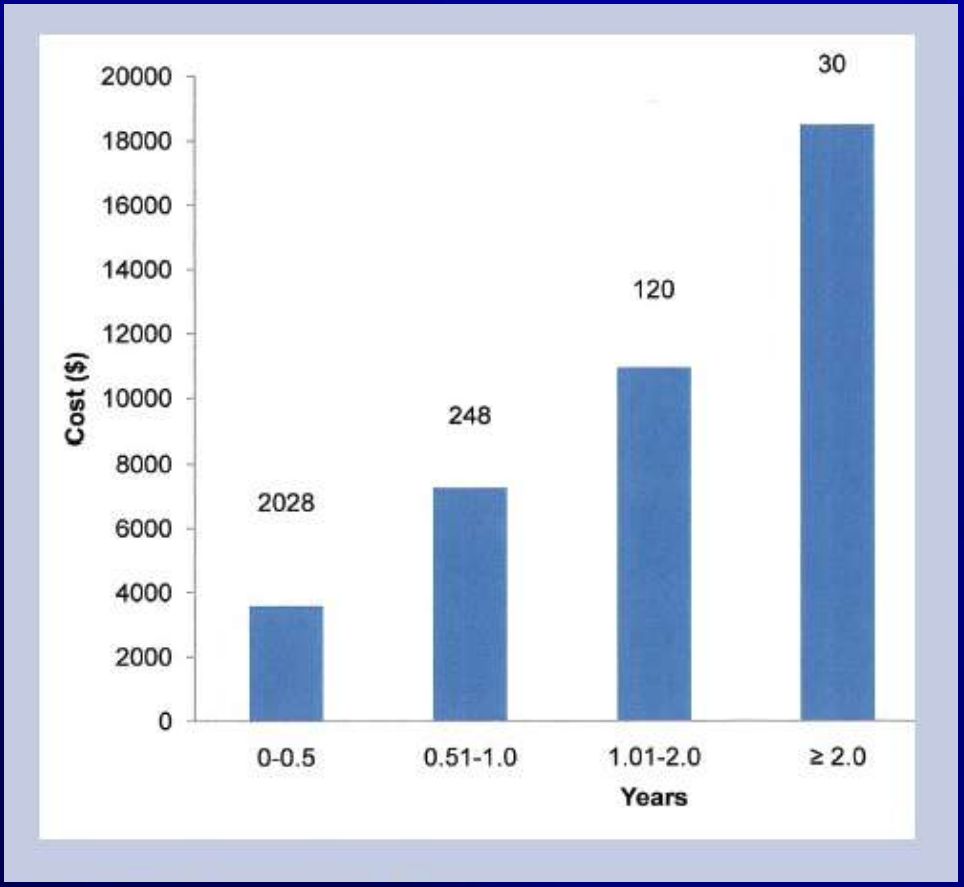
Presenter: Dr Marisse Venter, Plastic & Recon Surgeon
Co-authors: Professors CA Benn, S Naylor, E Ndobe, M Lukhele
Johannesburg, South Africa
Body Contouring Research Foundation

Wound Care Costs

- Incidence gen pop 2%,
- US: $50 Billion / year
- 25-40% of in-pt beds
- Time of nursing care



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Wound Care Outcomes and Associated Cost Among Patients Treated in US Outpatient Wound Centers: US Wound Registry. Five et al, Wound 2012

Adipose Derived Stem Cells

- Established role
- Isolation, purification and cultivation expensive
- Equipment and expertise
- Not readily available

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Role of adipose-derived stem cells in wound healing, Wound Repair Regen,May 2014, Hassan et al

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ISAPS 2016 KYOTO JAPAN

7 LARGE WHITE SOUTH AFRICAN PIGS

The Effect of Fat on Wound Healing:

Animal Model

Animal Ethics Approval number: TA 123-329

Aim

Develop an Animal Model

7 Large White South African Pigs 32 – 62 kg

Study done in 2 parts:

1. Confirmation of Stem Cells in Lipo-aspirate

2. Evaluate the effects of Lipo-aspirate on Wound Healing

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Introduction

Exploitation of Adipose Tissue

- General anaesthesia
- Easy Harvest
- Cheap
- Abundant Availability
- Ethically Acceptable

7 LARGE WHITE SOUTH AFRICAN PIGS

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University of the Witwatersrand
Animal Ethics Comity Nr T144682012

Never Out of Stock!

PART 1
Confirmation of Stem Cells i Lipo-aspirate

Site- Dorsal hump

- No tumescent
- 2 mm Coleman Cannula
- Soft Spin 1200rpm
- Volume 20ml

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Stem Cell Isolation

- 10 ml of processed lipo-aspirate
- Digested with Mixed Collagenase
- Stromal Vascular Fragment analysed
- Immunohistochemistry : CD 34+ & CD 31+
- Fraction Evaluated via Flow Cytometry

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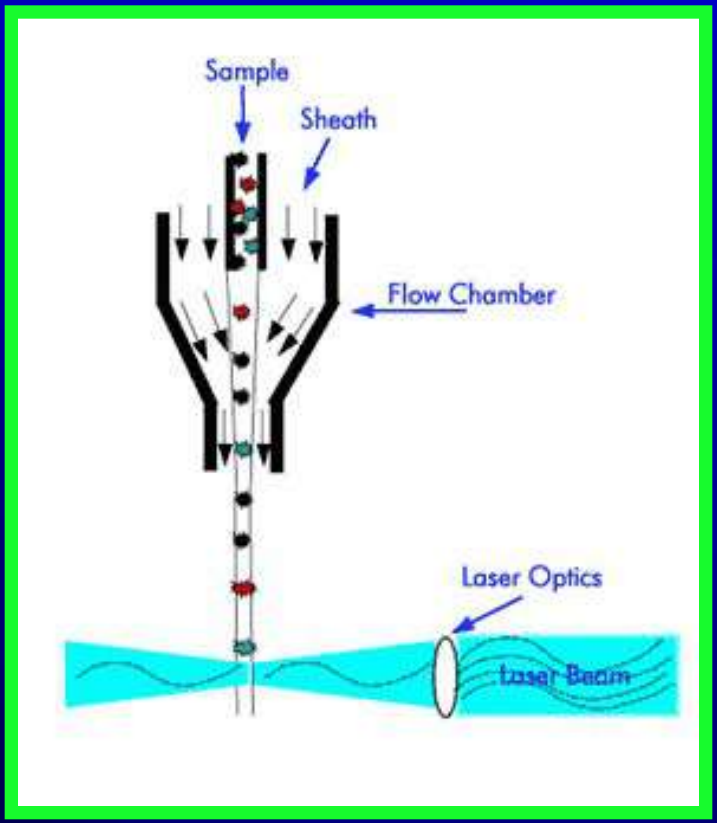
Strategies for Regeneration of Bone Using Porcine Adult Adipose Derived Mesenchymal Stem Cells, Mananco et al, Theriogenology 2011 : 25;1381-1399

