出國報告
(出國類別:出席國際研討會及發表論文)

出席 [2010 美國骨科研究學會及美國醫學會]
會議報告

服務機關: 行政院衛生署桃園醫院

姓名職稱: 鄭明德 主治醫師

派赴國家: 美國

報告日期: 99 年 6 月 14 日

出國時間: 99 年 3 月 5 日至 99 年 3 月 14 日

摘要

本次參加會議的主要目的是發表研究成果及向其他研究團隊學習。這次筆者在會中發表的研究內容是以同一捐贈者的前十字韌帶與骨髓幹細胞在體外培養，加以各種不同細胞生長因子刺激，分析兩種不同幹細胞的生長以及分化上的差異。這方面的研究目前在世界上並不多見，因此這次有機會獲選為組織工程 spotlight session 的演講者之一。spotlight session 是今年首創，目的是針對近年來較為熱門及重要的研究題目選出較有潛力及創新的研究為演講者，在大會中報告，據我所知筆者是此次所有台灣團隊中唯一獲選為 spotlight session 的演講者。此次會議重點在於幹細胞的研究及其應用於治療組織的缺損及疾病。目前大部分的研究還是著重於幹細胞特性及分化，也有一些在動物實驗上的進展。在歐洲有以幹細胞製造人工氣管來治療先天性氣管狹窄及後天因肺結核造成支氣管損傷之成功病例；在美國則有以幹細胞製造人工膀胱來成功治療膀胱缺損的病患，這些前驅而且成功的研究對於眾多再生醫學的研究人員來說無疑是打了一劑強心針，鼓勵我們更加努力，把手上的研究更進一步由實驗室轉至開刀房，治療更多因先天性疾病或後天損傷造成之器官或組織病變及缺損。

目次

摘要……..1
目次……..2
一. 目的及過程……3
二. 心得……...6
三. 建議事項……...7
四. 報告資料及內容……8
五. 攜回資料及內容……..…….……22

目的及過程

為了發表自己研究的成果，及趁機充實自己及吸收新知，因此近幾年來都會盡量想辦法排除萬難參加美國一年一度舉辦的骨科研究學會 (ORS; Orthropaedic Research Society）及美國骨科醫學會 (AAOS; American Academy of Orthropaedic Surgeons) 年會。本次參加美國骨科研究學會年會，美國骨科醫學會年會主要目的是發表過去一年的研究成果及學習其他研究團隊之長處，觀摩其他團隊之研究方向及進展。這次發表的論文是口頭演講十分鐘，並接受在場其他國家學者提問五分鐘，這次報告的是過去四年來對於前十字韌帶幹細胞研究的一個小的結論，研究內容大略是以同一捐贈者的前十字韌帶與骨髓幹細胞做體外培養，以及以各種不同細胞生長因子刺激，分析兩種不同幹細胞的生長以及分化上的差異。這方面的研究目前在世界上並不多見，因此這次有機會獲選為 tissue engineering spotlight session 的演講者之一。spotlight session 是今年首創，目的是針對近年來較為熱門及重要的研究題目選出較有潛力及創新的研究為 speaker，提供其他研究者參考，據我所知筆者是此次所有台灣團隊中唯一獲選為 spotlight session 的 speaker，因此覺得非常光榮但也很緊張，生怕表現不好丟台灣研究者的臉。幸好因為在演講前有多做幾次練習，因此在演講途中沒有發生什麼錯誤。雖然因為時間有限無法在演講進行中與其他學者交換意見，但演講結束後就有許多相同領域的研究者前來詢問研究的方法及細節，彼此交換意見及名片，方便之後的交流。

這個會議今年選在美國紐奧良舉行。紐奧良是路易斯安納州最大的城市，也是世界上最有名的美國南方文化及爵士樂中心。此外紐奧良附近還有如密西西比河等著名景點以及幹細胞研究的重鎮杜蘭大學 (Tulane University)。因此基於學術研究交流及朝聖雙重的目的，今年也就抱著興奮的心情第五次參與這個會議。開會期間全世界有超過兩萬名骨科醫師及相關研究學者專家，學生，參展廠商及其家屬湧入這個城市，加上紐奧良本來就是著名的旅遊勝地，因此會議期間無論日夜在著名的法國區內及各大飯店裏都熱鬧非凡，大街上人群摩頂放踵，群聚在街道上觀賞法式建築及與建築物照相，宛如盛大的節慶。雖然有這麼多旅客，但幸好紐奧良有足夠的旅館，因此訂房及住宿都不成問題。這次會議的會場在紐奧良會議中心 **(**Morial Convention Center)，會場也是大的驚人，許多與會者 在第一天都難免經過一番波折才終於找到自己的會場。

這個年度骨科界研究及臨床共聚一堂的會議，不單是美國本身，也是全世界骨科的年度盛事，就像奧運一樣，全世界最優秀最權威的醫師及研究者到這兒來發表他們的最新發現及心得。大部分的人都是經過了長期的努力及研究，在一年前就開始準備報告的內容，摩拳擦掌等待在會議中的發表。除了醫師及研究學者的研究發現外，會內各種骨科臨床及研究醫學資訊相當豐富，且全世界的相關工業廠商也都有設攤展示各種新穎的器械衛材及手術觀念，參加者除了醫師外，也有復

健師、護理師、技師、藥師及相關人員。會議從三月六號到九號是骨科研究學會，緊接著九號到十三號是骨科醫學會，共八天的會議安排得非常緊湊，共有數十個可容納千人的會場同時進行，另有近萬張的海報展，數十至數百組的基礎科學展示，錄影帶展示場及特別演講，可稱得上是巨型會議，每個人進到會場都難免頭昏眼花，因此會議前的準備工作很重要，得先翻閱厚如電話簿般的議程表，先選好自己有興趣的題目，看好各是在哪個會場，以便在會議中能迅速換場，才不會漏掉想聽的精采內容，但是常會遇到幾個感興趣的題目同時進行，這時就只得忍痛割捨，只能挑其他最感興趣的一個題目來聽了。而最有價值的是你可在此碰到很多仰慕已久，以前只能在教科書或期刊上看到的大師級的人物，親耳聆聽他們精闢的演講，運氣好的話還可以提出一些自己的疑問向他們請教。

在骨科學基礎研究方面，近幾年最大的進展主要在於幹細胞的研究及其應用於治療軟骨、硬骨、肌腱韌帶、甚至椎間盤的缺損及疾病。目前大部分的研究還是著重於幹細胞特性及分化，也有一些在動物實驗上的進展，今年還加上了一些初期的人體實驗結果的報告。在歐洲有以幹細胞組織工程製造人工氣管來置換及以治療先天性氣管狹窄及後天因肺結核造成支氣管損傷之成功病例；在美國則有以幹細胞組織工程製造人工膀胱來成功治療膀胱缺損的病患，目前已成功七例以上，這些前驅而且成功的研究對於眾多幹細胞及組織工程及再生醫學的研究人員及團體來說無疑，是打了一劑強心針，鼓勵我們更加努力，把手上的研究更進一步由實驗室轉至開刀房，治療更多因先天性疾病或後天損傷造成之器官或組織病變及缺損。總體而言近幾年幹細胞在骨科方面的研究有了長足的進步，而前年美國總統歐巴馬又放寬了許多過去研究幹細胞的限制，因此未來這方面研究應會有更快的發展與突破。此外在一些傳統骨科學的研究，如軟骨的生理研究以及生物醫材的研發還有生物力學等等，雖然已不像以往那麼熱門，但也有一些新的發現及進展。大會中在骨科的各個領域都有新的想法、新的技術被提出，從一些少見疾病的新治療的初期報告，到一些整理數千病例治療結果的心得分享，都讓與會者得到許多啟發。最精采的莫過於是關於人工膝及髖關節的聯合研討，數十個此領域中頂尖的醫師排排坐輪流發表各自所專精之不同治療方式的優劣，一個小時下讓與會者彷彿看見了整個人工關節的發展與治療史，也了解目前世界最新的趨勢，單單一堂課就值回來回票價了。今年在骨科醫師學會上熱門的研究及報告還有針對於最近熱門的金屬人工關節的討論以及人工關節術後感染的治療討論，涉及其精彩且可得到重要的資訊。此外許多議題設計也都以當前最熱門及大家最感興趣的題目為主，每個與會人員都可依自己需求找到自己想參加的演講及workshop，因此不管是初入門的住院醫師或學有專精的大教授都會有所收獲。近幾年來由於科技的發展，傳統的手術正面臨各方面的刺激而進步，各領域之間也在作橫向聯合，各種新的手術及治療方法甚至新的藥品都可在此會議中找到。如衛星定位系統也用於手術中定位且成效非凡。此外拜於手術輔助器械的進步，人工關節的置換也正邁向小切口、小傷口、少組織韌帶的變壞，即可達原傳統手術

的效果，而且因為比較少的組織韌帶破壞，所以病人於手術中出血較少可免於出血的潛在傳染病威脅，因為組織破壞少，故手術時間短，術後病人疼痛少，所以復健快，恢復正常狀態的時間較短而比較沒有術後疼痛的困擾，於時間經濟上都較有效益。在 ORS 及 AAOS 結束後，便在凌晨搭上接駁車前往紐奧良機場，經由丹佛轉機往洛杉磯，結束這充實而緊湊的八天會議，飛回台灣準備週一上班了。

