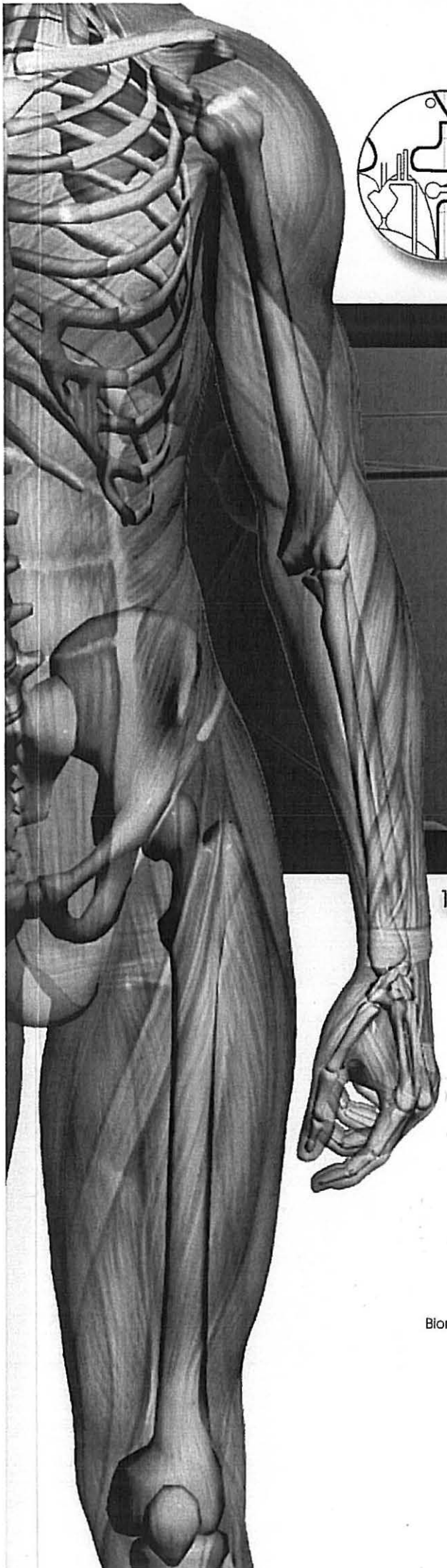

Congress Programme

6th World Congress of Biomechanics

In conjunction with

14th International Conference on Biomedical Engineering (ICBME)

&

5th Asian Pacific Conference on Biomechanics (APBiomech)

1 - 6 August 2010
Singapore Suntec Convention Centre

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Programme

WCB-A00790-03002 **PC-88** **pg 447**
The Effect of Temperature on Isometric Force and Stiffness in Isolated Intact Muscle Fibres from the Frogs Rana pipiens and Xenopus laevus
Brandon Hisey, Walter Herzog

WCB-A00827-01337 **PC-89** **pg 447**
Computational Model of Tissues in the Human Upper Airway
Jean-Paul Pelteret, Batmanathan Reddy

WCB-A00971-01644 **PC-90** **pg 449**
Practical Applications of the Passive Range of Motion on the Paraplegic Rehabilitation
Marin Chirazi

WCB-A00971-02913 **PC-91** **pg 449**
Aspects Regarding the Anthropometric Dimensions, the Movement of the Sportsman in Skiff and the Amplitude of the Movement Scull in Rowing
Marin Chirazi, Emil Budescu

WCB-A01016-01738 **PC-92** **pg 461**
Investigating Human Gallbladder Pain with an Active Stress Mechanical Model
W. G. Li, X. Y. Luo, N. Hill, R. Ogden, A. Smythe, N. Bird

WCB-A01068-01829 **PC-93** **pg 463**
On the Mullins Effect of Soft-biological Tissues: A Comparison between Material Models with Experimental Results
S. Sarangi

WCB-A01264-02220 **PC-94** **pg 464**
Correlations Between Volume and Area in Abdominal Adipose Tissue of C57BL/6 Female Mice
Chang-Yong Ko, Dong-Hyun Seo, Han-Sung Kim

