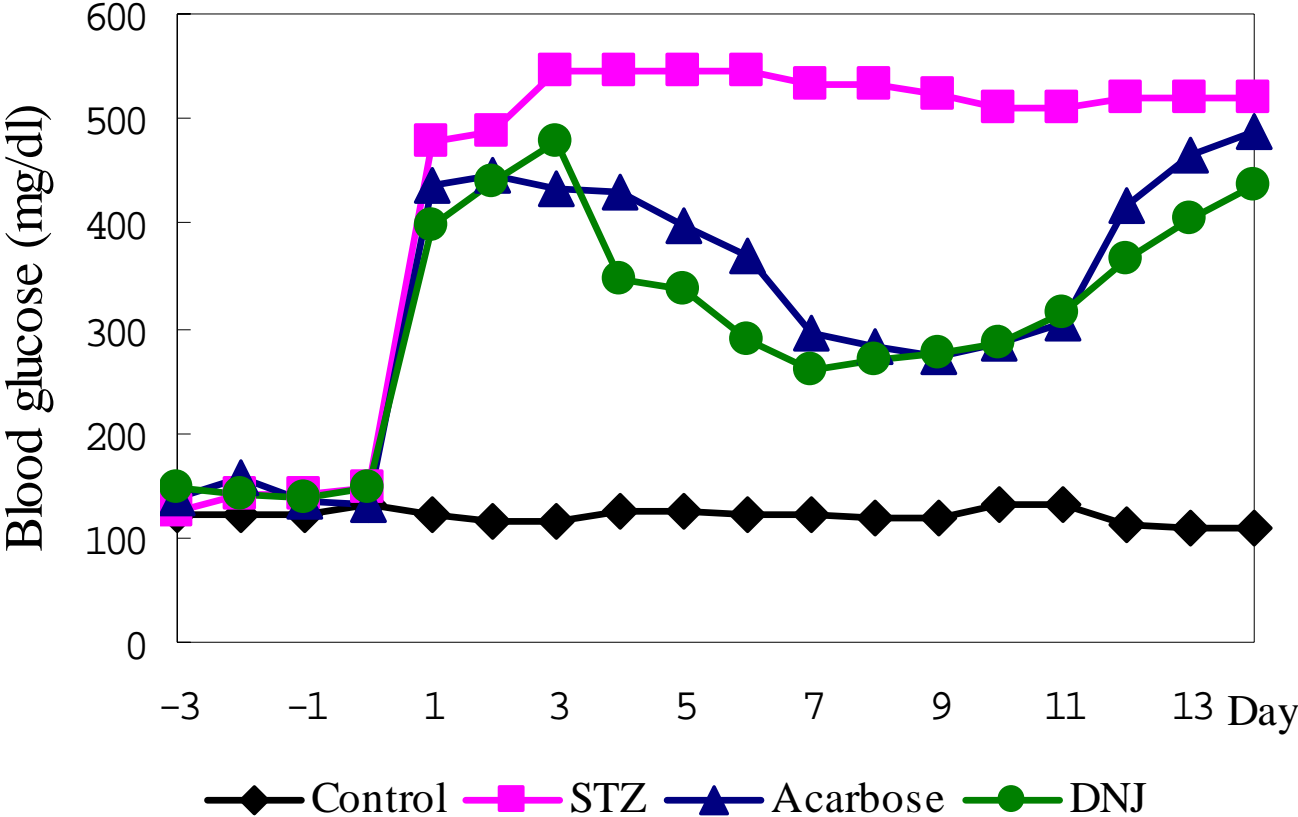
(mg/200g powder)

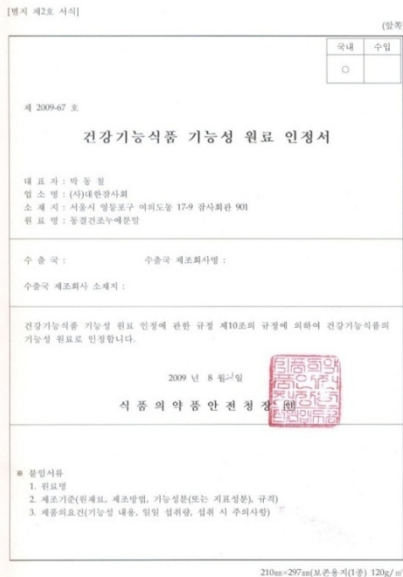
| Alkaloid | Mulberry fruits | Mulberry leaves | Silkworms |
|-------------|-----------------|-----------------|-----------|
| DNJ(1) | 168 | 138 | 376 |
| Me-DNJ(2) | 1.0 | None | None |
| Gal-DNJ(3) | 2.8 | 61 | None |
| Gal-DNJ(4) | 2.8 | 1.2 | None |
| FAG(5) | 3.6 | 37 | 25 |
| Glc-FAG(6) | None | 1.1 | None |
| epi-FAG(7) | None | 4.2 | 4.2 |
| DAB(8) | 2.4 | 11 | 13 |
| Glc-DAB(9) | 4.0 | 13 | 8.2 |
| CAL (10) | 3.6 | 5.2 | None |
| Gal-CAL(11) | 1.6 | 1.8 | None |
| HNT(12) | 2.0 | None | None |