一. 心得

這幾年來從觀察參加的人種的變化中發現東方人越來越多，且研究也越做越好。仔細看看發現一些表現傑出的大部分是日本人，而韓國及中國則是參加的人數增加很快但是還沒有很突出的成績；至於台灣則好像參加會議及發表研究的依舊是那些老面孔，沒有太多新血的加入，因此雖然大家都很認真及用心，但是在質和量上比起日韓還是差了一截。此外在骨科的手術及研究上各署立醫院相對於其他醫學中心顯得較為弱勢，醫院間橫向交流較為缺乏，人才的流動性低以及進修機會較為不足應佔了部分因素。現代醫療科學的進步除了了解書本上的知識與技術外，教科書上來不及提到的各種新器械、新材質、新手術及治療方法的發展也是日新月異，如何吸收新知並應用這些東西到臨床治療病患上，讓病人得到更好的預後，是我們所必須面對的課題。所以除了醫師自動自發參加國際會議吸收新知外，或許也可以選擇本院重點發展的科別，定期與國內各大醫學中心交流，或派人員至國外知名醫療中心做短期進修。這樣對於提高各署立醫院及本院的醫療水準及研究能力應該會有很大的助益。

二. 建議事項

建議選擇本院重點發展的科別，鼓勵餐與國際會議發表論文， 與國內各大醫學中心交流，或派人員至國外知名醫療中心做短期進修。

Comparison of Stem Cells Isolated from Human Anterior Cruciate Ligament and Bone Marrow

Journal:	*Orthopaedic Research Society*
Abstract ID:	ORS2010-1196.R1
Presentation Type:	Either Poster or Podium
Categories for Abstract Review:	Tissue Engineering - Growth Factors, Tendon/Ligament - Ligament and Tendon Biology, Progenitors and Stem Cells - Progenitors and Stem Cells
Keywords for Transactions on DVD-ROM:	Cytokines, Ligament and Tendon Biology, Tissue Engineering

Comparison of Stem Cells Isolated from Human Anterior Cruciate Ligament and Bone Marrow

[1,2]Ming-Te Cheng, [3]Tain-Hsiung Chen; [*,3,4]Oscar K. Lee
[1]Department of Surgery, School of Medicine, National Yang-Ming University, Taiwan; [2]Taoyuan General Hospital, Taoyuan county, Taiwan; [3]Taipei Veterans General Hospital, Taiwan; [*4]Instute of Clinical Medicine, National Yang-Ming University, Taipei, Taiwan
kslee@vghtpe.gov.tw

INTRODUCTION:

Due to the poor healing ability of anterior cruciate ligament (ACL) after rupture and the morbidity of current ACL reconstruction methods, ligament tissue engineering with stem cells is an attractive approach in future management of ACL injuries. Currently, the application of bone marrow stem cells (BMSC) in ex vivo ACL ligament tissue engineering has been evaluated extensively. In our previous study, we have successfully isolated stem cells from human cruciate ligament with multi-lineage differentiation ability and identical surface immunophenotype with BMSC. The purpose of this study is to evaluate the differences of proliferation, multilineage differentiation, and extracellular matrix formation abilities between BMSC and ACL ligament-derived stem cells (LSC) from the same donors.

METHODS:

Isolation of BMSC and LSC: Human LSC and BMSC were harvested from patients receiving total knee arthroplasty for advanced osteoarthritis as previously described[1,2]. The in vitro chondrogenesis, osteogenesis and adipogenesis assays were performed as previously described[1,2].

Effects of growth factors on cell proliferation: The effect of growth factors on the proliferation of LSCs and BMSCs were determined using a commercially available kit (CellTiter 96 AQ; Promega Corp., Madison, Wisconsin, USA). Briefly, 10,000 cells were placed in each well of a 96-well plate. After stimulation with growth medium supplemented with either 10 ng/ml FGF-2, 10 ng/ml EGF, or 10 ng/ml TGF-β1 for 72 hours, the relative cell number was estimated by measuring the absorbance at 490 nm on a microplate reader.

Real-time RT-PCR analysis

4,000 LSCs and BMSCs were cultured with growth medium and growth factors as above. Cells were harvested at days 7, 14, 21, and 28. Quantitative PCR was conducted on a Roche LightCycler® 480 (Roche Diagnostics, Laval, Quebec, Canada) real-time PCR system. The mean C_t value from duplicate measurements was used to calculate expression of the target gene, with normalization to a housekeeping control (GAPDH).

Quantification of collagen and total ECM proteins: Collagen and proteins were quantified by colorimetric analyses as described previously[3]. Briefly, cells were incubated with 1 mL of saturated picric acid solution that contained Sirius Red and Fast Green for 30 min. The fluids were then withdrawn, and the plates were washed repeatedly with distilled water. After washing, 0.5 mL of 0.1% NaOH and absolute methanol was added to the plates to elute the color. The elute color was immediately read by using a spectrophotometer at 540 and 605 nm.

RESULTS:

Isolation and expansion of cells: LSC and BMSC could be extensively sub-cultivated in standard culture condition. The cells were plastic adherent and spindle-shaped (Fig. 1). In MTS experiment, the proliferation rate of LSCs was significantly increased with the bFGF treatment than control, EGF and TGF-β1 treatment. The proliferation of BMSCs was significantly increased with the bFGF treatment than TGF-β1 and EGF groups (Fig. 2a). The population doubling (PD) time was estimated to be 64.5 hours for BMSC and 69.5 hours for LSC (Fig. 2b).

Multi-lineage differentiation: Upon osteogenic induction, BMSC showed typical osteogenic differentiation and were positive for alkaline-phosphatase (ALK-P) and alizarin red S stain. LSC showed similar ALK-P stain but weaker alizarin red S stain. (Fig. 3a). Under adipogenic induction, LSC had faster fat droplet formation at the first week. After three weeks' induction, both LSC and BMSC showed typical fat droplet and were positive for Oil red-O stain (Fig. 3b). Under chondrogenic condition, the cells aggregated to form pellets. The pellets from both LSC and BMSC were strongly positive for Alcian blue stain (Fig. 3c). Specific genes of bone (type I collagen, osteocalcin) (Fig. 3a), fat (PPAR-γ, FABP-fatty acid-binding protein) (Fig. 3b), and cartilage (type II collagen, aggrecan) (Fig. 3c) were expressed in cells treated with three weeks of osteogenic, adipogenic, and chondrogenic induction medium, respectively.

Gene expression analysis: The mRNA expression of Type I collagen was increased in LSC and BMSC treated with TGF-β1 (Fig. 4a). Type III collagen mRNA expression was increased in LSC treated with TGF-β1 for 2 and 4 weeks, and BMSC for 3 and 4 weeks (Fig. 4b). The mRNA expression of fibronectin, vimentin, and α-smooth muscle actin was the highest in LSC with TGF-β1 treatment for 4 weeks followed by BMSC with FGF-2 treatment for 2 weeks (Fig.4c, Fig. 4d, Fig. 4e). The mRNA expression of tenascin-c was increased in BMSC treated with EGF, TGF-β1. Tenascin-c expression was low in all four groups of LSC (Fig. 4f).

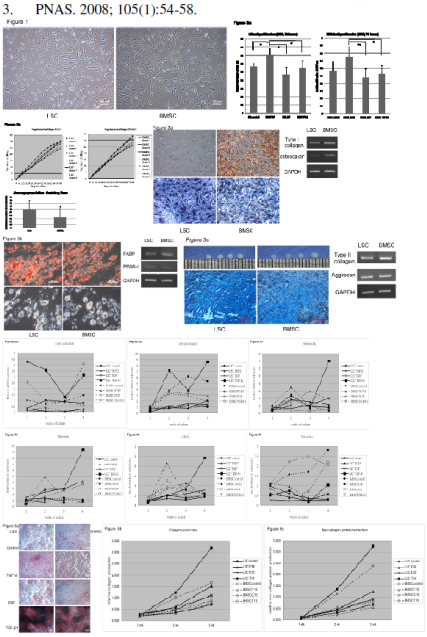
Quantification of collagen and total ECM protein production: Under phase contrast microscopy, strongly positive staining was noted in the TGF-β1 group (Fig. 5a). Highest collagen and non-collagen ECM protein production was noted in the TGF-β1 treatment of LSC, followed by the TGF-β1 treatment of BMSC, and lowest in the control and EGF treatment of LSC and BMSC (Fig. 5b, Fig. 5c).

DISCUSSION:

In this study, it was found that BMSC possessed faster proliferation rate and shorter doubling time than LSC. The differentiation ability of BMSC is superior to LSC in osteogenesis, but inferior to LSC in adipogenesis. Real-time RT-PCR revealed TGF-β1 treatment significantly increased type I collagen, type III collagen, vimentin, elastin, and α-SMA mRNA expression in LSC, but the effect TGF-β1 on BMSC is limited to type I collagen up-regulation. Protein quantification confirmed the result of real time RT-PCR and suggested that LSC with TGF-β1 treatment produced largest amount of collagen and non-collagen protein. In summary, although slightly slower in proliferation, LSC produced robust amount of ligament ECM protein upon the treatment of TGF-β1. This property makes LSC a potential cell source in future application on ACL tissue engineering.

REFERENCES:

1. Blood. 2004; 103(5):1669-75. 2. Cell Prolif. 2009; 42(4):448-60
3. PNAS. 2008; 105(1):54-58.



Comparison of Potentials Between Stem Cells Isolated from Human Anterior Cruciate Ligament and Bone Marrow for Ligament Tissue Engineering

Ming-Te Cheng, Tain-Hsiung Chen, Oscar K. Lee

Taoyuan General Hospital, Taiwan
School of Medicine, National Yang-Ming University, Taiwan
Department of Orthopaedic and Traumalogy,
Taipei Veterans General Hospital, Taiwan

The authors have no potential conflicts with this presentation.

Background: Anterior Cruciate Ligament (ACL) Injury

- One of the most common sport-related injuries.
- Annual incidence is estimated to be 1 in 3,000 in the U.S.
- 100,000 ACL reconstruction performed annually in the U.S.