WCB-A00982-01770 **PC-95** **pg 471**
Measurement of the Red Blood Cell (RBC) Dispersion in Microchannels: The Effect of the Temperature
Diana Pinho, Ana Pereira, Rui Lima, Takuji Ishikawa, Yohsuke Imai, Takami Yamaguchi

WCB-A00985-01731 **PC-96** **pg 471**
Flow of Physiological Fluids in Circular PDMS Microchannels: The Diameter Effect
Valdemar Garcia, Ricardo Dias, Teresa Correia, Rui Lima

WCB-A00985-01739 **PC-97** **pg 472**
In vitro Blood Flow in Circular PDMS Microchannels: Effect of the Flow Rate and Hematocrit
Valdemar Garcia, Ricardo Dias, Teresa Correia, Rui Lima, Elisa Pinheiro, Diana Pinho, Pedro Rodrigues

WCB-A01012-01768 **PC-98** **pg 472**
Measuring the Cell-Free Layer in circular Microchannels
Catia Fidalgo, Antonio Sa, Rui Lima, Monica Oliveira, Takuji Ishikawa, Yohsuke Imai, Takami Yamaguchi

WCB-A01683-03134 **PC-99** **pg 454**
Possible Implication of Satellite Cells in Regenerative Motoneuritogenesis: HGF and FGF2 Up-Regulate Neural Chemorepellent Sema3A Expression
Ryuichi Tatsumi, Mai-Khoi Q. DO, Naomi Shimizu, Yoriko Sankoda, Judy E. Anderson, Yusuke Sato, Takahiro Suzuki, Wataru Mizunoya, Yoshihide Ikeuchi, Ronald E. Allen

WCB-A01573-02922 **PC-100** **pg 479**
Multiscale Models of Cytoskeletal Mechanics and Contractility
Preethi Chandran, Mohammad R. K. Mofrad

WCB-A00100-00744 **PC-101** **pg 483**
Effect of Extracellular Matrix Stiffness on Ductular Formation of Biliary Epithelial Cells
Tomoya Komatsu, Ryo Sudo, Toshihiro Mitaka, Mariko Ikeda, Kazuo Tanishita

WCB-A01269-02406 **PC-102** **pg 488**
The Effect of Cell Orientation Control on the Cell Viability after Cryopreservation in Monolayer Cells Cultured by Arbitrary Cell Densities
Akira Iwama, Masanobu Ujihira, Yasunori Saeki

WCB-A01354-02616 **PC-103** **pg 489**
Living Cell FAK Expression for Substrate Rigidity Sensing
Wei-Yin Lin

WCB-A01631-03088 **PC-104** **pg 490**
Modulating Nuclear Organization Alters Segmental Gene Expression Patterns in Drosophila Embryos
Abhishek Kumar, Shivashankar G.V.

WCB-A01632-03073 **PC-105** **pg 490**
Transitions in Nuclear Plasticity and Higher Order Chromatin Assembly during Cellular Differentiation
Shefali Talwar, Shivashankar G.V.

WCB-A01655-03084 **PC-106** **pg 491**
Nuclear Reorganization and its Coupling to Gene Function during T Cell Activation
Soumya Gupta, Apurva Sarin, G.V. Shivashankar

WCB-A00492-00704 **PC-107** **pg 497**
Effect of Initial Morphology of Endothelial Cells on RhoGTPases Activation Induced by Fluid Shear Stress
Kazuma Nishio, Yosuke Ueki, Naoya Sakamoto, Masaaki Sato

WCB-A00493-00698 **PC-108** **pg 498**
Spatial Gradient of Shear Stress Modulates Endothelial Cell Gene Expression Associated with Aaneurysmal Remodeling
Takayuki Okumura, Naoya Sakamoto, Makoto Kanzaki, Masaaki Sato