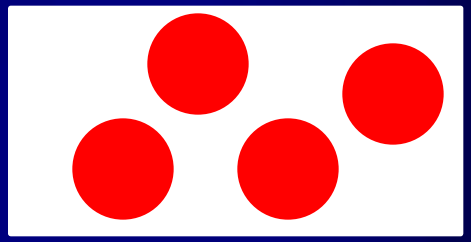
Methods
Flow Cytometry

- Rabbit Antigen
- Markers : **CD 34+** **CD 31+**



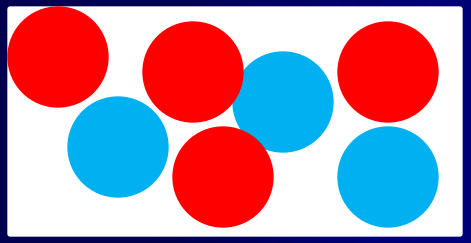
Adipose Stem Cell

CD 34 +
CD 31 -



Marrow Stem Cell

CD 34 +
CD 31 +



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Results
Flow Cytometry

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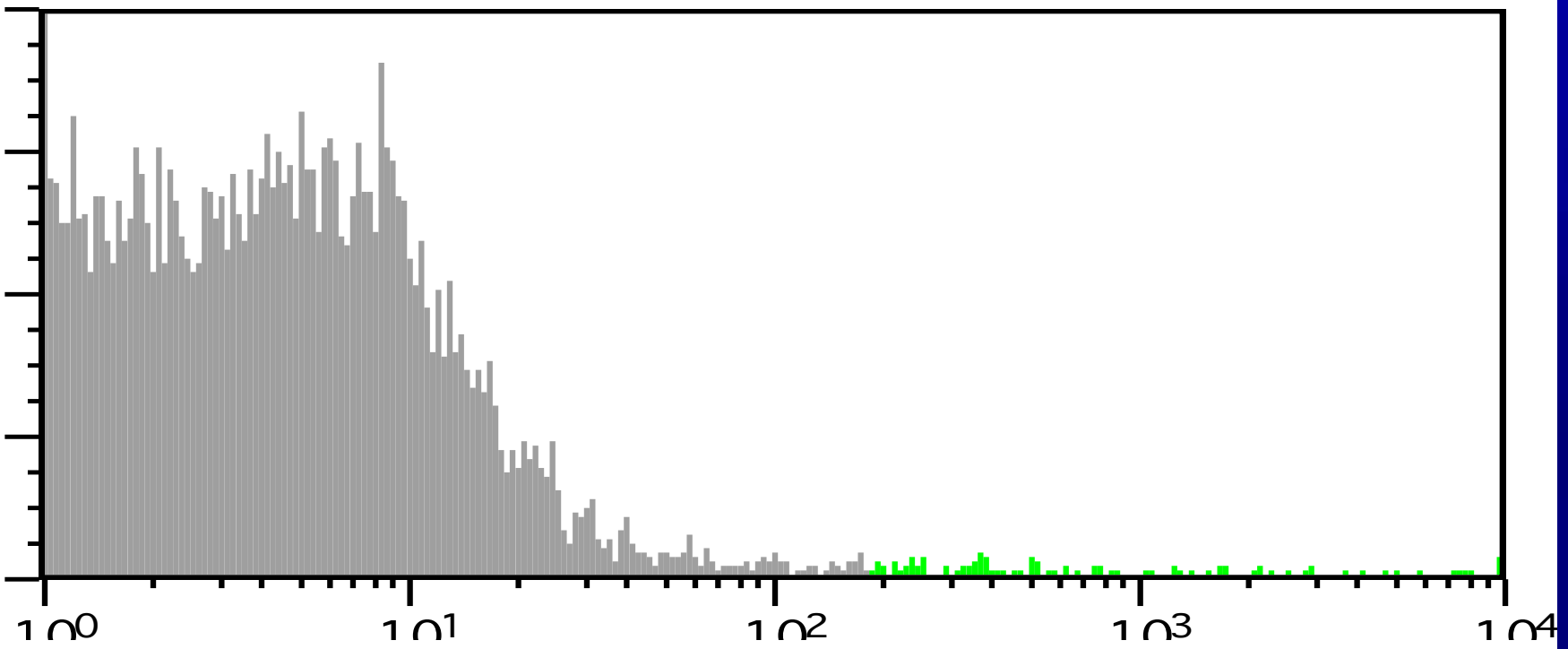
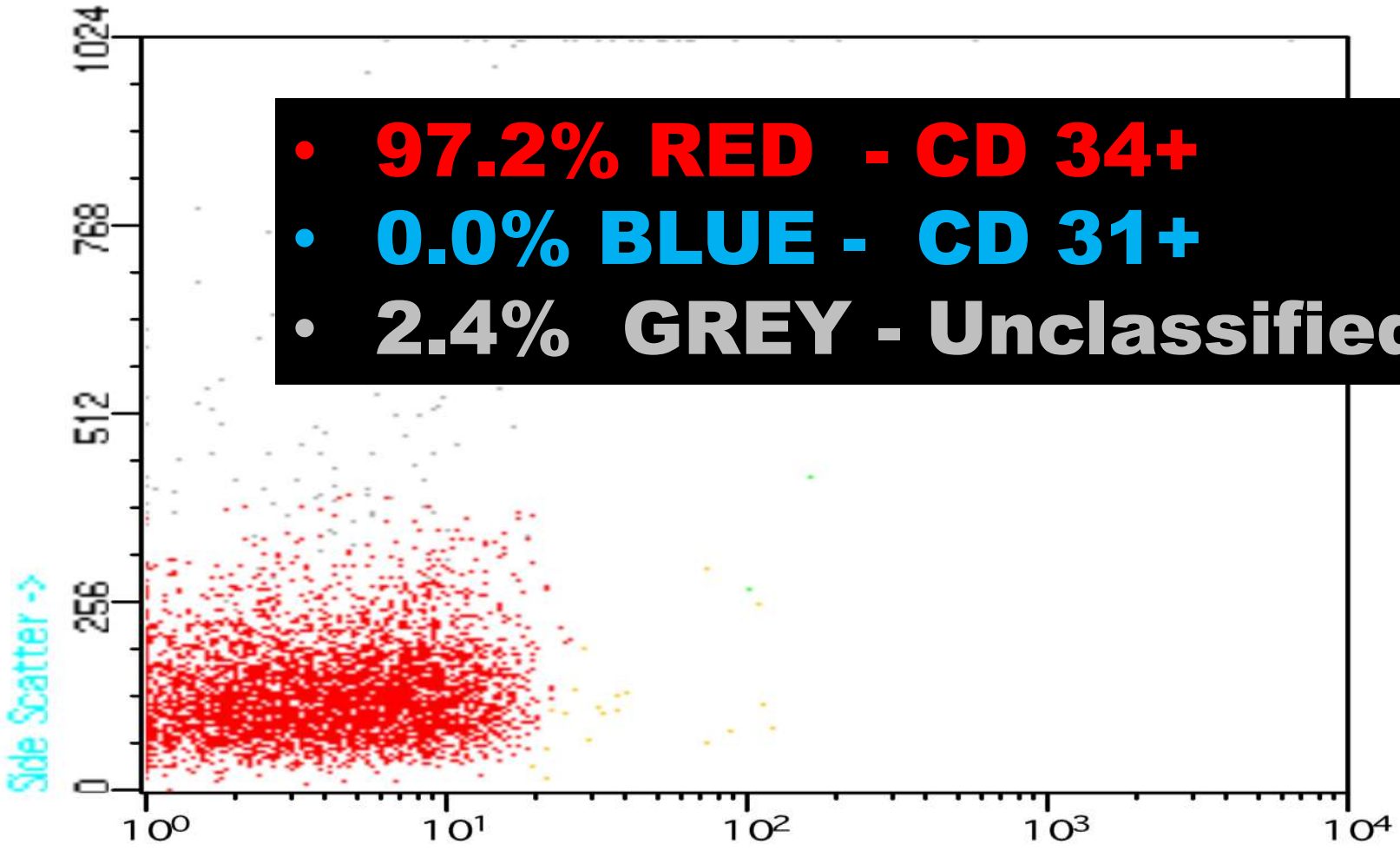


0.96 % Dead Cells - (PI uptake)

99.04 % Live Cells - No PI uptake

Current Study



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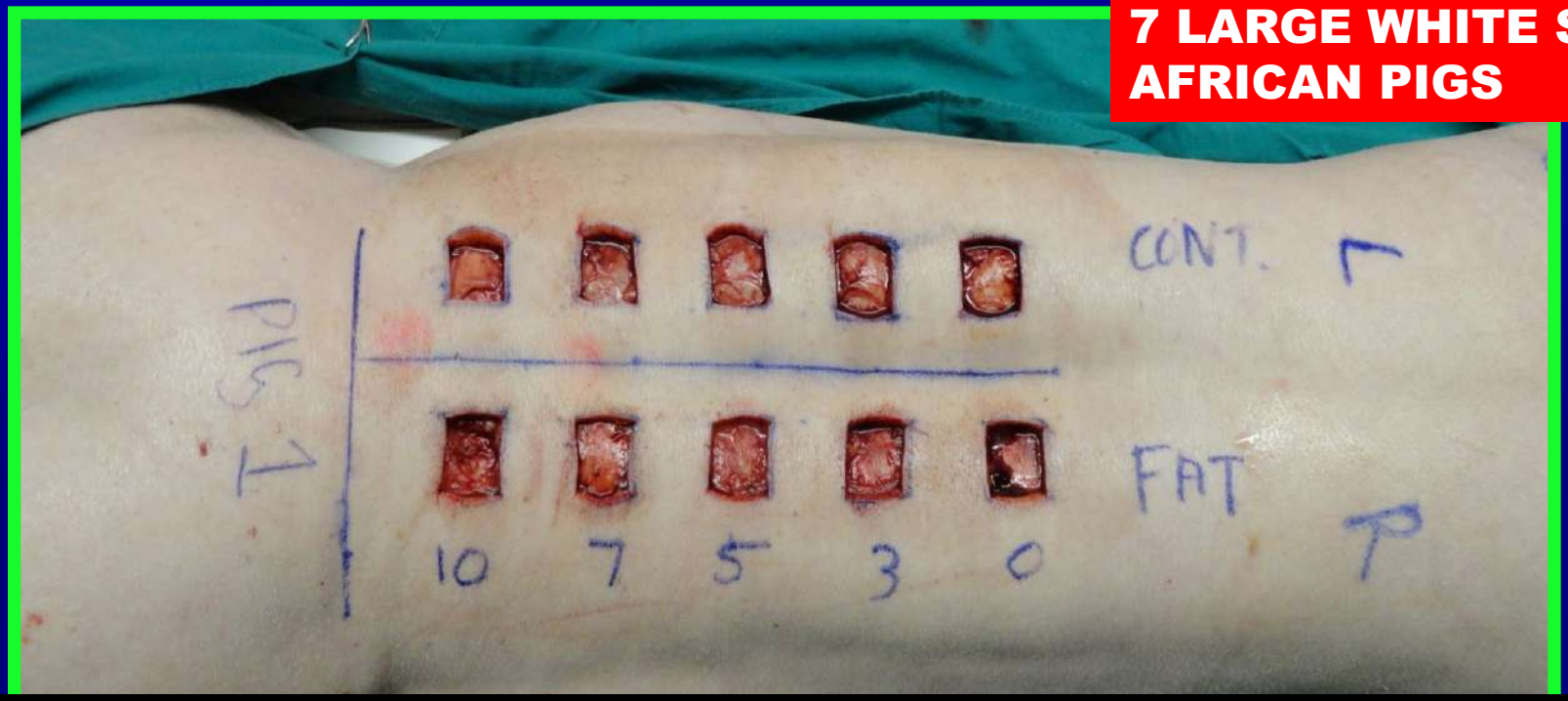
Analyzed by Prof M Hosie Department of Anatomical Sciences

PART 2

Evaluate the effects of lipo-aspirate on wound healing

7 LARGE WHITE SOUTH AFRICAN PIGS



- 5 Wounds each side of midline
- 2.5 x 2.5 cm
- Left (Control) vs Right (Fat)

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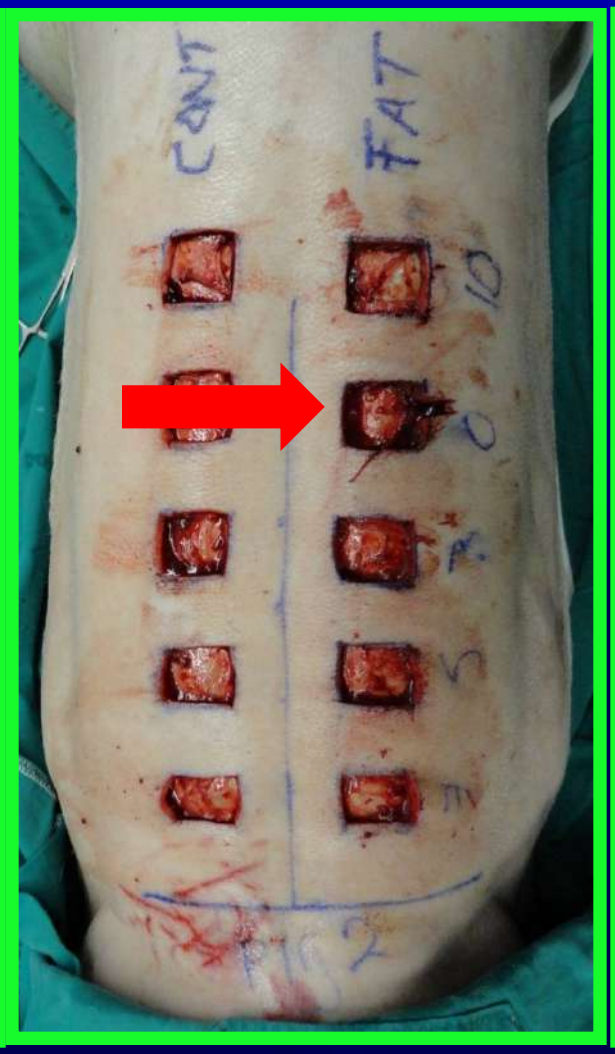
PIG 1

PIG 2

PIG 3



Variability in initial incision site

Full Thickness Wound

- 0.5 ml per Side
- 2 ml per Wound

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JOHANNESBURG

- **Wound Biopsy - day 0, 3, 5, 7, 10**
- **Surface area - day 0, 3, 5, 7, 10**

- **Bacteriology - day 0 ,5 , 10**

Transparent Film Dressing

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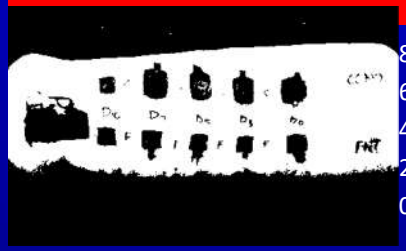
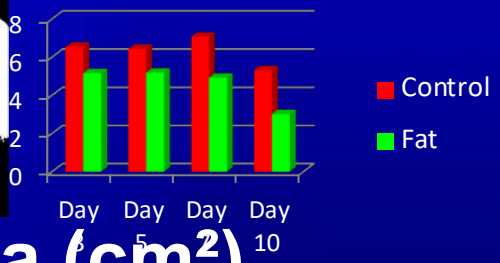
JOHANNESBURG