Clark *et al*. Clin Sports Med 2009
Laurencin *et al*. Biomaterials 2005
Judd *et al*. Arthroscopy 2006

Limitations of Current ACL Reconstruction

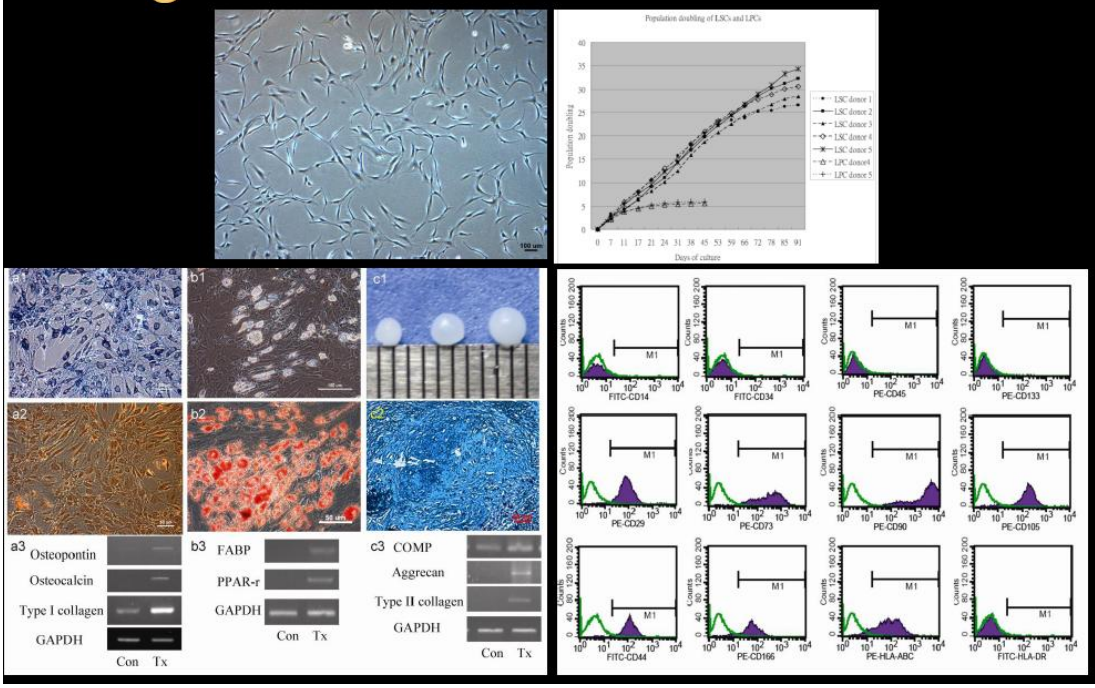
- Annually, 38,000 ACL ruptures were high school students with immature skeletal development.
- 78% risk of radiographic osteoarthritis within 14 years after the injury whether surgically reconstructed or not.
- Donor site morbidity due to autograft harvest.
- Complications of reconstruction.

Clark *et al.* Clin Sports Med 2009
Laurencin *et al.* Biomaterials 2005
Judd *et al.* Arthroscopy 2006

Sources of Stem Cells for Ligament Tissue Engineering

- Bone marrow
  - Pittenger *et al.* Science 1999
- Adult tissues: periosteum, trabecular bone, adipose tissue, periodontal ligament, peripheral blood, muscles, synovial tissue, hamstring tendon, etc.
- Cruciate ligaments
  - Cheng *et al.* Cell Prolif 2009, Tissue Eng 2009

Characterization of Ligament-derived Stem Cells



Aims

- To determine preferential cell sources for ACL tissue engineering
  - Stem cells from bone marrow ?
  - Stem cells from ACL ?
- To determine optimal culture condition (growth factor) for ACL tissue engineering
  - FGF-2 (basic fibroblast growth factor)
  - EGF (epidermal growth factor)
  - TGF-β1 (transforming growth factor β1)

Materials and Methods
Cell Isolation

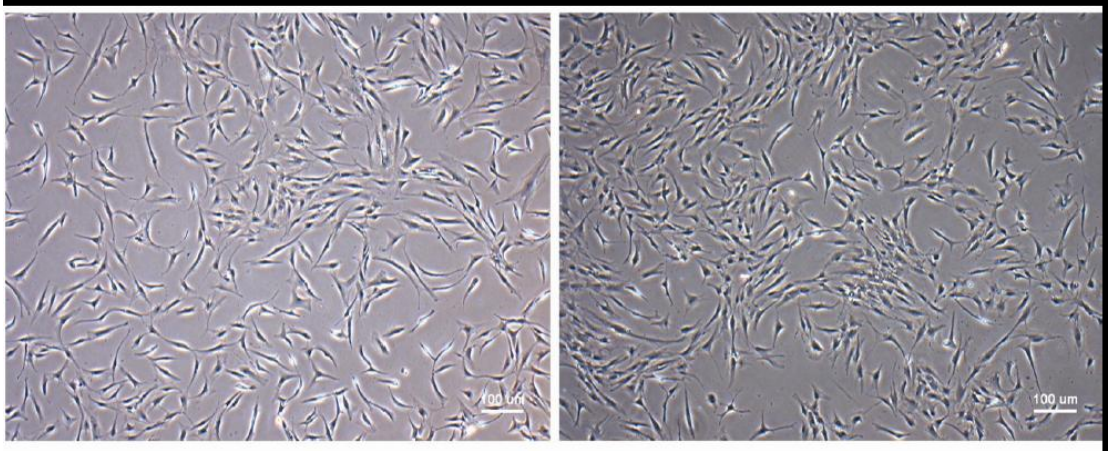
- Human ACL tissues and bone marrow were harvested during arthroscopic surgeries (n=2) and total knee arthroplasties (n=4).

- LSCs (ligament-derived stem cells) were isolated with collagenase digesting and plating
- BMSCs (bone marrow stem cells) were isolated with Ficoll-Paque separation and plating.

Cheng *et al.* Tissue Eng 2009

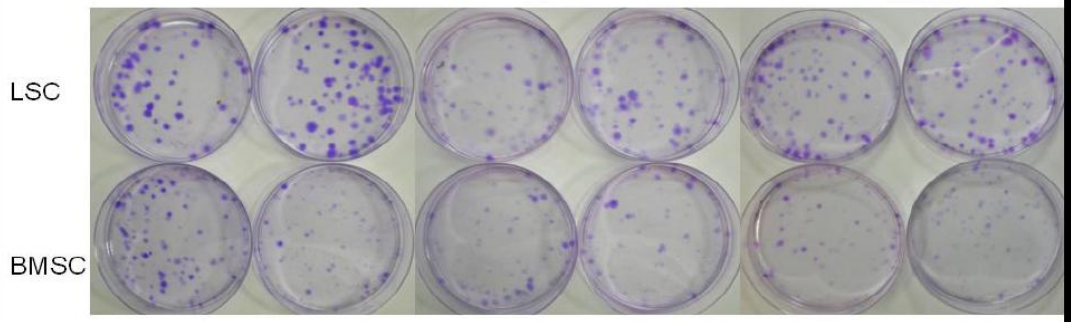
Morphology

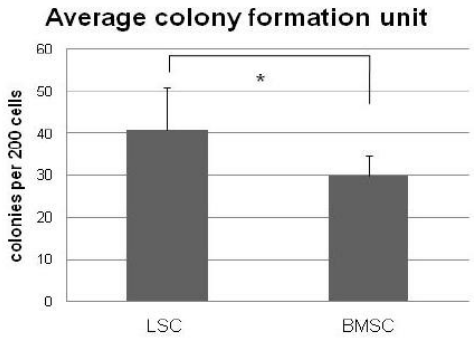
- Spindle-shape, fibroblastic-like, and plastic adherent
- Can be maintained in standard culture condition (α-MEM, 10% FCS, 1% PenStrept).



LSC BMSC

Colony Formation

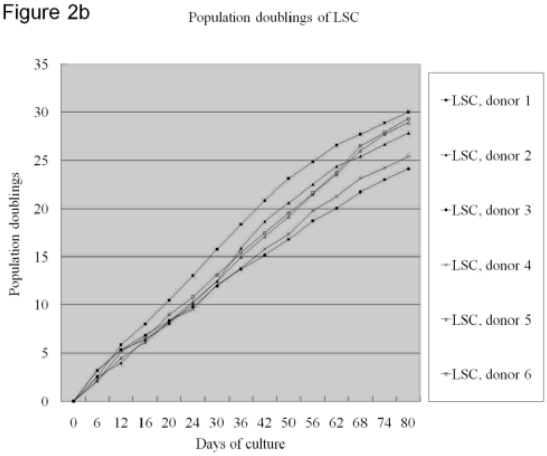


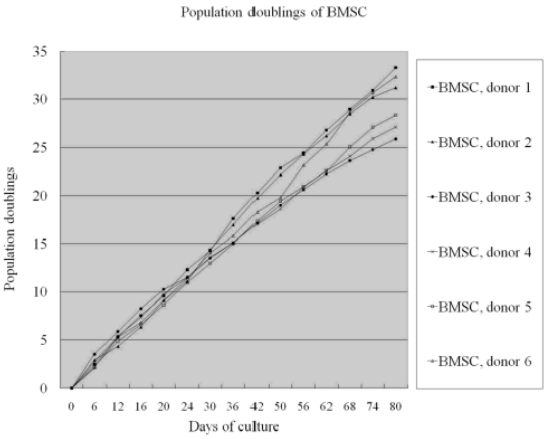


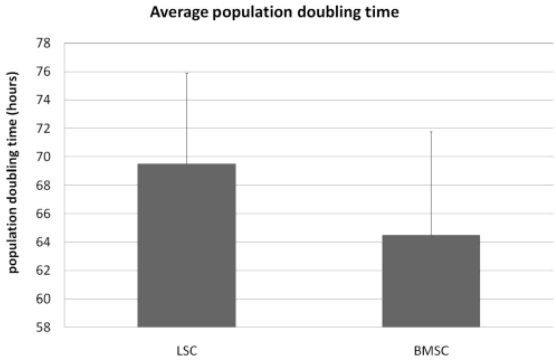
(n=6, *p=0.039)

