FINAL REPORT

THE EFFECTS OF BOVINE BONE SCAFFOLD ON THE MICROSCOPIC BIOLOGICAL RESPONSE OF HUMAN CHONDROCYTES

By

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UNIVERSITI SAINS MALAYSIA

LAPORAN AKHIR PROJEK PENYELIDIKAN JANGKA *PENDEK*

FINAL REPORT OF SHORT TERM RESEARCH PROJECT

Sila kemukakan laporan akhir ini melalui Jawatankuasa Penyelidikan di Pusat Pengajian dan Dekan/Pengarah/Ketua Jabatan kepada Pejabat Pelantar Penyelidikan

1. Nama Ketua Penyelidik:
Name of Research Leader

☐ Profesor Madya/ *Assoc. Prof.* ☐ / **DR BAHARUDIN BIN ABDULLAH** ☐ Encik/Puan/Cik *Mr/Mrs/Ms*

2. Pusat Tanggungjawab (PTJ): *School/Department* JABATAN ORL-HNS, PUSAT PENGAJIAN SAINS PERUBATAN USM

3. Nama Penyelidik Bersama: *Name of Co-Researcher*
1)PROFFESSOR DR. AB RANI SAMSUDIN
2)DR SUZINA SHEIKH ABDUL HAMID
3) NOR SHAMSURIA OMAR

4. Tajuk Projek: *Title of Project*
THE EFFECTS OF BOVINE BONE SCAFFOLD ON THE MICROSCOPIC BIOLOGICAL RESPONSE OF HUMAN CHONDROCYTES

5. Ringkasan Penilaian/*Summary of Assessment*:	Tidak Mencukupi *Inadequate*		Boleh Diterima *Acceptable*	Sangat Baik *Very Good*	
	1	2	3	4	5
i) Pencapaian objektif projek: *Achievement of project objectives*	☐	☐	☐	☐	/
ii) Kualiti output: *Quality of outputs*	☐	☐	☐	☐	/
iii) Kualiti impak: *Quality of impacts*	☐	☐	☐	/	☐
iv) Pemindahan teknologi/potensi pengkomersialan: *Technology transfer/commercialization potential*	☐	☐	☐	☐	/
v) Kualiti dan usahasama : *Quality and intensity of collaboration*	☐	☐	☐	/	☐
vi) Penilaian kepentingan secara keseluruhan: *Overall assessment of benefits*	☐	☐	☐	☐	/

6. **Abstrak Penyelidikan**
(Perlu disediakan di antara 100 - 200 perkataan di dalam **Bahasa Malaysia dan juga Bahasa Inggeris.** Abstrak ini akan dimuatkan dalam Laporan Tahunan Bahagian Penyelidikan & Inovasi sebagai satu cara untuk menyampaikan dapatan projek tuan/puan kepada pihak Universiti & masyarakat luar).

Abstract of Research
(An abstract of between 100 and 200 words must be prepared in Bahasa Malaysia and in English). This abstract will be included in the Annual Report of the Research and Innovation Section at a later date as a means of presenting the project findings of the researcher/s to the University and the community at large)

Please see attachment (Appendix A).

7. **Sila sediakan laporan teknikal lengkap yang menerangkan keseluruhan projek ini.**
[Sila gunakan kertas berasingan]
Applicant are required to prepare a Comprehensive Technical Report explaning the project. (This report must be appended separately)

Please see attachment (Appendix B).

Senaraikan kata kunci yang mencerminkan penyelidikan anda:
List the key words that reflects your research:

Bahasa Malaysia	*Bahasa Inggeris*
kondrosit	chondrocytes
skafol tulang bovin	bovine bone scaffold

8. **Output dan Faedah Projek**
Output and Benefits of Project

(a) * **Penerbitan Jurnal**
Publication of Journals
(Sila nyatakan jenis, tajuk, pengarang/editor, tahun terbitan dan di mana telah diterbit/diserahkan)
(State type, title, author/editor, publication year and where it has been published/submitted)

1. Published in the Journal of Cell and Tissue Banking 2008 as "THE MICROSCOPIC BIOLOGICAL RESPONSE OF HUMAN CHONDROCYTES TO BOVINE BONE SCAFFOLD".
2. 1st National Tissue Engineering and Regenerative Medicine Scientific Meeting. "The Effects of Bovine Bone Scaffold on The Biological Response of Human Chondrocytes". Hospital UKM, K. Lumpur. 29-30th August 2006.
3. Malaysian Society of Otorhinolaryngologists-Head and Neck Surgeons (MSO-HNS) Annual Scientific Meeting. "A Study of Human Cartilage and Bovine Scaffold For Usage in Reconstructive Surgery". Le Meridien K.Lumpur 7th April 2007.
4. 3rd Malaysia-Singapore Joint Meeting. "Experimental Cartilage Development for Head and Neck Surgery". Le Meridien K.Lumpur. 24th June 2007.