Body Stocking

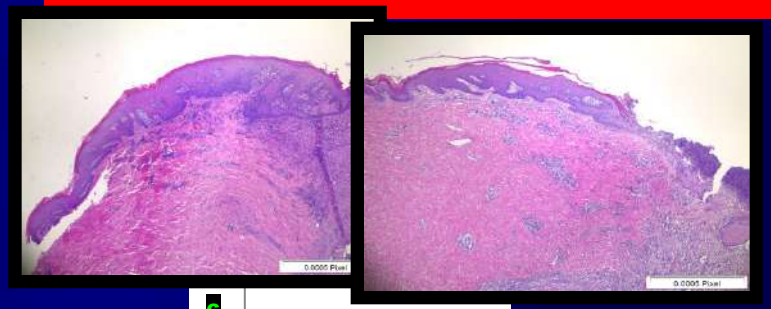
1. Macroscopic Evaluation

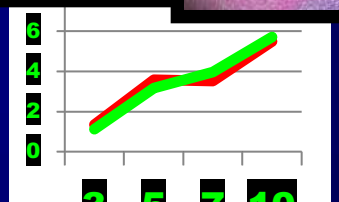




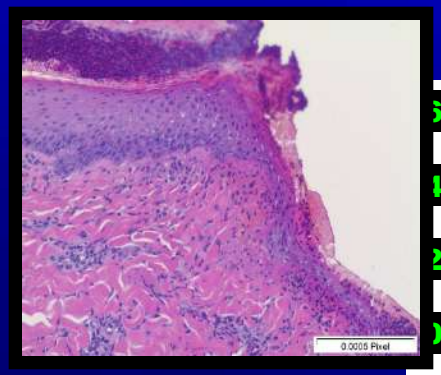
Wound Area (cm^2)

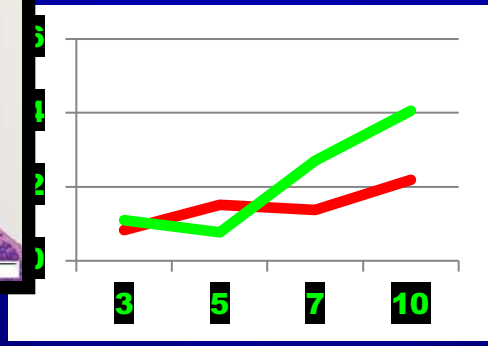
2. Epidermal Length



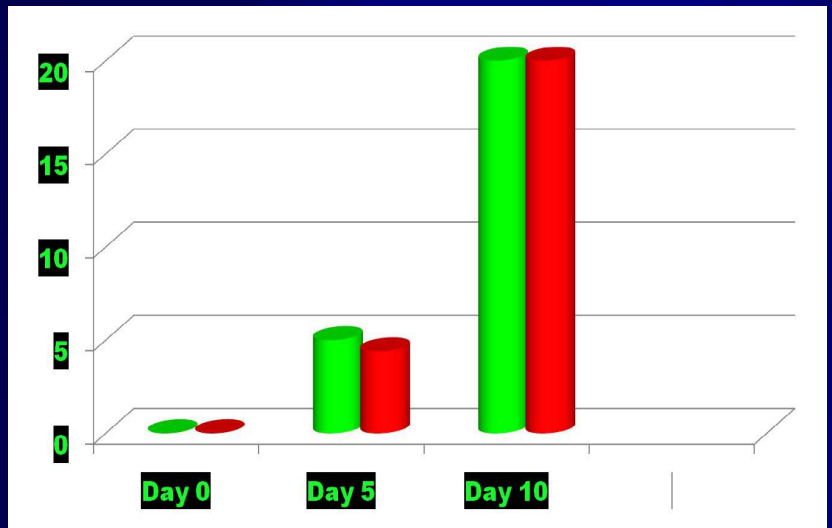


3.Epidermal Thickness



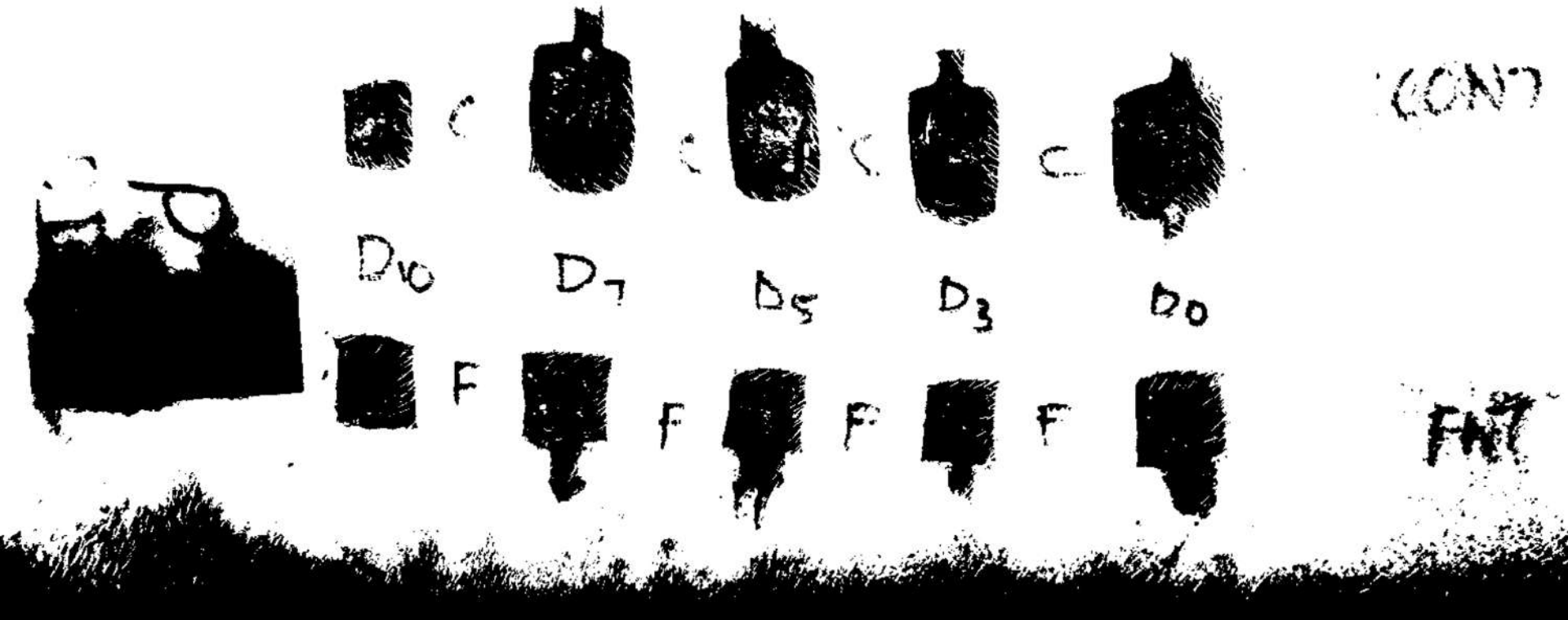


4.Bacteriology



Results

1. Wound Surface Area



Method

Macroscopic Assessment

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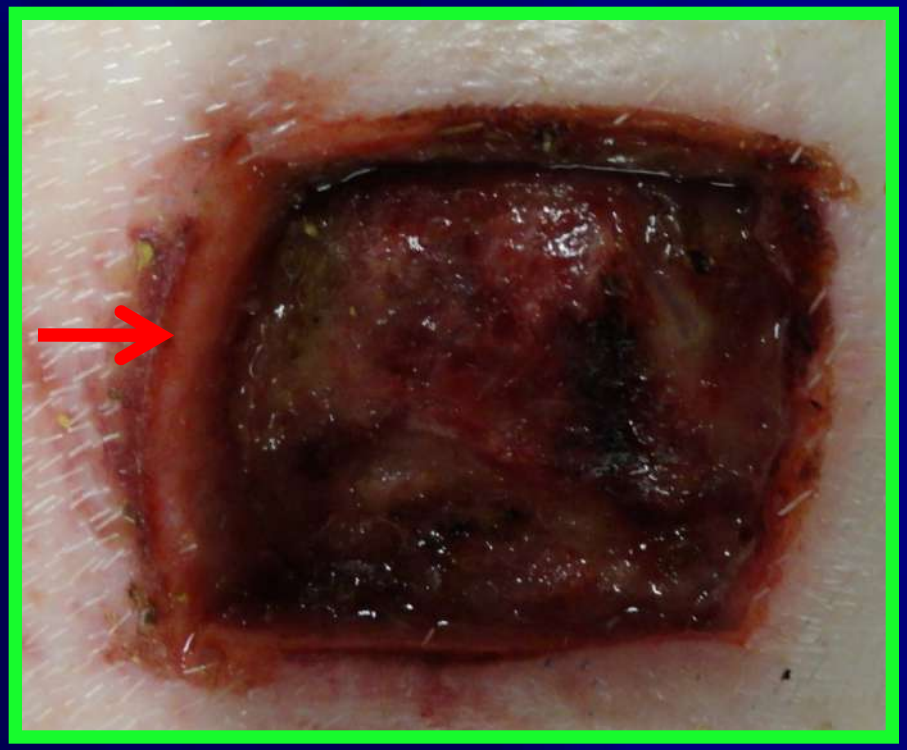
$$\text{Wound Area cm}^2 = \frac{\text{Area of original wound} - \text{Area of remaining wound}}{\text{Area of Original wound}} \times 100$$