LSCs have significant higher colony formation ability than BMSCs

Figure 2b

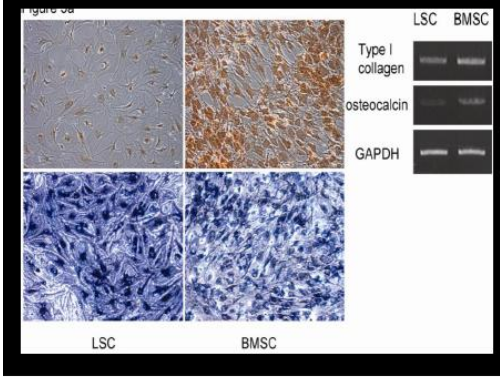


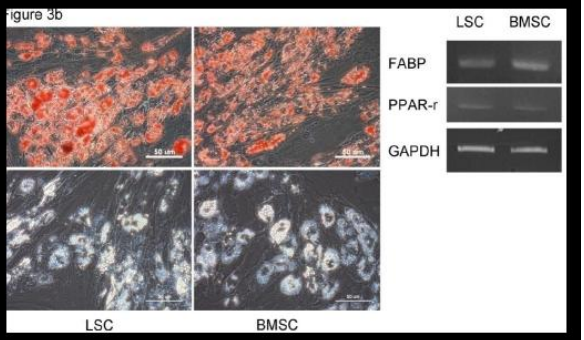


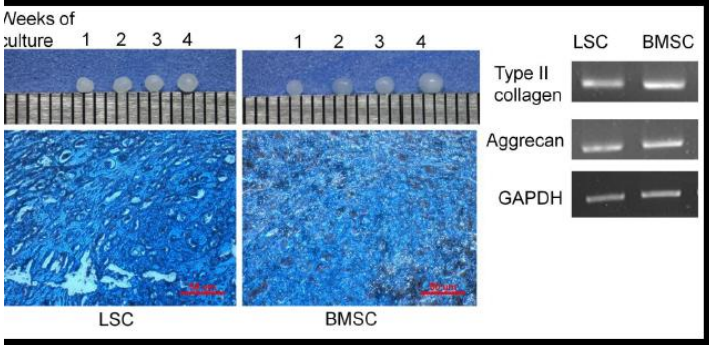


- **Population doubling time** is longer in LSCs but without significant difference.

Multi-lineage Differentiation







LSC have similar differentiation abilities with BMSC, except inferior osteogenic differentiation ability.

The Effect of Growth Factors on Stem Cells

- FGF-2 (basic fibroblast growth factor)
  - a strong mitogen for a variety of stem cells in vitro.

Hankemeier *et al.* Tissue Eng 2005

- EGF (epidermal growth factor)
  - increase proliferation and maintain stem cell multipotency.

Tamana *et al.* Stem Cells 2006

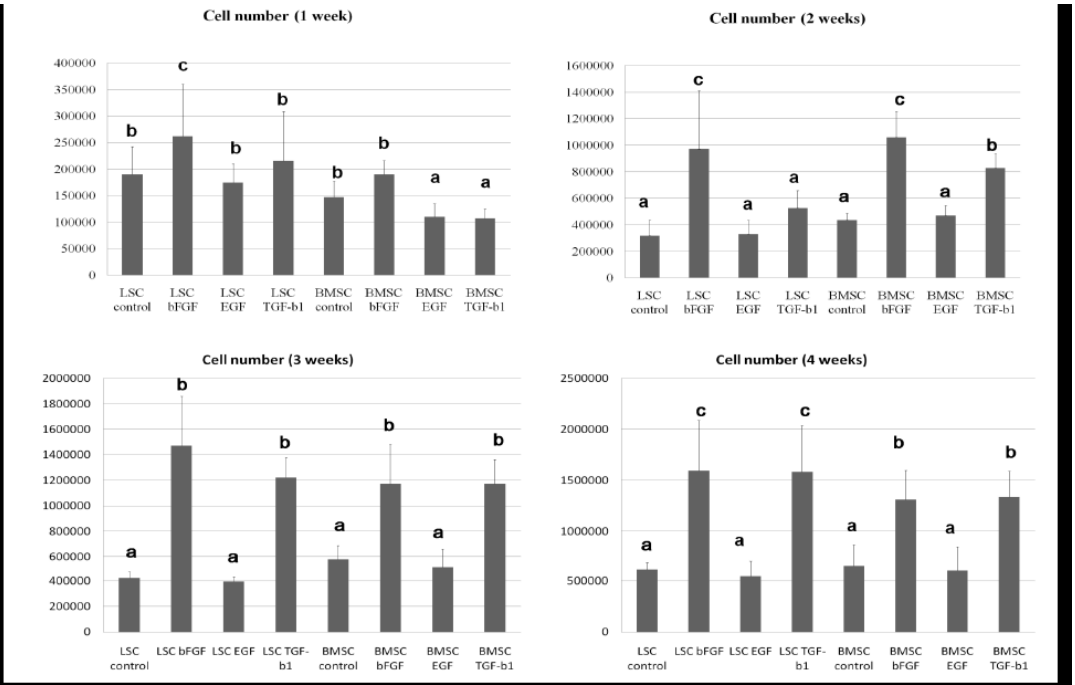
- TGF-β1 (transforming growth factor β1)
  - inhibition of growth of fibroblast, also is known to be a fibroblast trans-differentiation cytokine.

Narine *et al.* Tissue Eng 2006

Cell Proliferation under Different Growth Factors

- LSCs and BMSCs were seeded at 6-well plates ($5*10^2$ cells/cm^2) with the following treatment protocols for 4 weeks
  - Control: α-MEM, 10% FCS
  - FGF-2: control + FGF-2 10 ng/ml
  - EGF: control + EGF 10 ng/ml
  - TGF-β1: control + TGF-β1 10 ng/ml
- The same treatment protocols were used for the subsequent real-time PCR and protein quantification experiments.

ANOVA with Tukey's post-hoc tests were performed at 95% confidence intervals; different levels of significance were shown by different letters.

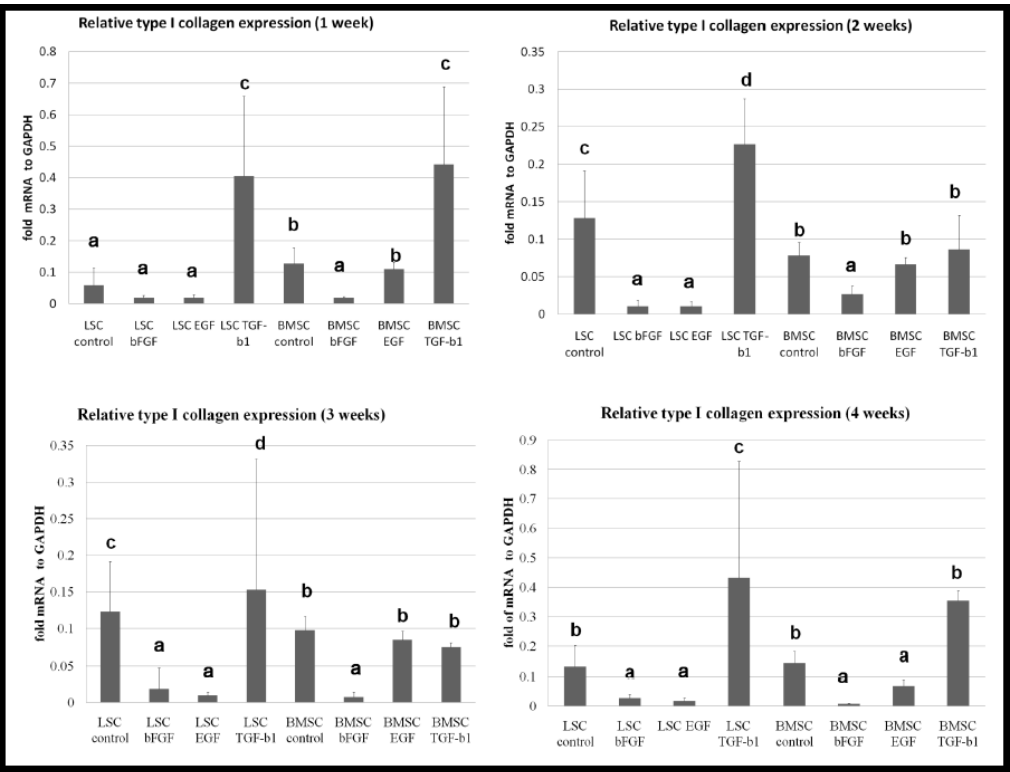


FGF-2 and TGF-β1 increase LSCs and BMSCs proliferation.
After 3 weeks, LSCs have higher proliferative ability than BMSCs
After 3 weeks, TGF-β1 have similar proliferative ability with FGF-2