WCB-A00495-00691 **PC-109** **pg 498**
PI3-kinase Activity Regulates Lamellipodial Formation of Vascular Endothelial Cells Exposed to Shear Stress
Toshiro Anno, Naoya Sakamoto, Masaaki Sato

WCB-A00847-01391 **PC-110** **pg 499**
Coupled Modeling of Tumour Angiogenesis with Tumour Growth
Yan Cai, Quan Long, Shixiong Xu, Jie Wu

WCB-A01393-02517 **PC-111** **pg 502**
Ex vivo and *in vitro* Regulation of Arginase in Response to Wall Shear Stress
Rafaela F. da Silva, Vania Olivon, Dolf Segers, Rini de Crom, Rob Krams, Nikos Stergiopulos

WCB-A00793-01277 **PC-112** **pg 523**
Fabrication, Nanomechanical Properties and *In Vitro* Evaluation of (Ti, O)/Ti Composite Coating on NiTi Shape Memory Alloy
Tao Sun, Lang-Ping Wang, Min Wang, Ho-Wang Tong, William W. Lu

WCB-A01052-02463 **PC-113** **pg 524**
Fabrication and Property of Degradable Magnesium Calcium Alloy Composites Mixed with HAP
Yoichi Murakoshi, Kaoru Kikuchi, Masahito Katoh, Kunio Matsuzaki

WCB-A01071-01832 **PC-114** **pg 524**
Decellularization of Living Tissue using Microwave Chemical Process for Tissue-engineered Scaffold Applications
Azran Azhim, Yoshitaka Narita, Kazuaki Muramatsu, Yuji Morimoto, Masato Tanaka

WCB-A01071-02347 **PC-115** **pg 524**
Decellularization of Meniscal Tissue using Ultrasound Chemical Process for Tissue-engineered Scaffold Applications
Azran Azhim, Tetsuya Takahashi, Kazuaki Muramatsu, Yuji Morimoto, Masato Tanaka

WCB-A01089-01865 **PC-116** **pg 524**
Effect of Sterilization on Biomembranes for Guided Tissue Regeneration
Sheba Rani Nakka David, Subrata Pal

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Escola Superior de Tecnologia e Gestão
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In vitro blood flow in circular PDMS microchannels: effect of the flow rate and hematocrit

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[1]IPB, ESTiG, Braganca Polyt. Inst., C. Sta. Apolonia, 5301-857 Braganca, Portugal.

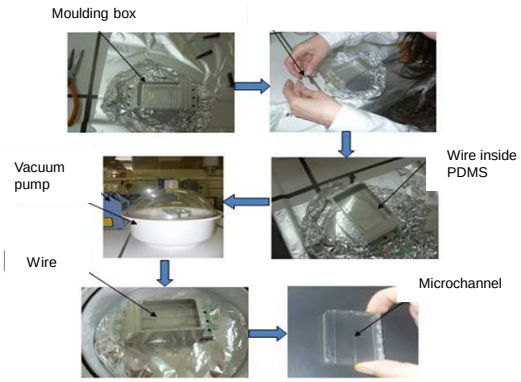
Introduction

BRIEF THEORETICAL INTRODUCTION: Several studies have shown that information obtained on the rheological properties of blood from glass capillaries differs from the situation in vivo [1]. It is therefore important to investigate in vitro blood fluids which have a behavior as close as possible of the in vivo environment.

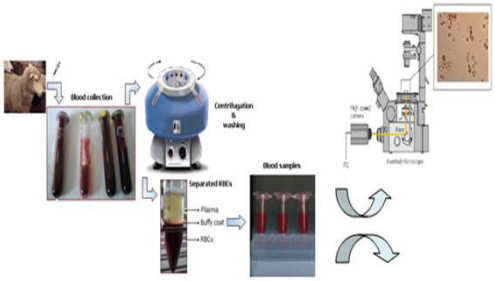
OBJECTIVE: The main aims of the present work is to study the flow behavior of blood cells from a sheep and a rabbit diluted in two kinds of plasma fluids such as saline (PS) and dextran 40 (Dx40).