Migrating Epithelium



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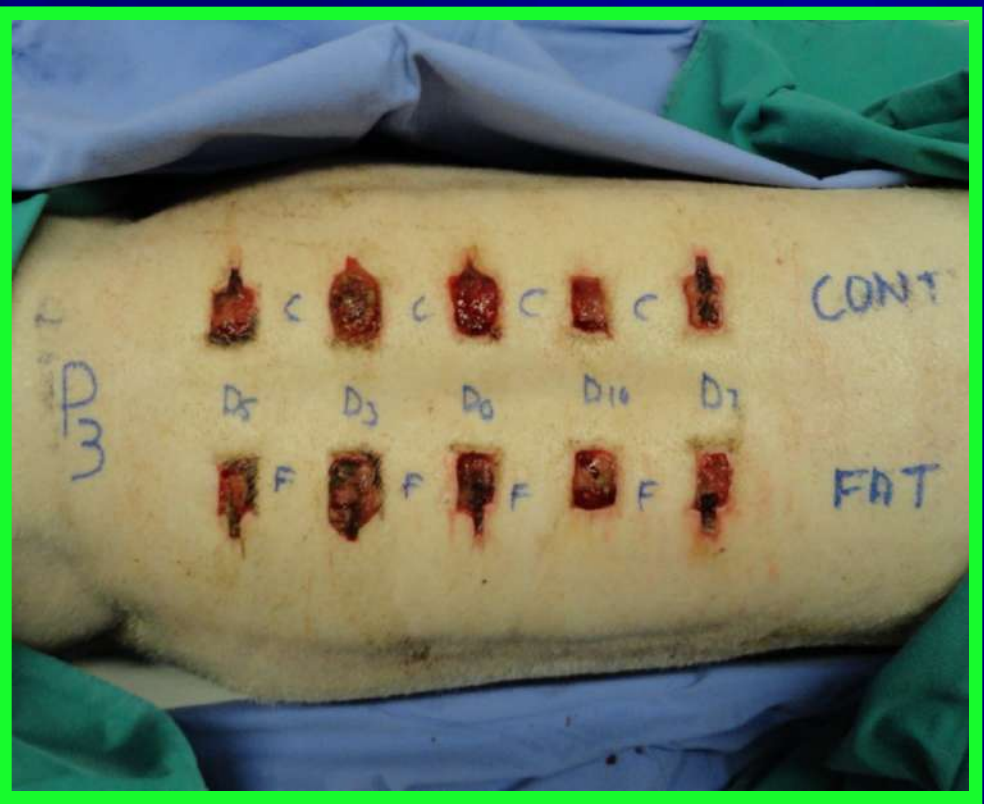
Results

1. Wound Surface Area



Results

1. Wound Surface Area

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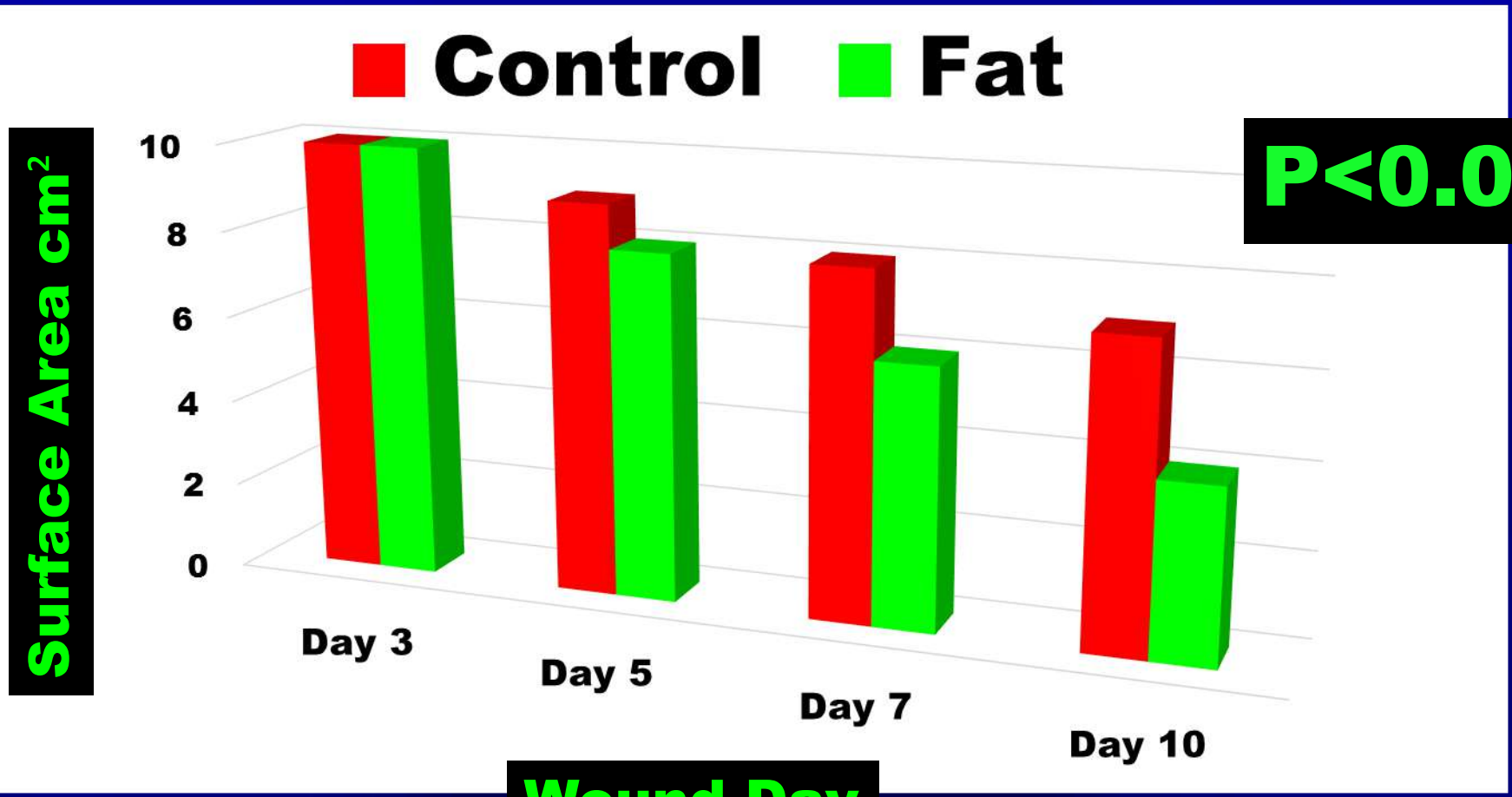
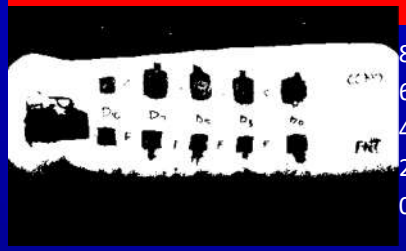
Results
1. Wound Surface Area

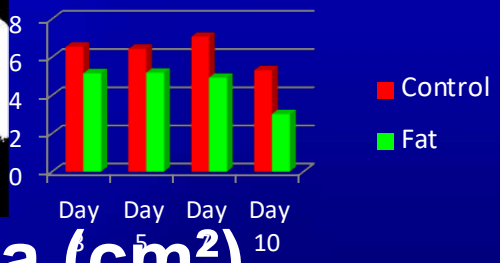


P<0.05

Statistical evaluation by Prof G Candy

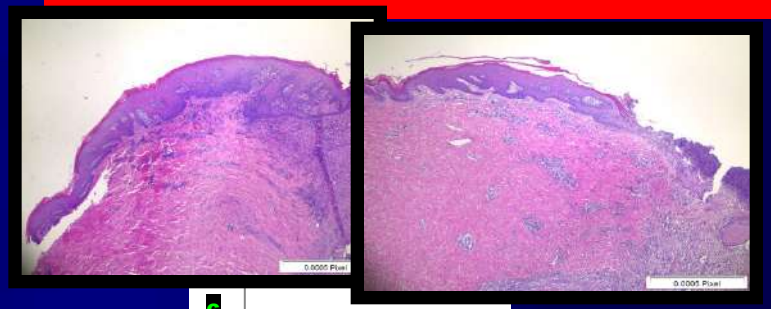
1. Macroscopic Evaluation

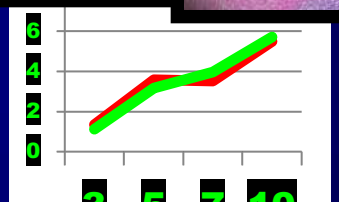




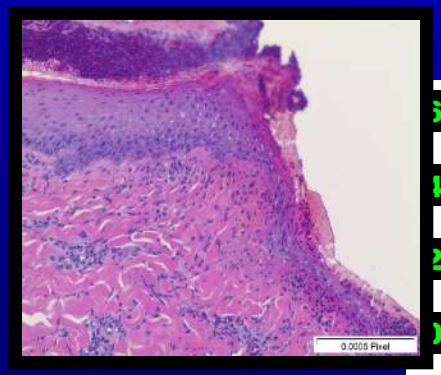
Wound Area (cm^2)

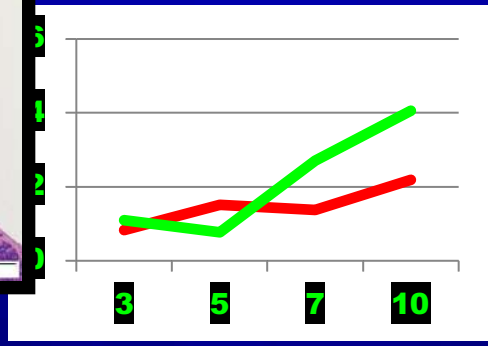
2. Epidermal Length



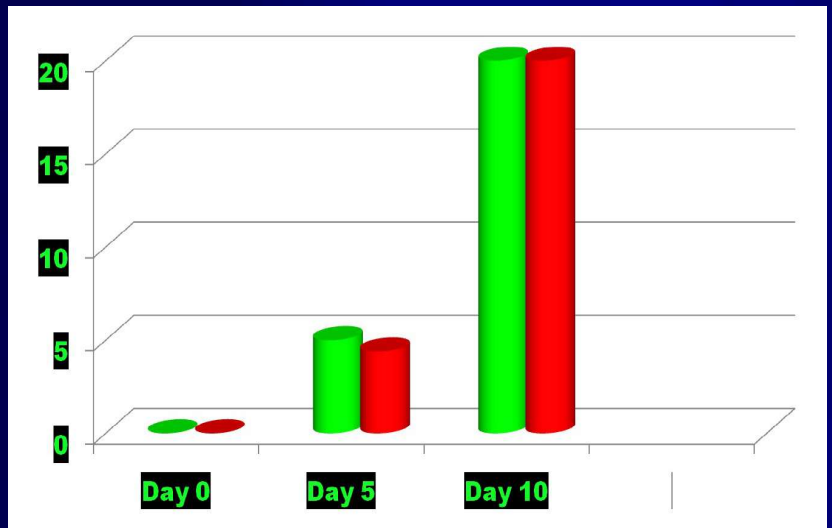


3.Epidermal Thickness





4.Bacteriology



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Results

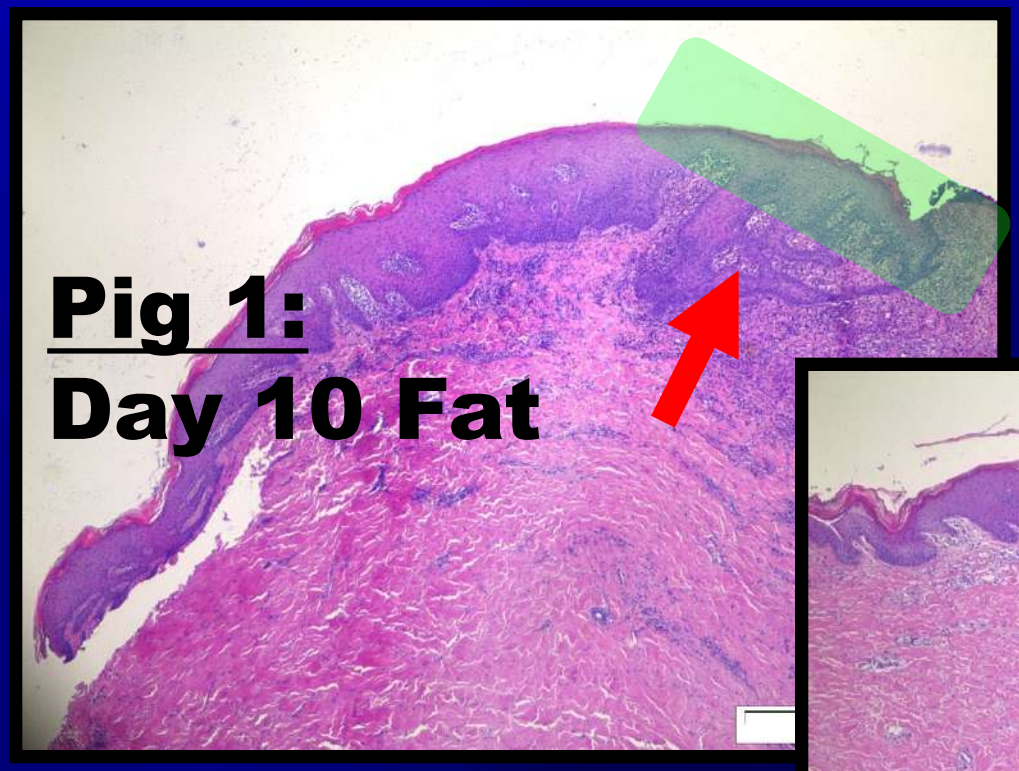
2. Epidermal Length (tongue)