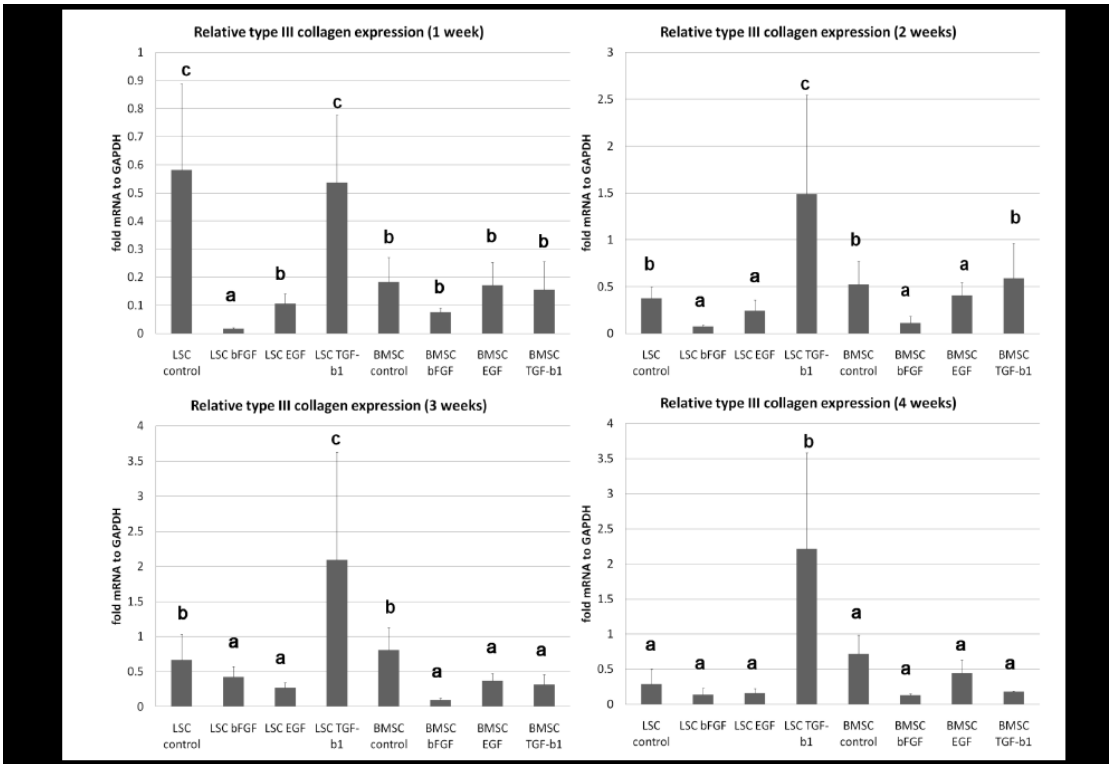
Relative Transcription Level of Genes with Different Treatments

- LSCs and BMSCs were placed in each well of 6-well plates ($5*10^2$ cells/cm^2), cultured with the same protocols as in proliferation study.

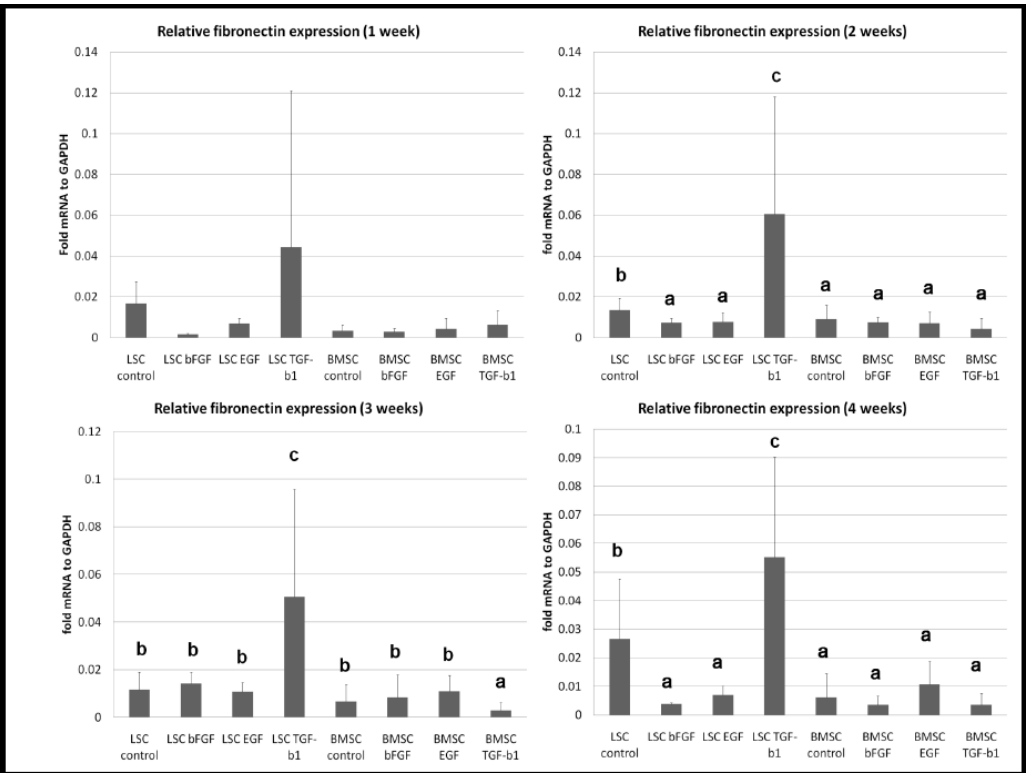
- Cells were harvested weekly and relative transcription levels of Type I collagen, Type III collagen, fibronectin ,and α-smooth muscle actin were quantitatively measured by real-time RT-PCR. GAPDH expression was used as internal control.



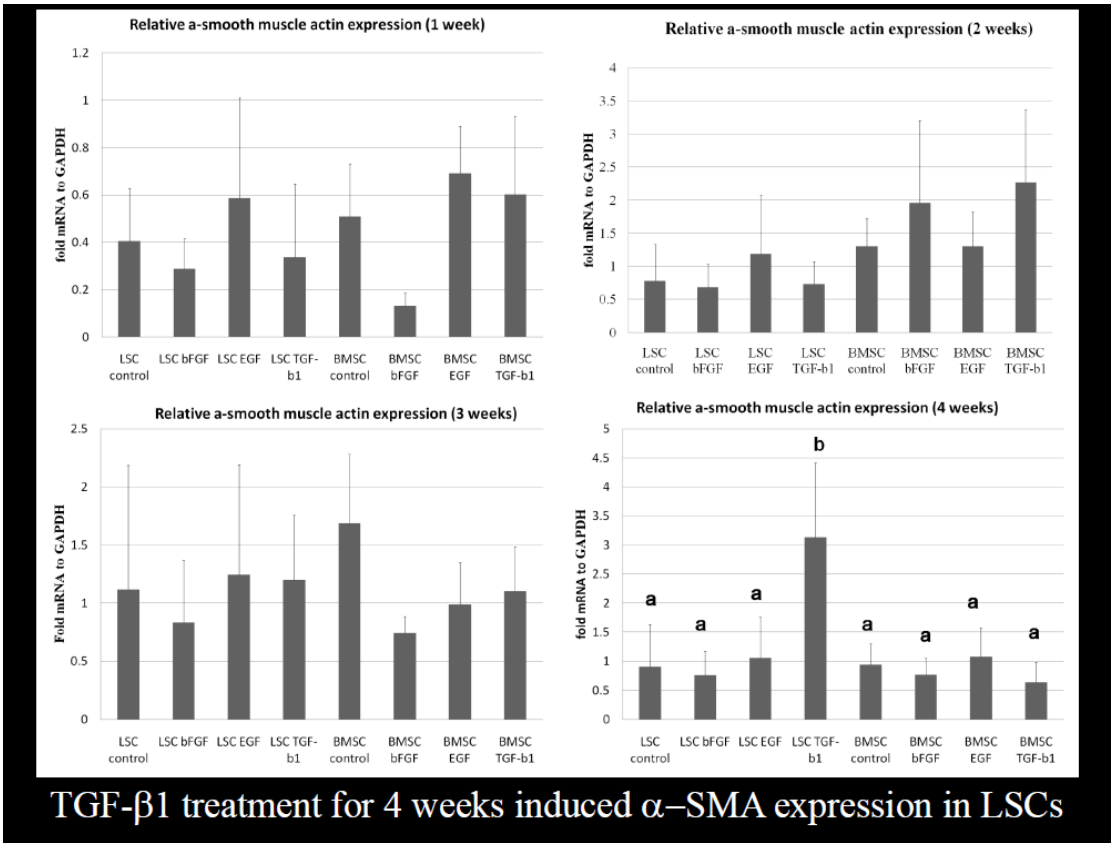
TGF-β1 up-regulated type I collagen expression in LSCs