(b) **Faedah-faedah lain seperti perkembangan produk, pengkomersialan produk/pendaftaran paten atau impak kepada dasar dan masyarakat.**
State other benefits such as product development, product commercialisation/patent registration or impact on source and society.

Bovine bone is packaged in tissue bank and available for use in reconstructive surgery. It can be used for other development and research purposes.

* Sila berikan salinan/*Kindly provide copies*

(c) **Latihan Sumber Manusia**
Training in Human Resources

i)Pelajar Sarjana: DR ABDULHALIM B. SHIBGHATULLAH
(Perincikan nama, ijazah dan status)
(Provide names, degrees and status)

MMED ORL-HNS(USM), GRADUATED IN THE YEAR MAY 2008

ii) Lain-lain:
Others

9. Peralatan yang Telah Dibeli:
Equipment that has been purchased

1) FUJITSU CPU FOR DATA ANALYSIS OF GRAPHICAL IMAGES AND THE STUDY OF THE INTERACTION OF CHONDROCYTES AND BOVINE BONE

15 hb Jun 2008

Tarikh
Date

Komen Jawatankuasa Penyelidikan Pusat Pengajian/Pusat
Comments by the Research Committees of Schools/Centres

Objektif projek tercapai dan hasil penyelidikan diterbitkan

22/1/09

Tarikh
Date

UNIVERSITI SAINS MALAYSIA
JABATAN BENDAHARI
KUMPULAN WANG PENYELIDIKAN GERAN USM(304)
PENYATA PERBELANJAAN SEHINGGA 30 NOVEMBER 2007

Jumlah Geran:	RM	17,448.00	Ketua Projek:	DR. BAHARUDDIN ABDULLAH
Peruntukan 2005 (Tahun 1)	RM	8,724.00	Tajuk Projek:	The Effects of Bovine Scaffold on the Microscopic Biological Response of Human Chondrocytes
Peruntukan 2006 (Tahun 2)	RM	8,724.00		
Peruntukan 2007 (Tahun 3)	RM	0.00	Tempoh:	15 Okt 05-14 Okt 07
			No.Akaun:	304/PPSG/6131401

Kwg	Akaun	PTJ	Projek	Donor	Peruntukan Projek	Perbelanjaan T'kumpul Hingga Tahun Lalu	Peruntukan Semasa	Tanggungan Semasa	Bayaran Tahun Semasa	Belanja Tahun Semasa	Baki Projek
304	11000	PPSG	6131401		1,500.00	1,676.90	(176.90)	-	-	-	(176.90)
304	14000	PPSG	6131401		-	-	-	-	-	-	-
304	15000	PPSG	6131401		-	-	-	-	-	-	-
304	21000	PPSG	6131401		1,000.00	2,278.50	(1,278.50)	-	1277.9	1,277.90	(2,556.40)
304	22000	PPSG	6131401		-	-	-	-	-	-	-
304	23000	PPSG	6131401		150.00	-	150.00	-	-	-	150.00
304	24000	PPSG	6131401		-	-	-	-	-	-	-
304	25000	PPSG	6131401		-	-	-	-	-	-	-
304	26000	PPSG	6131401		-	-	-	-	-	-	-
304	27000	PPSG	6131401		13,998.00	2,635.00	11,363.00	898	1,030.00	1,855.00	9,435.00
304	28000	PPSG	6131401		-	-	-	-	-	-	-
304	29000	PPSG	6131401		800.00	1,952.00	(1,152.00)	-	-	1,080.00	(1,152.00)
304	32000	PPSG	6131401		-	-	-	-	-	-	-
304	35000	PPSG	6131401		-	-	-	-	5,690.00	5,690.00	(5,690.00)
					17,448.00	8,542.40	8,905.60	898.00	7,997.90	9,902.90	9.70

BORANG LAPORAN HASIL PENYELIDIKAN
PPSP

Tajuk geran: THE EFFECTS OF BOVINE BONE SCAFFOLD ON THE MICROSCOPIC BIOLOGICAL RESPONSE OF HUMAN CHONDROCYTES
Penyelidik:
Jenis geran:
Tempoh geran: 15-10-2005 sehingga 14-10-2007