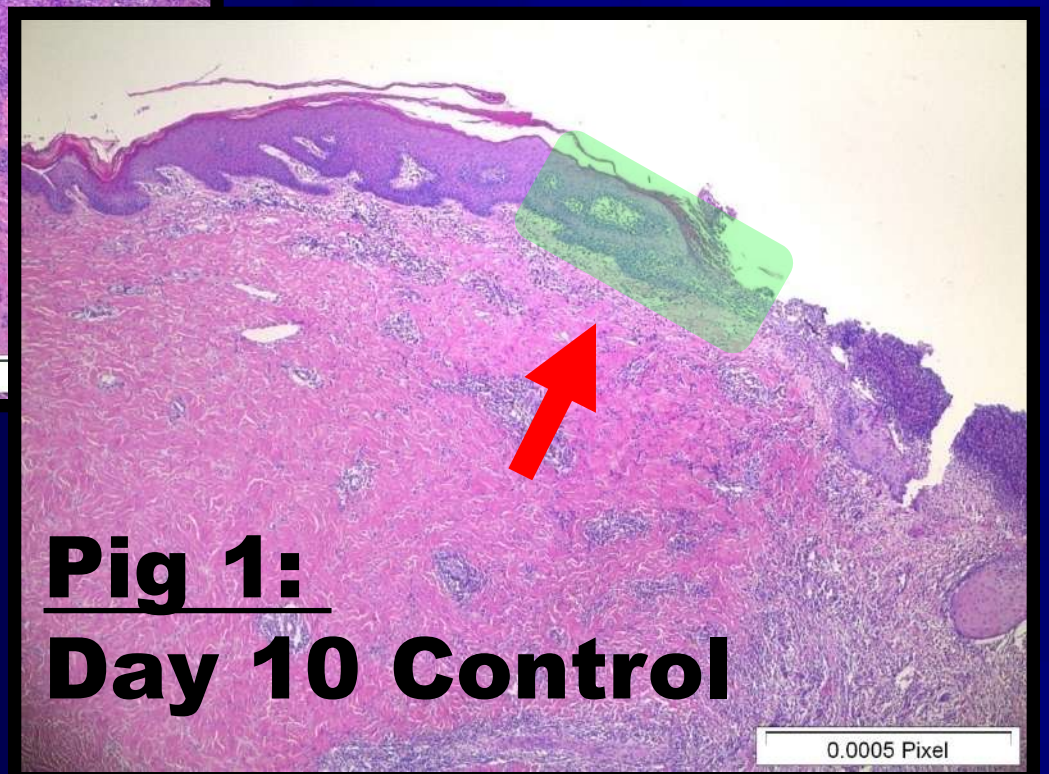
40 x Magnification

Length Epidermal Tongue

Image provided by Prof Naylor

2. Epidermal Length (Tongue)





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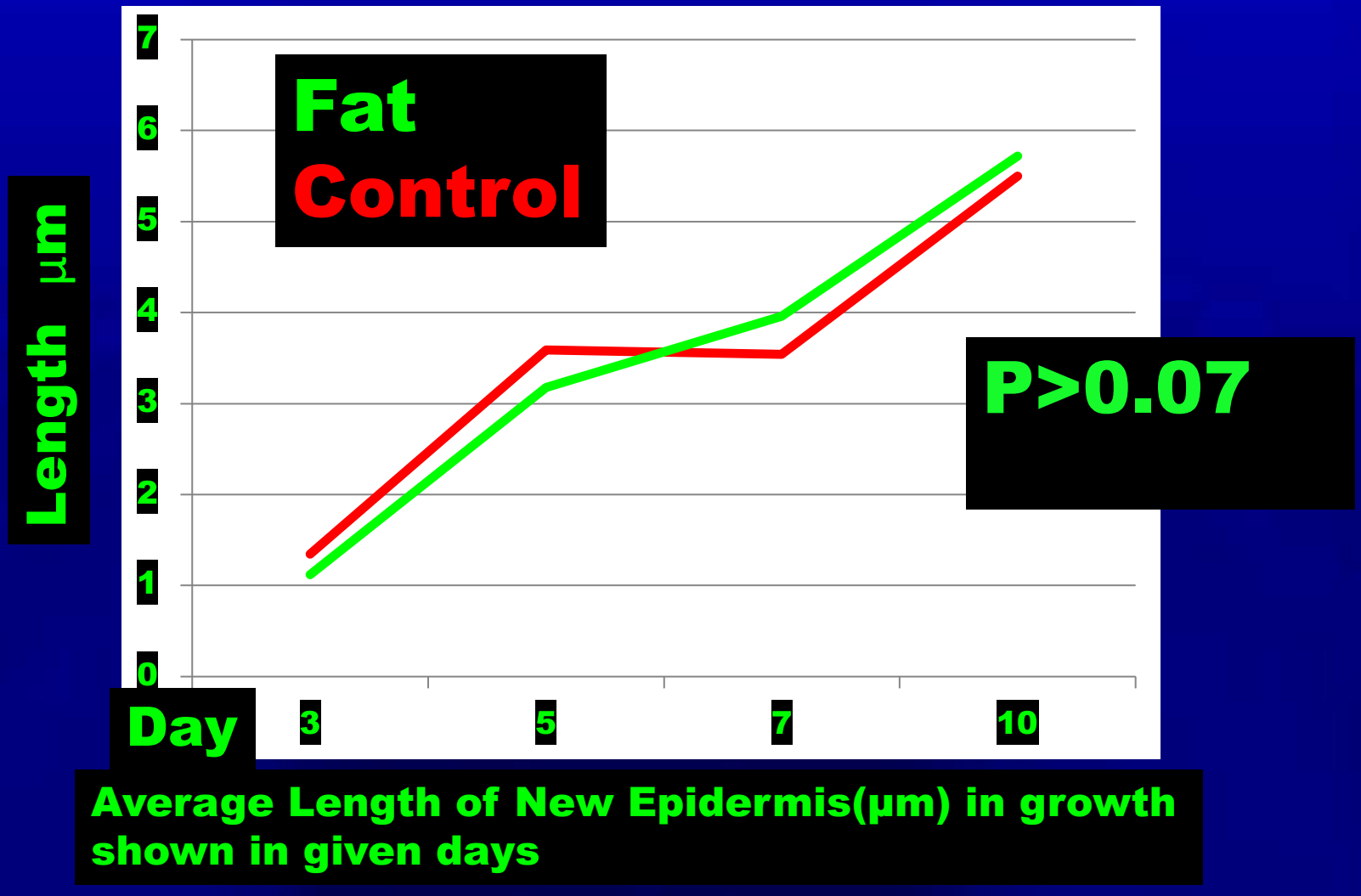
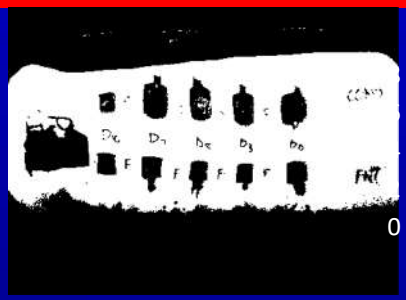
Results

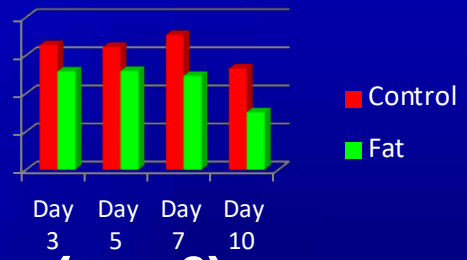
2. Epidermal Length (tongue)



Average Length of New Epidermis(µm) in growth shown in given days

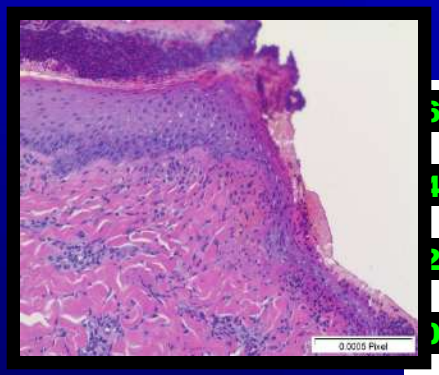
Macroscopic Evaluation

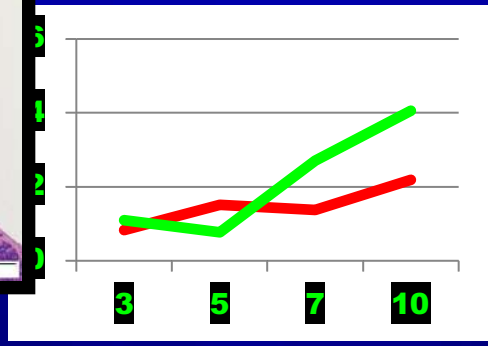




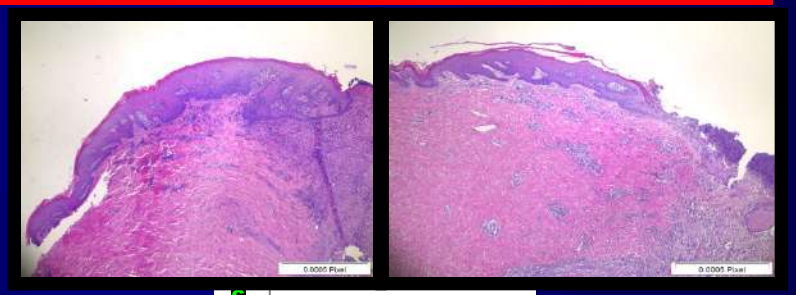
Wound Area (cm²)