Type III collagen was induced by TGF-β1 in LSCs, but not BMSCs

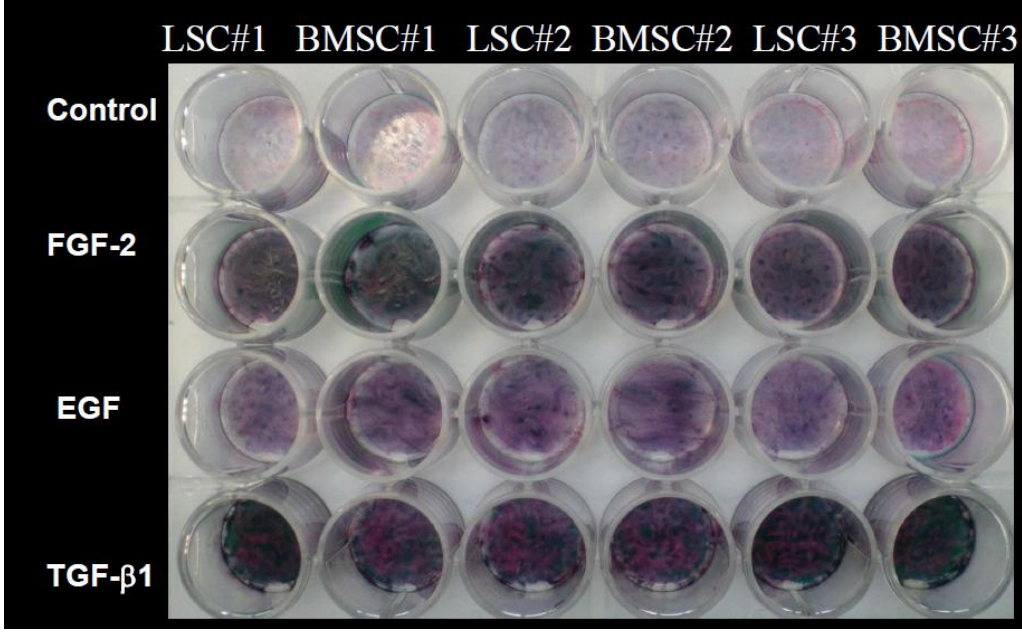


Fibronectin was induced by TGF-β1 in LSCs, but not BMSCs

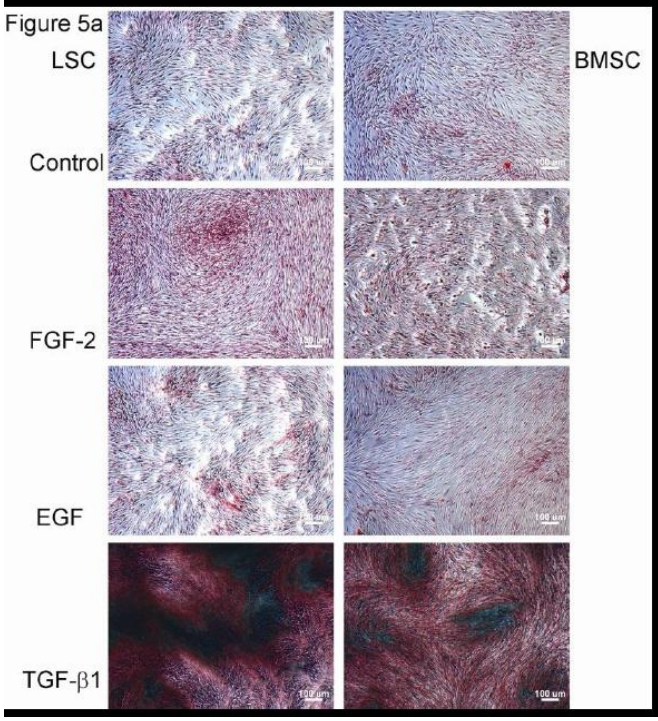


TGF-β1 treatment for 4 weeks induced α–SMA expression in LSCs

LSCs and BMSCs Cultured for 3 weeks and Stained with Sirius red (Specific for Collagen) and Fast Green (Specific for Non-collagen Protein)

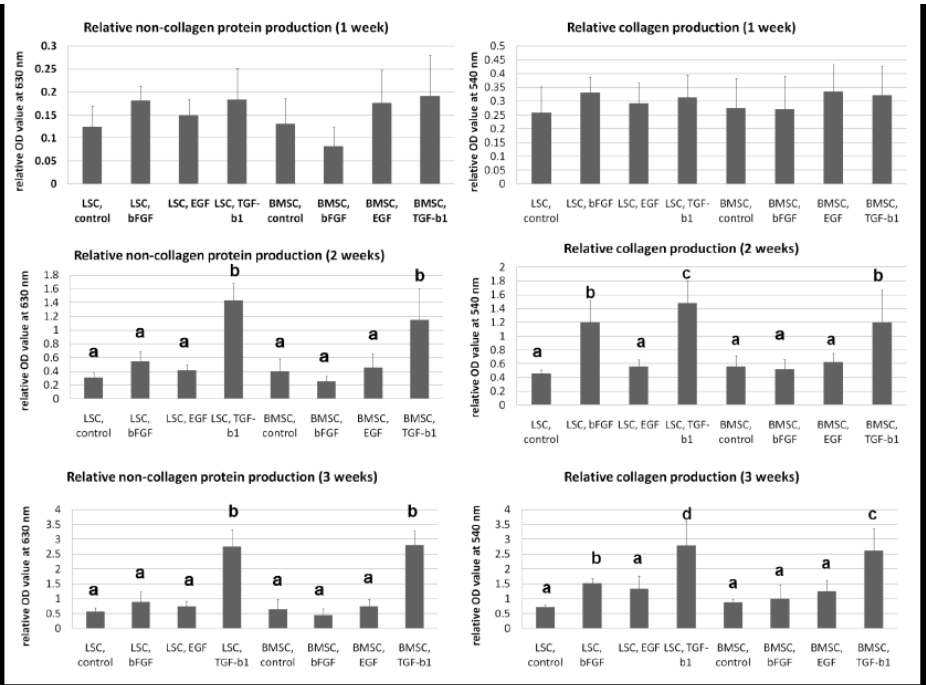


Photomicrograph of LSCs and BMSCs Cultured for 3 Weeks and Stained



The stain was eluted with 100% methanol and NaOH then measured with spectrophotometer 540 nm (collagen) and 630 nm (non-collagen).

Helman et al. Proc Natl Acad Sci U S A. 2008
Tullberg et al. Histochem Cell Biol. 1999



After 2 weeks, significant more non-collagen protein production is noted in LSCs and BMSCs with TGF-β1 treatment.
After 2 weeks, significant more collagen production is noted in LSCs with TGF-β1 treatment, followed by BMSCs treated with TGF-β1 and LSCs treated with FGF-2.

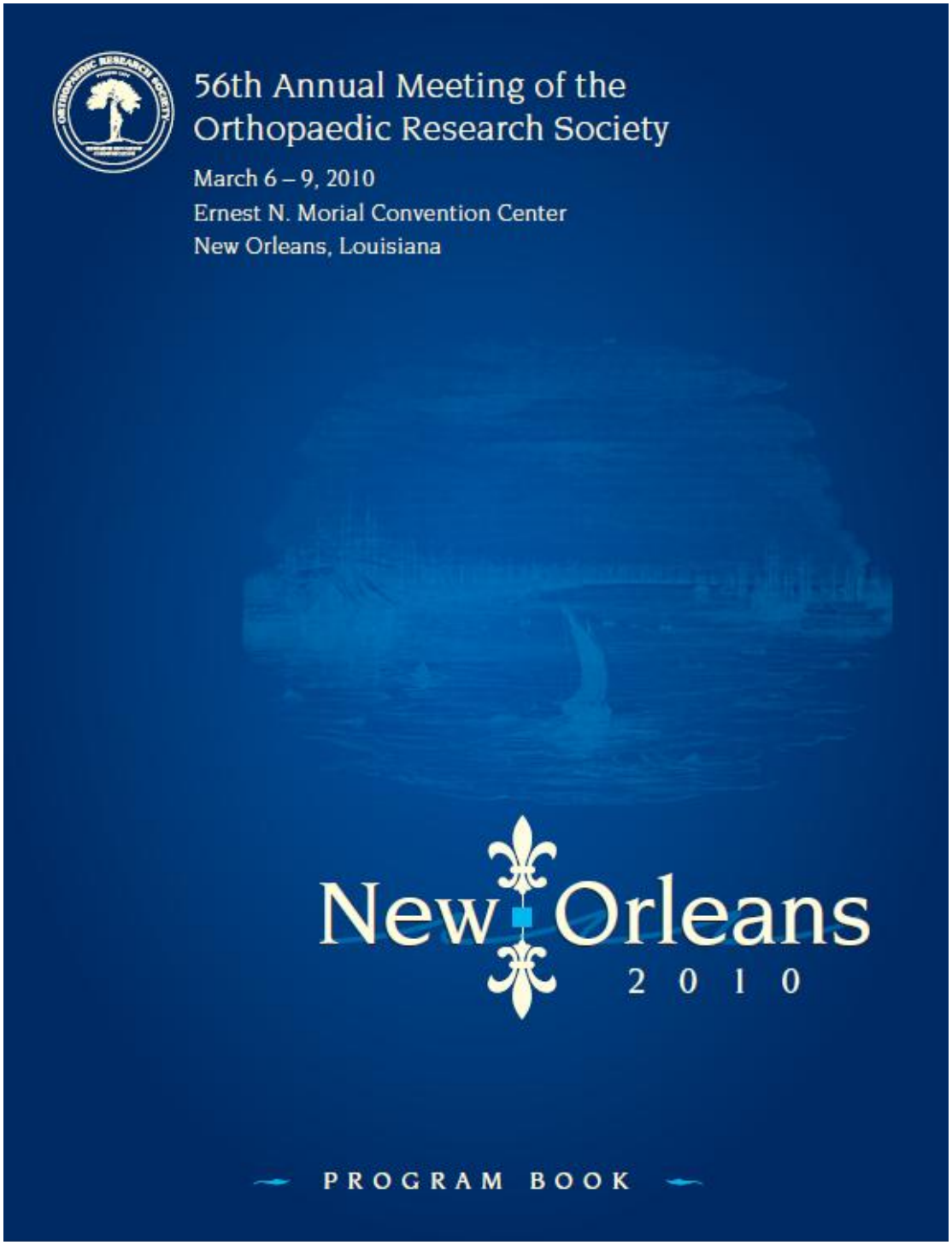
Summary

- FGF-2 and TGF-β1 significantly increase the proliferation of LSCs and BMSCs.
- TGF-β1 treatment significantly increased the expression of type I collagen, type III collagen, fibronectin, and α-SMA expression in LSCs.
- TGF-β1 treatment only up-regulate BMSCs type I collagen expression in 1st and 4th week.
- TGF-β1 treatment also increase ECM protein production in LSCs and BMSCs in 2nd and 3rd week.

Conclusions

- LSCs proliferate faster and produce more tendinous ECM protein than BMSCs under growth factors treatment, making LSCs a potential cell source in future ACL tissue engineering.

- TGF-β1 treatment significantly increase cell proliferation, up-regulate major tendinous gene expression, and induce robust ECM protein production in both LSCs and BMSCs.