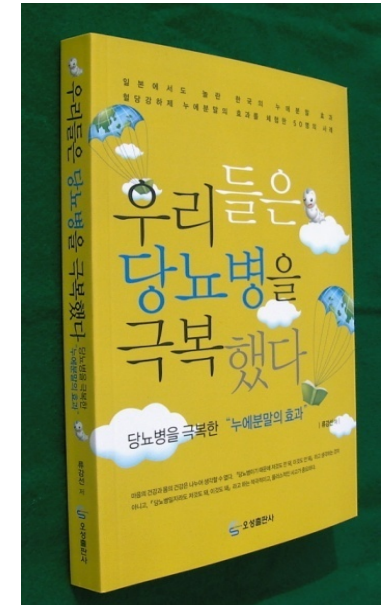
* 1-deoxynojirimycin (DNJ)

Activity of Purified DNJ from Silkworm Powder





Japanese



Korean

Certificate of 'Functional Health Food' from KFDA(2009)

Comparison of Sperm counts

| Treatments | Sperm counts (X10 ⁶ /g epididymis) | Percent(%) |
|------------------------------------|--|--------------|
| control | 53.38 ± 2.18 | 100.0 |
| Viagra | 59.72 ± 0.80 | 111.9 |
| Kissometer | 51.51 ± 1.68 | 96.5 |
| Silkworm moth extract 100mg | 70.22 ± 2.37 | 135.6 |
| Silkworm moth extract 250mg | 75.47 ± 0.09 | 141.4 |
| Silkworm moth extract 500mg | 66.47 ± 4.71 | 124.5 |
| Botany 1 | 70.95 ± 2.05 | 132.9 |
| Botany complex | 66.73 ± 1.11 | 125.0 |

Sex chromosome in human



men(♂) : XY

women(♀) : XX

Sex determined

Sex chromosome in silkworm

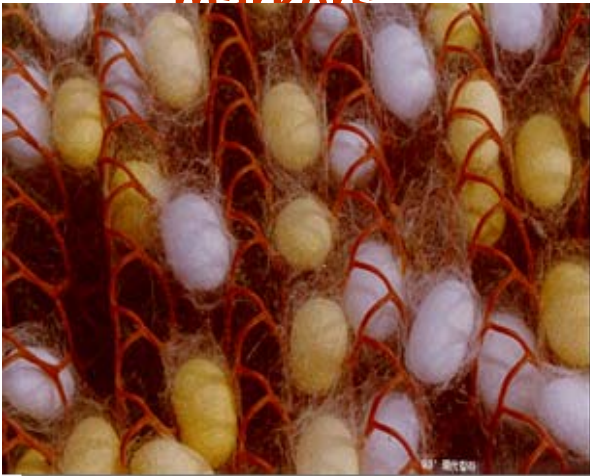


male(♂) : ZZ

female(♀) : ZW

Sex determined

□ W chromosome : yellow cocoon, larval markers



♀

♂



♀



♂

Optimal stage for male pupa production



4days



8days



12days



14days



Nuegra® for stamina from male silk-moth

Effects of Cordyceps

- Anti-cancer
- Build-up of immunity
- Anti-fatigue
- Anti-stress



Mini-kits for growing



'Bulhee' wine



drink

Healthy foods using mulberry leaves

■ Mulberry leaves ice-cream

- Simple prepared powdery mulberry leaves : green smell
- Preservation of original color

■ Effect of mulberry leaves ice-cream on the blood glucose

| level | Before | After 45 min | Lowering effect(%) |
|-----------------|------------|--------------|--------------------|
| General | 87.4±14.8 | 107.8±10.9 | 27.8 |
| Mulberry leaves | 113.4± 7.8 | 111.4±14.0 | -1.6** |



Mulberry leaves jelly, noodle

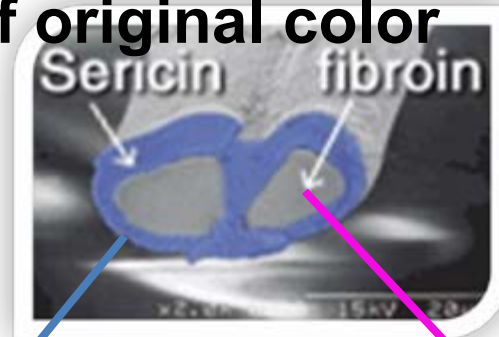
■ Silk cosmetics

- Moisturizing and activating skin tissue
- Sericin : moisturizing factor, fibroin : collagen formation

Preservation of original color



Sericin soap



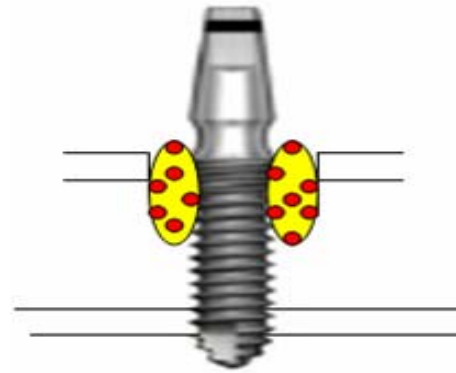
Silk toothpaste(wound care in mouth)