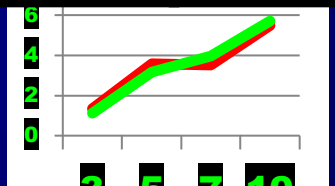
Epidermal Thickness



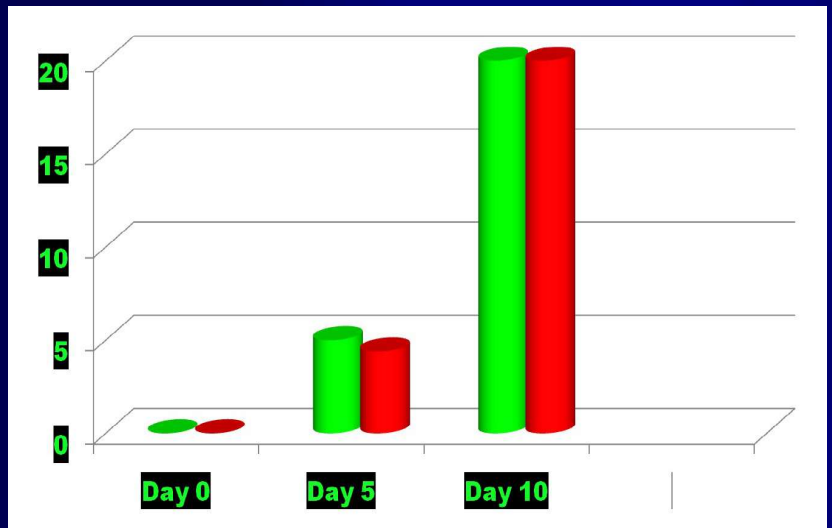


Epidermal In Growth





Bacteriology



Results
3. Epidermal Thickness

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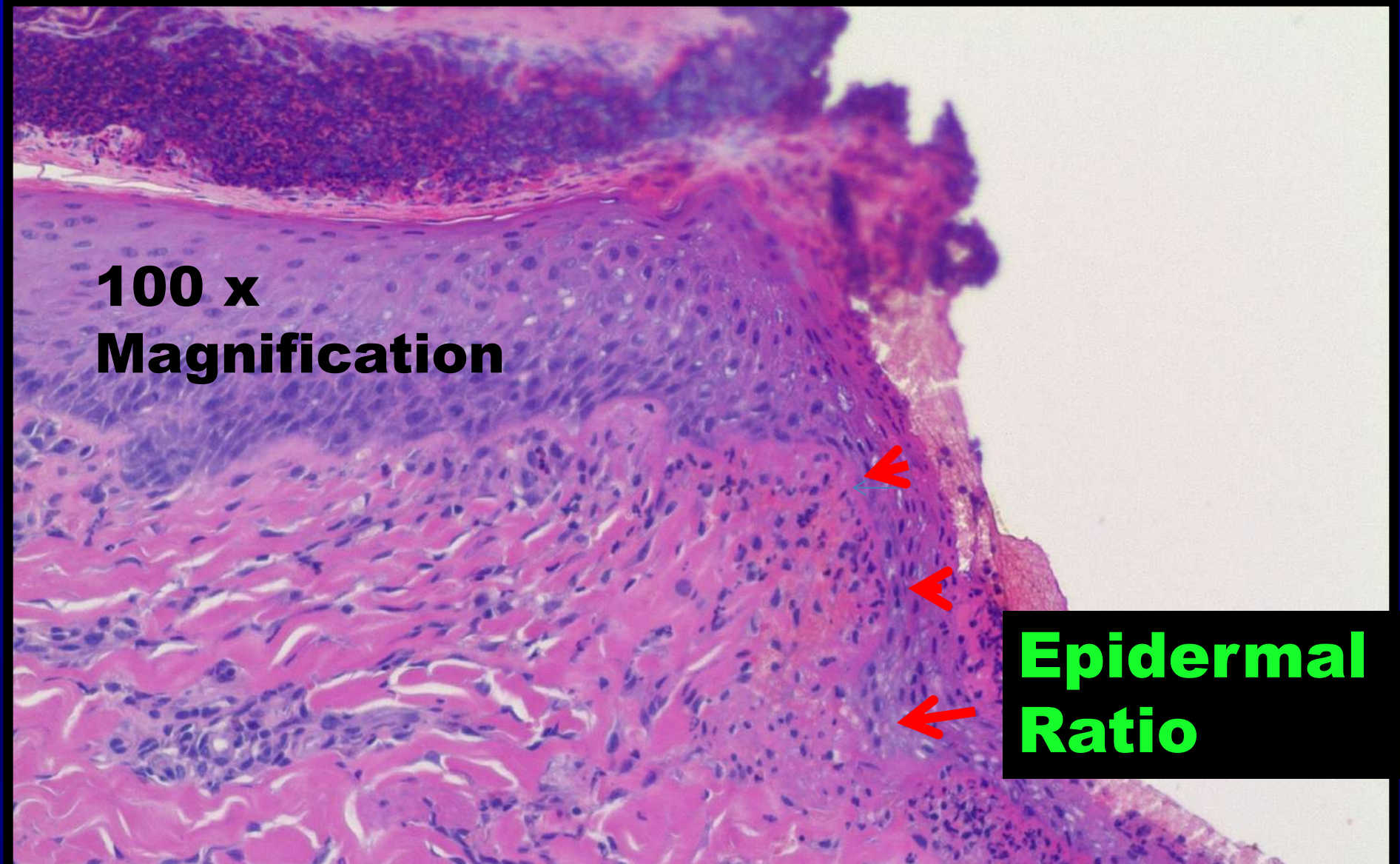

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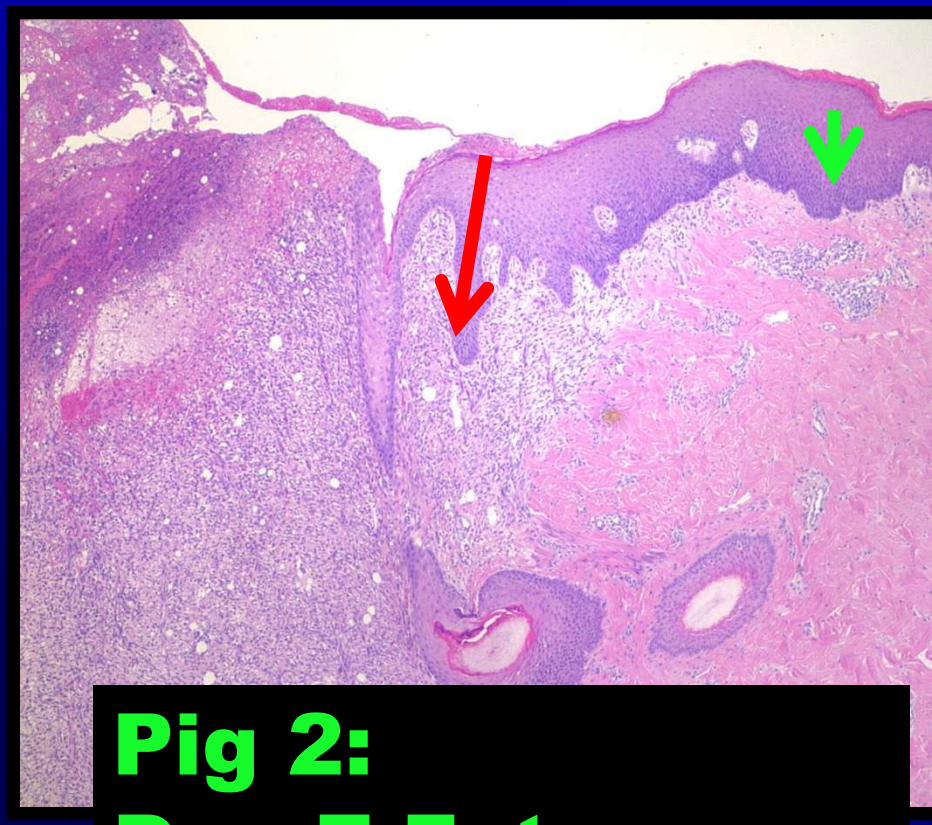
Epidermal Ratio

Pig 2:
Day 7 Control



Pig 2:
Day 7 Fat

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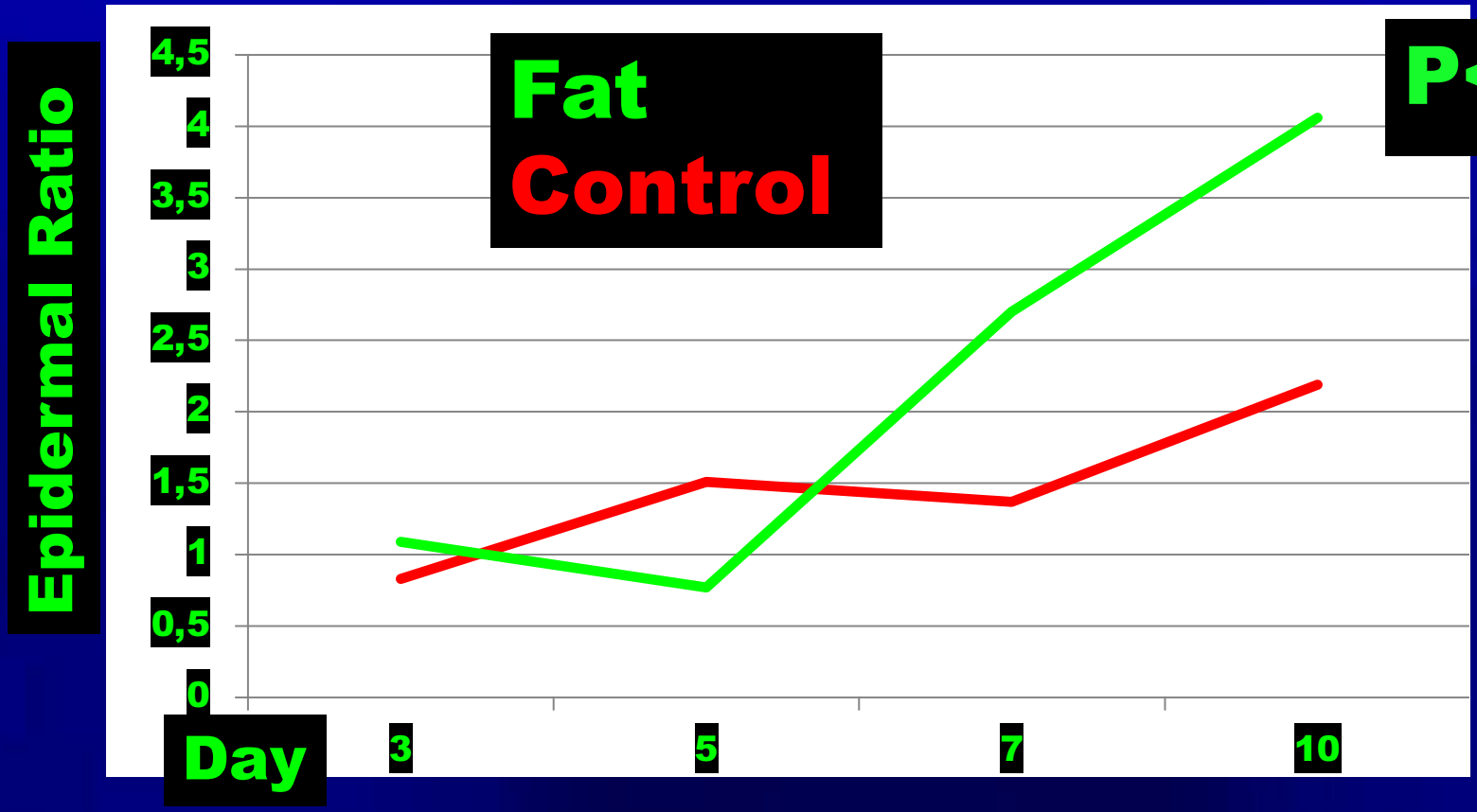
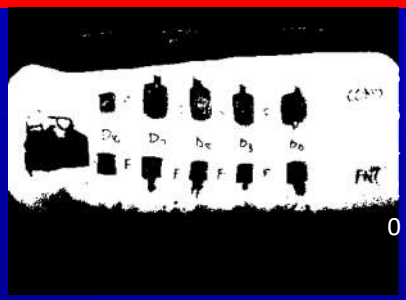
Epidermal Ratio