56th Annual Meeting of the
Orthopaedic Research Society
March 6 – 9, 2010
Ernest N. Morial Convention Center
New Orleans, Louisiana
New Orleans
2010
PROGRAM BOOK

Meeting At-A-Glance

Friday, March 5, 2010

1:00 pm - 5:00 pm	Registration Open - Level 2 Lobby
8:30 am - 5:00 pm	Grant Writing Workshop - Room 286-287

Saturday, March 6, 2010

Rooms	Auditorium A	Auditorium B	Auditorium C	Room 291-292	Room 293-296
7:30 am - 5:00 pm	Registration Open - Level 2 Lobby				
8:00 am - 9:30 am	Session 01 Chondrocyte Cell Signalling	Session 02 Intervertebral Disc Biomechanics	Session 03 Bone Development	Session 04 Tendon Mechanics	Session 05 Biomaterials
10:00 am - 11:00 am	Session 06 Cartilage Biology	Session 07 Cartilage Mechanics I	Session 08 Bone Adaptation	Session 09 Muscle and Nerve	Session 10 Progenitors and Stem Cells
11:30 am - 12:30 pm	Session 11 Skeletal Development	Session 12 Cartilage Mechanics II	Session 13 Bone Cell Differentiation	Session 14 Meniscus	Session 15 Bone Material Properties I
12:30 pm - 1:45 pm	Meet the Mentors Luncheon Room 288-289				
1:45 pm - 3:15 pm	*SPOTLIGHT* Session 16 Enzymes in Arthritis *Spotlight Speaker:* *Hideki Nagase* *"Can Metalloproteinases be Therapeutic Targets in Osteoarthritis?"*	*SPOTLIGHT* Session 17 Joint Function *Spotlight Speaker:* *Scott Tashman, PhD* *"Assessing Dynamic Joint Function: New Tools for Understanding Musculoskeletal Injury, Disease and Treatment"*	*SPOTLIGHT* Session 18 Osteoclastogenesis *Spotlight Speaker:* *Dongwon Choi* *Regulation of Osteoclast Differentiation"*	*SPOTLIGHT* Session 19 Tendon *Spotlight Speaker:* *Ronen Schweitzer, PhD* *Between a Muscle and a Hard Bone - Regulation of Tendon Induction and Differentiation"*	*SPOTLIGHT* Session 20 Stem Cell Differentiation *Spotlight Speaker:* *Henry J Donahue, PhD* *"Optimizing Adult Stem Cells for Musculoskeletal Regeneration"*
3:30 pm - 4:30 pm	Short Talk 1 Chondrocytes and Matrix Degradation	Short Talk 2 Biomaterials	Short Talk 3 UHMWPE and PEEK	Short Talk 4 Tendon Biology and Repair	Short Talk 5 Bone Biology
4:30 pm - 5:30 pm	*NEW Networking Reception - Hall H*				
5:30 pm - 6:30 pm	Poster Session *(all presenters)* / Exhibits Open - Hall H				

Sunday, March 7, 2010

Rooms	Auditorium A	Auditorium B	Auditorium C	Room 291-292	Room 293-296
7:30 am - 5:00 pm	Registration Open - Level 2 Lobby				
8:00 am - 9:30 am	Workshop 1 Biomechanics and Inflammation in Health and Diseases of Musculoskeletal System: Anti-Inflammatory Component of Mechanosignaling	Workshop 2 Adaptation in Articular Cartilage - Evidence, Assessment and Interpretation	Workshop 3 Evaluation and Manipulation of Angiogenesis in Bone Regeneration	Workshop 4 Protecting and Marketing Your Ideas: Intellectual Property Considerations	
10:00 am - 11:30 am	Session 21 Scaffolds	Session 22 Intervertebral Disc	Session 23 Cell Imaging and Mechanobiology	Session 24 Hip & Knee Disease Process	Session 25 Bone Matrix: Mechanisms
11:30 am - 12:45 pm	Meet the Industry Member Luncheon - Room 288-289				
12:45 pm - 1:45 pm	Short Talk 6 Arthritis	Short Talk 7 Cartilage Mechanics	Short Talk 8 Progenitors and Stem Cells	Short Talk 9 Hip Resurfacing	Short Talk 10 Bone Mechanics
1:45 pm - 2:45 pm	Poster Session *(Even numbered poster presenters)* / Exhibits Open - Hall H				
2:45 pm - 4:15 pm	*SPOTLIGHT* Session 26 Tissue Engineering *Spotlight Speaker:* *Prof. Anthony Peter Hollander, PhD* *"Cartilage Tissue Engineering From Stem Cells: Turning Science Into Medicine"*	*SPOTLIGHT* Session 27 Development and Disease *Spotlight Speaker:* *Benjamin Alman, MD* *"From Development to Disease: Hedgehog in Tumors and Arthritis"*	*SPOTLIGHT* Session 28 Clinical Trials *Spotlight Speaker:* *Mohit Bhandari, MD* *"Moving from the Bench to the Bedside: Designing Modern Day Clinical Trials in Fracture Healing"*	*SPOTLIGHT* Session 29 Implants *Spotlight Speaker:* *Kenneth A Mann, PhD* *"Micromechanics of Cemented Implant Fixation: How Fixed is Well-Fixed?"*	*SPOTLIGHT* Session 30 Bone Adiposity *Spotlight Speaker:* *Clifford Rosen, MD* *"Bone Marrow Adiposity: Structural and Functional Correlates"*
4:45 pm - 5:45 pm	Session 31 Polymers, Scaffolds, and Surfaces	Session 32 Cervical Spine	Session 33 Stem Cells and Fracture Healing	Session 34 Arthroplasty: Implant Fixation	Session 35 Bone Material Properties II

Monday, March 8, 2010.

Rooms	Auditorium A	Auditorium B	Auditorium C	Room 291-292	Room 293-296
7:30 am - 5:00 pm	Registration Open - Level 2 Lobby				
7:30 am - 8:00 am	Business Meeting - Room 291-292				
8:00 am - 9:30 am	*New Horizon Workshop 5* Chondrocyte Motility in Development and Disease	*New Horizon Workshop 6* Imaging Stem Cell Fate and Function			*New Investigator Skills Development Forum* Room 286-287
10:00 am - 11:00 am	Session 36 Lubrican	Session 37 Mechanobiology	Session 38 Arthroplasty: Implant Wear I	Session 39 Bone Matrix: Microdamage	Session 40 Tissue Engineering: Fibrous Tissues and Fibrocartilage
11:30 am - 12:30 pm	Session 41 Shoulder - Biologic and Mechanical Factors	Session 42 Imaging	Session 43 Arthroplasty: Implant Wear II	Session 44 Infection and Inflammation	Session 45 Ligament Biology and Repair
1:45 pm - 3:15 pm	ORS Awards and NIRA Presentations - Auditorium B				
3:30 pm - 4:30 pm	Short Talk 11 Osteoarthritis	Short Talk 12 Biology of Fracture Repair	Short Talk 13 Total Hip Arthroplasty	Short Talk 14 Infection and Inflammation	Short Talk 15 Tissue Engineering: Load and Growth Factors
4:30 pm - 5:30 pm	Poster Session *(all presenters)* / Exhibits Open - Hall H				

Tuesday, March 9, 2010

Rooms	Auditorium A	Auditorium B	Auditorium C	Room 291-292	Room 293-296
7:30 am - 5:00 pm	Registration Open - Level 2 Lobby				
8:00 am - 9:30 am	Workshop 7 Hypersensitivity and Biomaterials: What are the Facts, Myths and Legends?	Workshop 8 The Armed Forces Institute of Regenerative Medicine: Its Structure, Operations, and Goals	Workshop 9 Functional Attachment of Soft Tissues to Bone: Development, Healing, and Tissue Engineering	Workshop 10 Post-Traumatic Osteoarthritis: Improved Understanding and Opportunities for Early Intervention	
9:45 am - 10:45 am	Short Talk 16 Enhancement of Fracture Healing	Short Talk 17 Biomaterial Cell Interaction	Short Talk 18 Total Knee Arthroplasty	Short Talk 19 Musculoskeletal Tumors	Short Talk 20 Spine
10:45 am - 11:45 am	Poster Session *(Odd numbered posters)* / Exhibits Open - Hall H				
11:45 am - 12:15 pm	Presidential Address — "Research and Responsibility: More than Just Responsible Research"— Regis J. O'Keefe, MD, PhD - Auditorium B				
1:00 pm - 2:30 pm	Session 46 Ligament Kinematics	ORS/AAOS Symposium I Intramuscular Fatty Atrophy: Physiology, Imaging, and Treatment	Session 47 Hand and Wrist	Session 48 Total Knee Arthroplasty	Session 49 Foot and Ankle
1:30 pm - 5:00 pm	Maintenance of Certification Curriculum - Room 343				
2:45 pm - 4:15 pm	Session 50 Shoulder	ORS/AAOS Symposium II Applied Biomechanical Engineering – Joint Injuries from Benchtop to Bedside	Session 51 Arthroplasty: Bearing Surfaces	Session 52 Gait and Kinematics	Session 53 Spine
4:30 pm - 5:30 pm	Kappa Delta Award and ORS Award Paper Presentations - Auditorium B				

Sunday, March 7, 2010
2:45 PM – 4:15 PM

Spotlight Session 26
Tissue Engineering
Room # Auditorium A
Moderators: James Dennis, PhD and Mauro Alini, PhD

2:45 PM *Spotlight Speaker*
Prof. Anthony Peter Hollander, PhD, Bristol, UK
Cartilage Tissue Engineering From Stem Cells:
Turning Science Into Medicine

3:15 PM *Paper No. 121*
Functional Maturation of Engineered Composites that Mimic the Hierarchical Organization of the Intervertebral Disc
Nandan Nerurkar, Sounok Sen, Alice Huang, Dawn Elliott, Robert Mauck