Jenis laporan: Laporan Kemajuan (setiap 6 bulan) [ ]

Laporan Akhir*: [√]

Alatan di beli [√] Ya : nyatakan FUJITSU CPU

[ ] Tidak

OBJEKTIF SPESIFIK KAJIAN (sama spt dalam proposal asal)	**SECARA RINGKAS TERANGKAN PENCAPAIAN/HASIL**	**SEBAB-SEBAB JIKA TAK TERCAPAI**
1. To determine the effect of bovine bone on human chondroblast proliferation in vitro.	We have found that the bovine bone is a viable potential scaffold for cartilage tissue engineering as it provides good cell attachment and promotes proliferation and maturity of cells. Furthermore it is non toxic, easily resourced and relatively cheap.	
2.		
3.		
4.		

** Laporan Akhir perlu disertakan salinan manuskrip dan surat yang dihantar kepada mana-mana jurnal untuk penerbitan.*

APPENDIX A

ABSTRACT IN BAHASA MALAYSIA AND ENGLISH

ABSTRAK

Pengenalan

Untuk menghasilkan tisu rawan, pemilihan kerangka yang sesuai masih menjadi cabaran utama. Kerangka yang sedia ada sama ada dari bahan semulajadi atau sintetik masih tidak memenuhi sifat yang diperlukan untuk penghasilan tisu rawan. Kerangka yang baik juga memberi keseimbangan mekanikal kepada sel dalam bentuk gabungan atau jaringan sebelum sel tersebut menghasilkan sendiri jaringan untuk menyokongnya.

Objektif

Tujuan kajian ini adalah untuk menghasilkan kerangka yang dibuat dari tulang lembu yang akan digunakan untuk penghasilan tisu rawan dan juga mengkaji kesan kerangka tersebut keatas sel rawan manusia.

Metodologi

Sel rawan manusia dibiakkan dalam makmal dan sebanyak 1×10^5 sel diletakkan pada setiap kerangka dan dieramkan selama 24 jam, 2 hari, 5 hari dan 7 hari. Perkembangan sel dikaji dengan mengukur aktiviti enzim mitokondria dehydragenase, pelekatan sel dikaji di bawah Elektron Mikroscope dan kematangan sel dikaji menggunakan Mikroscope Konfokal.

Keputusan

Berlaku perkembangan sel rawan diatas kerangka diantara 24 jam dan 7 hari. Sel rawan juga melekat dengan baik dan meningkat dengan masa pada permukaan dan ruang-ruang kecil pada kerangka. Kematangan sel rawan meningkat mengikut hari dengan ditunjukkan melalui penghasilan serat kolagen jenis II.

Kesimpulan

Tulang lembu berpotensi untuk dijadikan kerangka tiga dimensi untuk penghasilan tisu rawan kerana menunjukkan perkembangan sel, pelekatan yang baik, mencapai kematangan,tidak toksik dan selamat serta mudah diperolehi dan murah.

ABSTRACT

Introduction

In the creation of cartilaginous tissue, the choice of suitable scaffold remains a great challenge. The current available scaffold either natural or synthetic still does not meet the requirement of a scaffold for cartilage tissue engineering. The ideal scaffold provides mechanical stability to the individual cell as a construct or transitional framework before synthesis of new extra cellular matrix.

Objective

The aim of this study was to produce bovine bone as a tissue engineering construct for cartilage reconstruction and to determine the effects of bovine bone on biological human chondrocyte in vitro.

Method

Human chondrocytes were cultured and seeded into bovine scaffold with seeding density of 1 x 10^5 cells per 100 ul / scaffold and incubated for 24 hours, 2 days, 5 days and 7 days. Proliferation and viability of the cells were measured by mitochondrial dehydrogenase activity (MTT assay), adhesion study was analyzed using Scanning Electron Microscopy (SEM) and differentiation study was analyzed by Immunoflorescent staining using Confocal Laser Scanning Electron Microscopy (CLSM).

Result

The data showed the presence of proliferation and viability of the cells on the scaffolds by MTT method within 24 hours to 7 days observed. SEM pictures revealed presence of chondrocytes located on the scaffolds, showed increasing number of cell within the days and that cells readily grew on the surface and into the open pores of the scaffold. Immunoflorescent staining detected collagen type II on the scaffolds which was increasing within the days.

Conclusion

The results showed the potential of bovine bone as three dimensional scaffold for cartilage tissue engineering because of the good cells proliferation, attachment, maturity, non toxic, safe, easily resourced and relatively cheap.