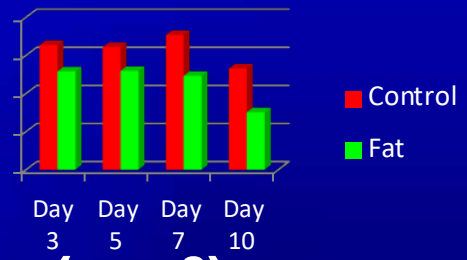


New Epidermal to Normal Epithelial Thickness Ratios on Given Day

Statistical evaluation by Prof G Candy

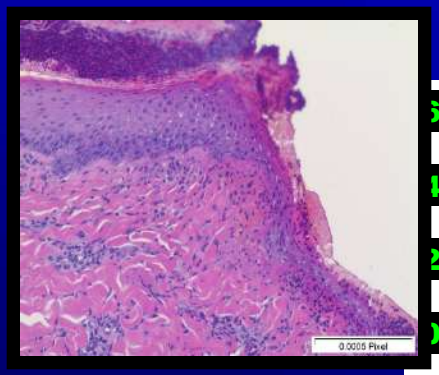
Macroscopic Evaluation

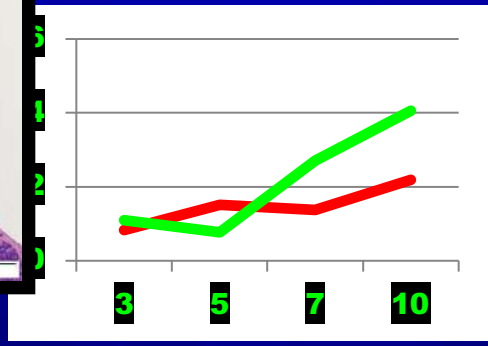




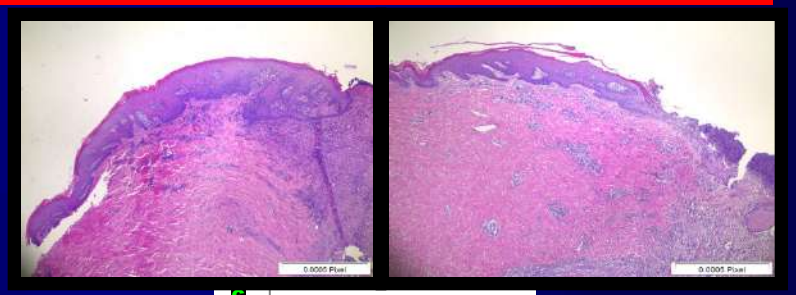
Wound Area (cm²)

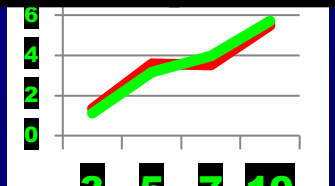
Epidermal Thickness



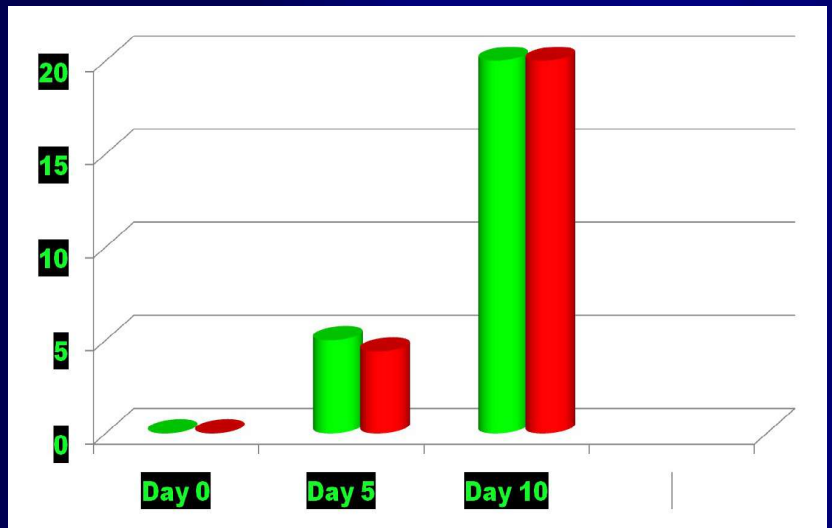


Epidermal In Growth

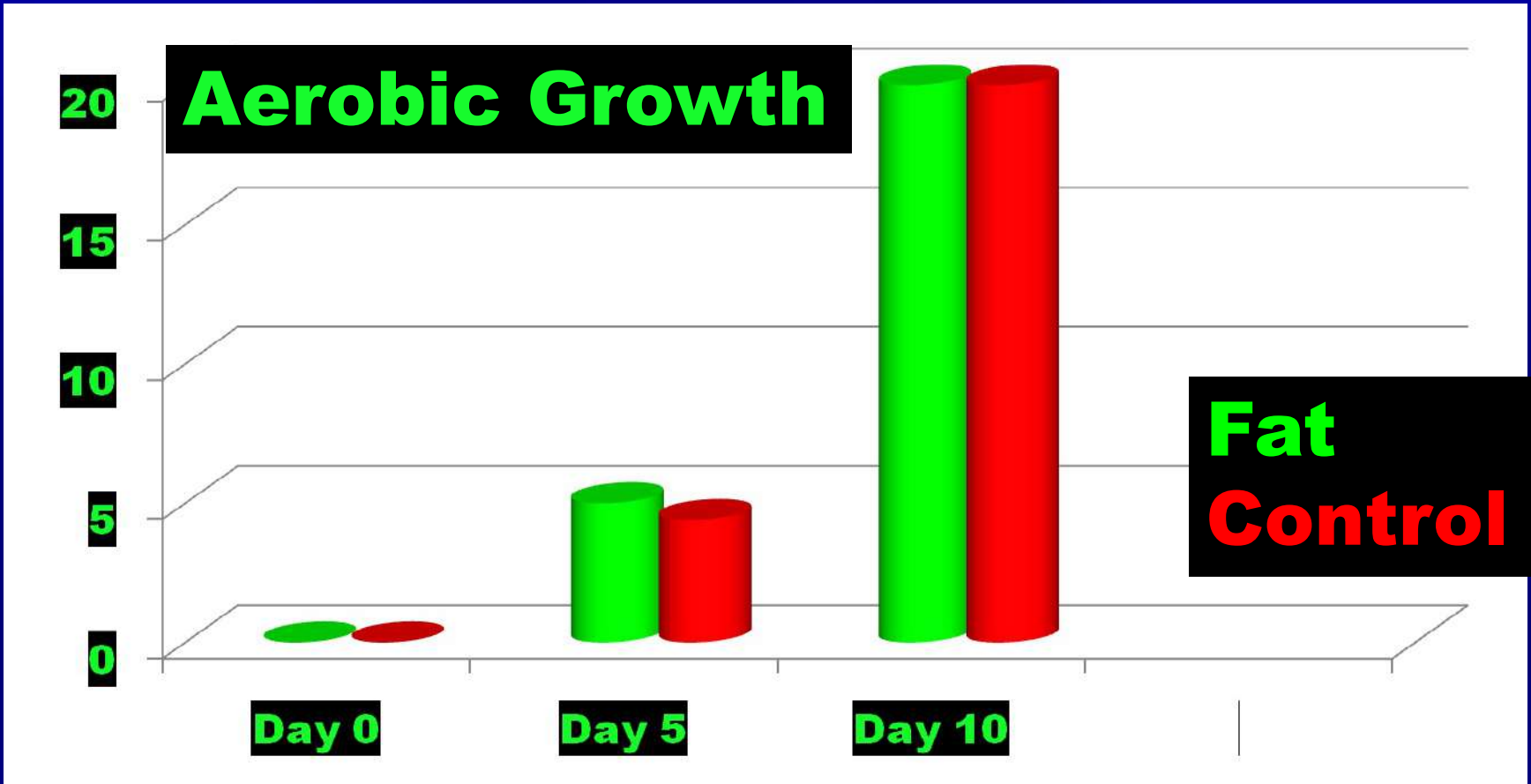




Bacteriology



Results
4. Bacteriology



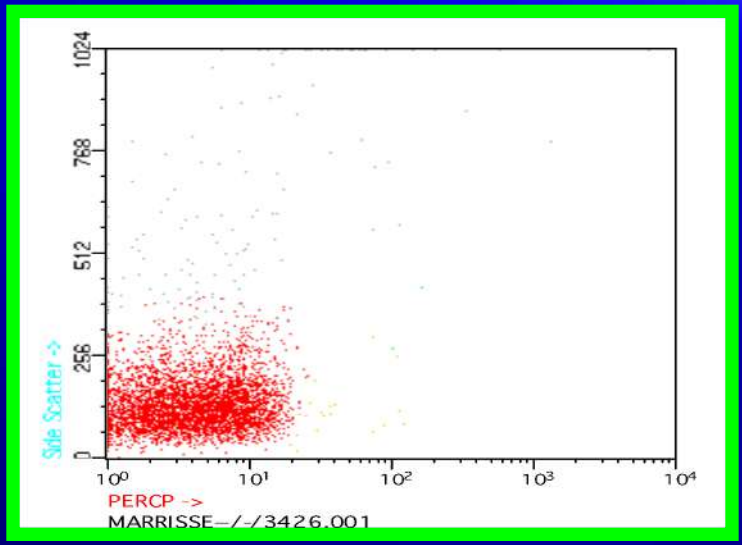
No Anaerobic Growth

Discussion
Bacteriology

- No qualitative nor quantitative difference in bacteriology
- ? High cellular viability.