Fibroin cosmetics



Silk eardrum

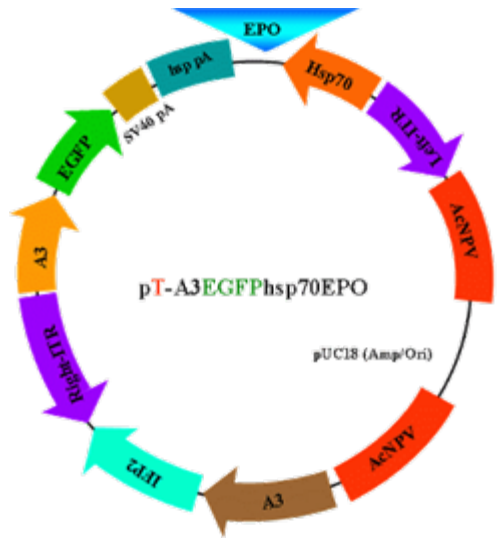


PRF
Silk fibroin

Silk bone with implant

Construction of piggy Bac vector fused with Ac NPV

● Transgenic efficiency : 2%→70%



Improved piggy Bac vector

pG-A3-EGFP
-Hsp70-EPO

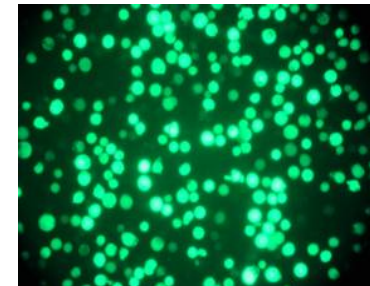
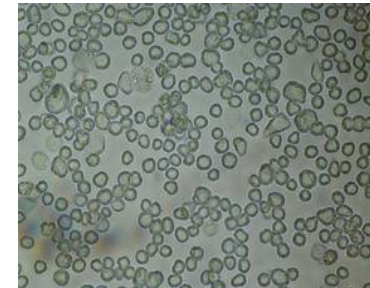


Bright



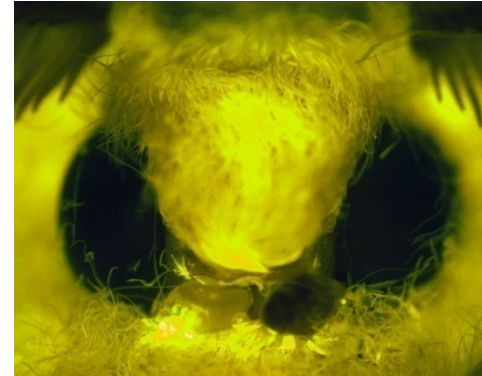
EGFP

pT-A3-EGFP
-Hsp70-EPO

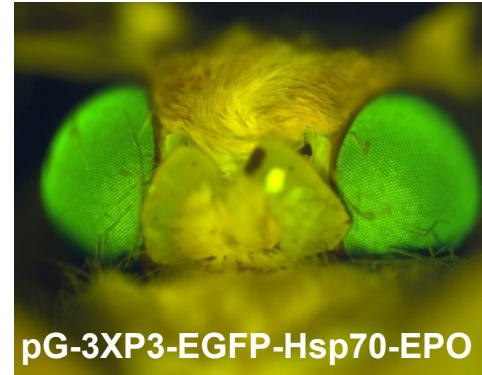


Comparison of pG and pT of transgenic vector

Normal
silkworm



Transgenic
silkworm



Illumination under white light EGFP-excitation-wavelength light

- ◆ Development of highly efficient transgenic vector
- ◆ Construction of transgenic technology
- ◆ Produce of materials with induction of valuable gene
- ◆ Expression control of specific gene : mass production of specific materials

Sericulture-complex town



Buan Nue-Town & Museum

Silkworm farmer's clean town



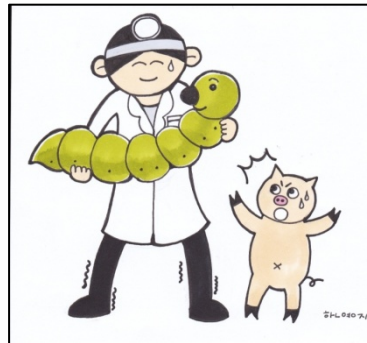
Asan silkworm town for the retired



See the inside silkworm in Youngchon !

R&D and Legal Policy for Next Generation Sericulture

- **Genetic resources of silkworm & mulberry : special var. breeding**
- **Silkworm Powder : Authorization with Functional Health Food from KFDA and Natural Medicine**
- **New food industry of mulberry fruit : Wine, Food additives, etc.**
- **Silk Protein : new bio-materials for medical application**
- **Bio-technology in Sericulture : (transgenic)'bio-factory silkworm'**
- **Activation of rural community : town for aged man & tourism**



THANK YOU