Materials and Methods

PDMS fabrication



Experimental procedures



The blood was collected from a healthy sheep, where heparin was added to prevent coagulation. The RBCs were separated and washed by centrifugation. The washed RBCs where diluted with PS to make up the required RBCs concentration by volume.

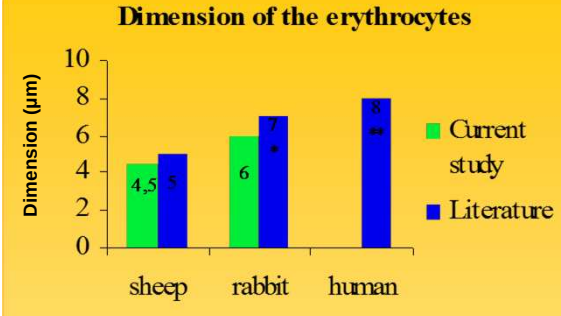
The capillaries were placed horizontally on a slide glass and by using a syringe pump a pressure-driven flow was kept constant at 50 µl/mim.

Segmentation Process:

1. Using CorelPaintShop Photo ProX3:
1.1.Effects, Plugins KPT Collection-Equalizador (low pass filter);
1.2.Effects, Edeges Effects, Trace Contours;
1.3.Image; negative Image;

2. Using the Matlab:
2.1.Binarization of the image by using Otsu method – '*graythresh*' and '*im2bw*';
2.2.Selection of cells to measure according to criterion of minimum area;
2.3.Measurement of properties (maximum radius, minimum radius) of cells through the function'*regionprops*'.

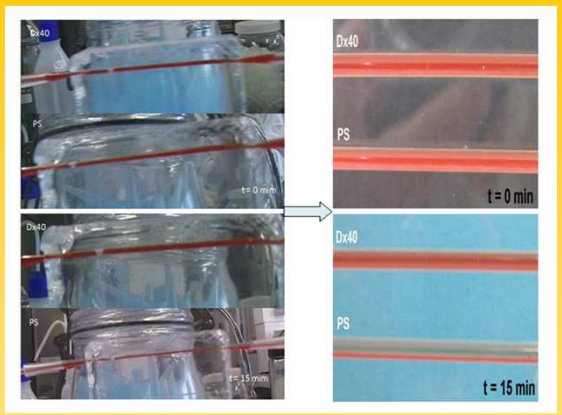
Results and discussion



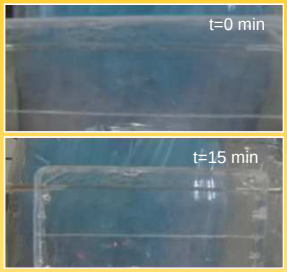
* Mitruka, B. M., & Rawnsley, H. M. (1981) *Clinical biochemical and hematological reference values in normal experimental animals and normal humans*. Masson Pub. USA.
** Caro, C.G., et al. (1978) *The Mechanics of the Circulation*. Oxford University Press.

- The results obtained for the size of erythrocytes are in good agreement with values found in the literature.
- Matlab was used to segment the cells image and automatically binarized (with software functions).

Analysis of sedimentation over time:



Sheep



Rabbit

For a flow rate of 50 µl/min the qualitative results suggest that the in vitro blood containing Dextran 40 is the fluid closest to the in vivo behavior. We did not observe any sedimentation for a period of 15 minutes. In contrast, for the case of physiological saline, we observed that the RBCs tend to settle down on the bottom of the microchannels for the same period of time.

From the rabbit images, sedimentation was not visible, because the technology used was not adequated to obtain images with enough quality to be analysed, however it is worth saying that naked eye observations have shown evidence that PS tends to settle in the bottom of the microchannels over time.

Conclusions and future work

- **S**heep *in vitro* blood containing Dx40 has a flow behaviour closer to the one observed *in vivo* microvessels.
- **RECOMMENDATIONS FOR FUTURE WORK**. We intend to perform the experiments with higher hematocrits, different flow rates and to record the blood flow with a high speed camera.