***Subcutaneous fat in normal and diseased states*, Avram et al, 2005**
J Am Acad Dermatology 53: 671-83

Discussion



- Liposuction aspirate
- Coleman's Technique 1200 rpm/3min
- Viable Adipose Derived Stem Cells

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Discussion
Wound Healing Model

- Reduced surface area FAT treated grp

- Enhanced wound healing

Macroscopically

Discussion
Wound Healing Model

- *Epidermal length* ∞ Epithelial Migration

- Epidermal length longer in fat treated wounds

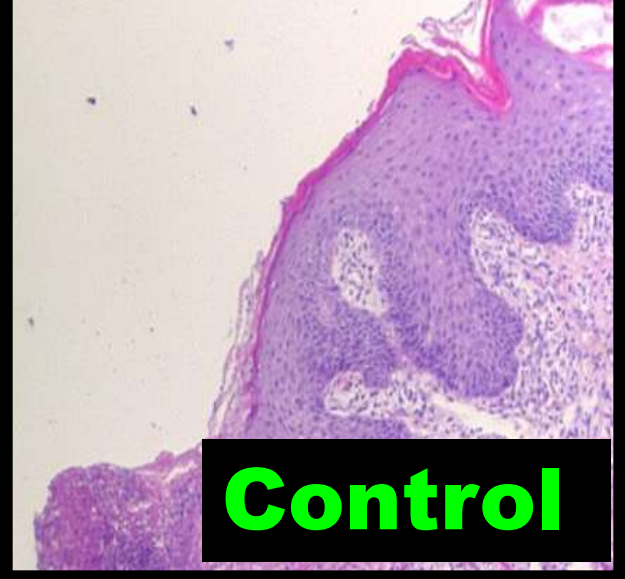
7 LARGE WHITE SOUTH AFRICAN PIGS

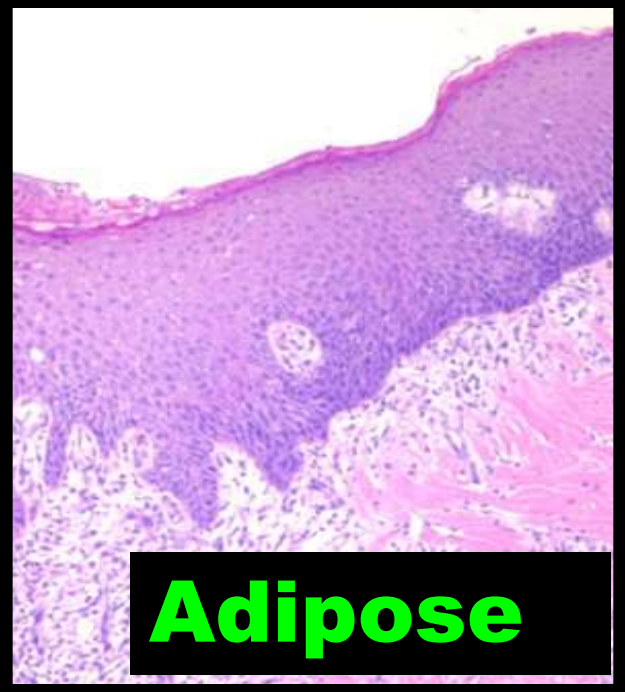
Discussion
Wound Healing Model

- Fat ∞ Increased *Epithelial Thickness*

- Suggest underlying processes related to *Matrix Quality*

7 LARGE WHITE SOUTH AFRICAN PIGS





Histologically

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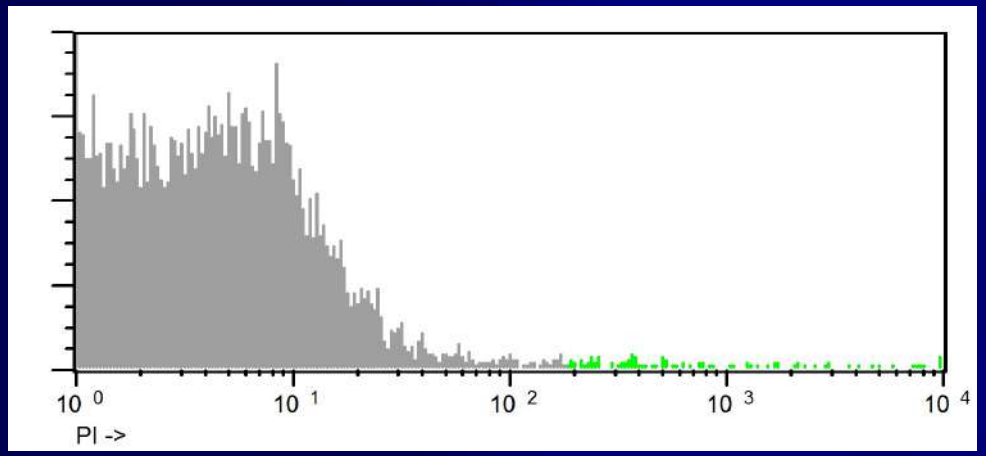
In Conclusion

Standard liposuction & fat preparation using Coleman's technique

1.) Yields > 90% **Live Cells**

2.)Contains **Stem Cells**

3.) Aids **Wound Healing**



The evidence...

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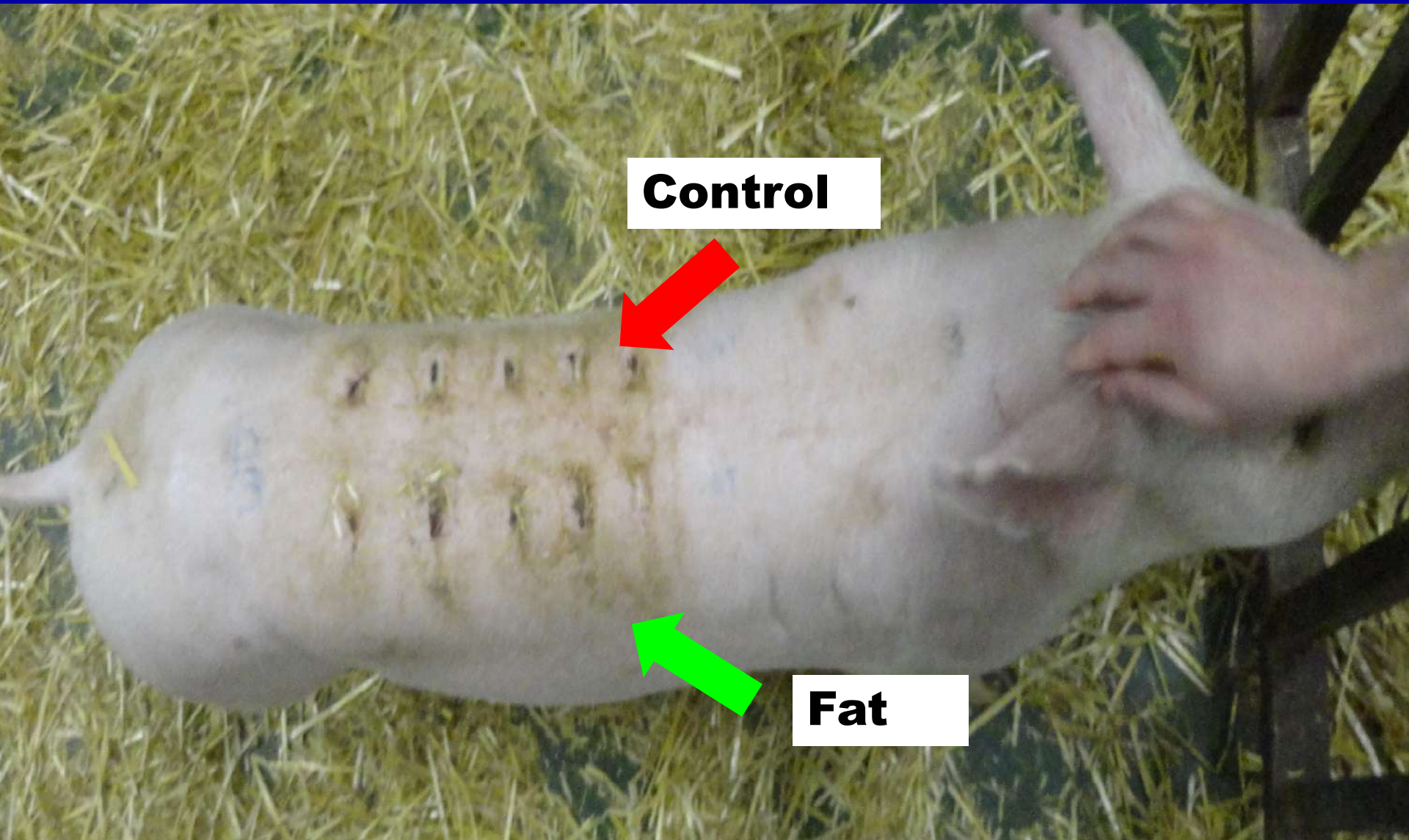

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Conclusion

- Fat from **LIPOSUCTION**

Enhances Wound Healing

- Easy Cost Effective

- Propose Possible Treatment Modality in Armamentarium

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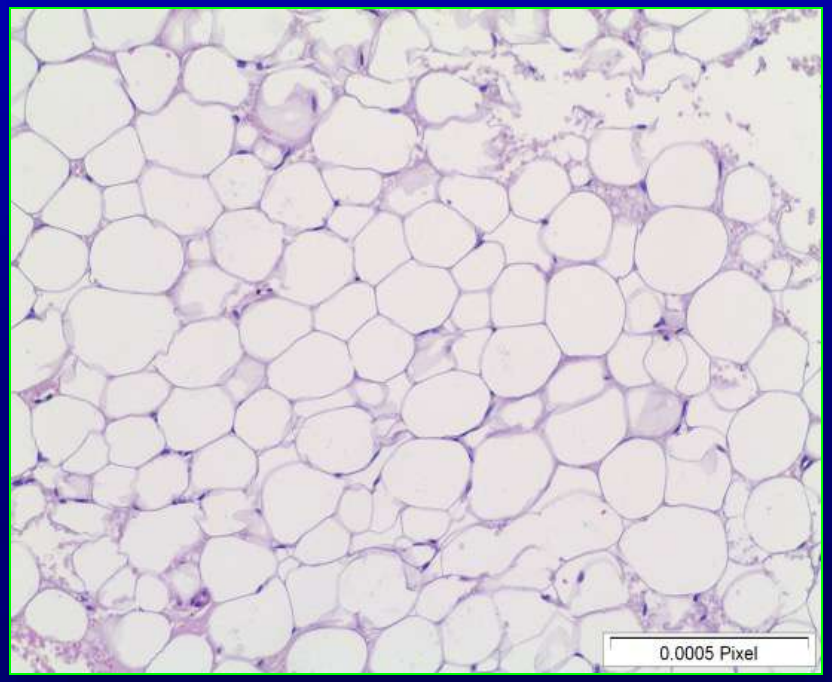

In Simplicity lies .....

Great Complexity

Thank You