3:30 PM *Paper No. 122*
Comparison of Stem Cells Isolated from Human Anterior Cruciate Ligament and Bone Marrow
Ming-Te Cheng, Tain-Shung Chen, Oscar Kuang-Sheng Lee

3:45 PM *Paper No. 123*
Reducing Expression of P65 Improved Success of Muscle stem Cells Transplantation by attenuating inflammation
Aiping Lu, Ying Tang, Jonathan Proto, Paul Robbins, Johnny Huard

4:00 PM *Paper No. 124*
The Clinical Use of Human Autologous Bone Marrow Derived Mesenchymal Stem Cells Transplanted on Platelet-Rich Fibrin Glue in the Treatment of Articular Cartilage Defects
Amgad Haleem, Constance Chu, Abdel Aziz El Singergy, Dina Sabry, Hazem Atta, Laila Rashed, Mohammed El Sewy, Akram Azzam, Mohammed Abdel Aziz

Spotlight Session 27
Development and Disease
Room # Auditorium B
Moderators: Mary Goldgring, PhD, MD and Richard Terek, MD

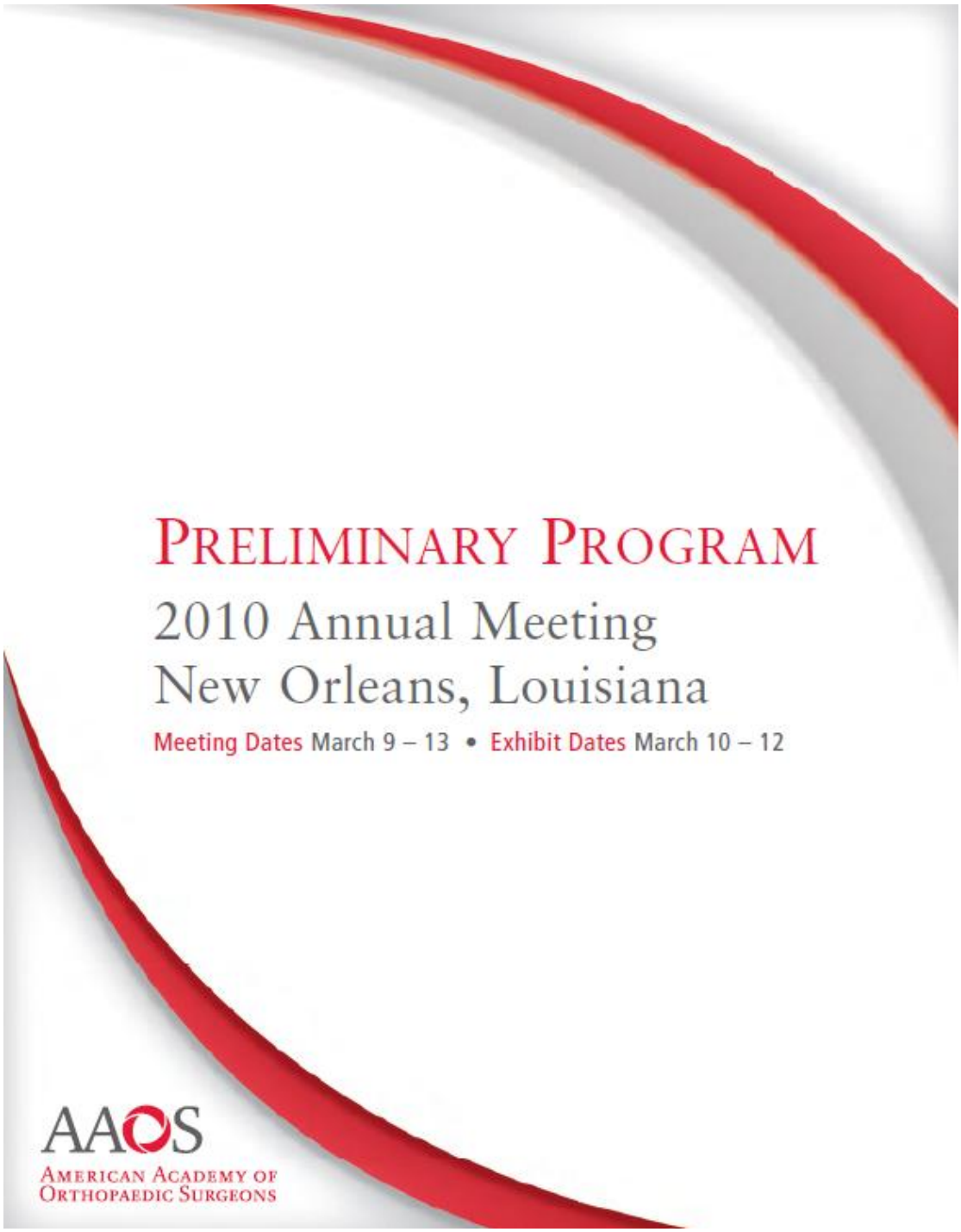
Spotlight Speaker
Benjamin Alman, MD, Toronto, Canada
From Development to Disease:
Hedgehog in Tumors and Arthritis

Paper No. 125
PTHrP Blocks Thyroid Hormone-Mediated Terminal Differentiation in Growth Plate Chondrocytes
Lai Wang, Yvonne Shao, Tracy Ballock

Paper No. 126
Activation of Indian Hedgehog Promotes Chondrocyte Hypertrophy and Upregulation of MMP-13 in Osteoarthritic Cartilage
Lei Wei, Fangyuan Wei, Jingming Zhou, xiaochun wei, Wesley Wu, Qian Chen

Paper No. 127
Smoothened as a New Therapeutic Target for Human Osteosarcoma
Osamu Kunigou, Takao Setoguchi, Masataka Hirotsu, Yukihiro Matsunoshita, Setsuro Komiya

Paper No. 128
Microarray Analysis of Upstream Hedgehog Genes Provide Potential Radiorecovery Targets
Jason Horton, Meredith Pritchard, Timothy Damron, Frank Middleton, Joseph Spadaro


PRELIMINARY PROGRAM
2010 Annual Meeting
New Orleans, Louisiana
Meeting Dates March 9 – 13 • Exhibit Dates March 10 – 12
AAOS
American Academy of Orthopaedic Surgeons

	Tuesday, March 9	Wednesday, March 10	Thursday, March 11	Friday, March 12	Saturday, March 13
American Joint Replacement Registry Update MCC, Room 210		9:00 – 11:00 AM			
Business Meetings MCC, La Nouvelle Ballroom			9:00 AM		
Ceremonial Meeting MCC, La Nouvelle Ballroom			10:00 AM		
Electronic Skills Pavilion MCC, Hall A		9:00 AM – 5:00 PM	9:00 AM – 5:00 PM	9:00 AM – 5:00 PM	
Forum for Young Orthopaedists MCC, Room 349			10:30 AM – 12:30 PM		
Guest Speaker – TBD MCC, La Nouvelle Ballroom			11:00 AM		
Induction of New Members MCC, La Nouvelle Ballroom		5:00 PM			
Instructional Courses See Schedule or pages 16 – 39 MCC, Rooms TBD	1:30 – 3:30 PM 1:30 – 4:30 PM 1:30 – 6:00 PM 4:00 – 6:00 PM	7:00 – 10:00 AM 8:00 – 10:00 AM 8:00 – 11:00 AM 10:30 AM – 12:30 PM 1:30 – 3:30 PM 1:30 – 4:30 PM 4:00 – 6:00 PM	7:00 – 10:00 AM 8:00 – 10:00 AM 8:00 – 11:00 AM 10:30 AM – 12:30 PM 1:30 – 3:30 PM 1:30 – 4:30 PM 4:00 – 6:00 PM	7:00 – 10:00 AM 8:00 – 10:00 AM 8:00 – 11:00 AM 10:30 AM – 12:30 PM 1:30 – 3:30 PM 1:30 – 4:30 PM 4:00 – 6:00 PM	
Job Placement Center MCC, Academy Hall B2	1:00 – 6:00 PM	7:00 AM – 6:00 PM	7:00 AM – 6:00 PM	7:00 AM – 6:00 PM	7:00 AM – 5:30 PM
Kappa Delta & OREF Award Paper Presentations, MCC	4:30 – 5:30 PM				
Multimedia Education Center MCC, Academy Hall E	1:00 – 6:00 PM	7:00 AM – 6:00 PM	7:00 AM – 6:00 PM	7:00 AM – 6:00 PM	7:00 AM – 5:30 PM
Nursing and Allied Health Courses MCC, Room R09, CAST Room R03		8:15 AM – 12:30 PM 1:30 – 5:45 PM	8:15 AM – 12:30 PM 1:30 – 5:45 PM	8:00 AM – 12:00 PM 1:30 – 5:30 PM	
Opening Ceremony MCC, La Nouvelle Ballroom		4:00 – 5:30 PM			
Orthopaedic Research Society MCC, Rooms TBD MCC, Hall H	8:00 AM – 4:15 PM 9:30 AM – 1:00 PM				
Orthopaedic Review Course New Orleans Hilton Riverside				8:00 AM – 5:30 PM	
Poster Presentations MCC, Academy Hall CD	1:00 – 6:00 PM	7:00 AM – 6:00 PM	7:00 AM – 6:00 PM	7:00 AM – 6:00 PM	7:00 AM – 5:30 PM
Ready Rooms MCC, Rooms 231 & 253	6:30 AM – 10:00 PM	6:30 AM – 6:00 PM	6:30 AM – 6:00 PM	6:30 AM – 6:00 PM	6:30 AM – 5:30 PM
Registration Physician MCC, Academy Hall B2	11:00 AM – 7:00 PM	7:00 AM – 6:00 PM	7:00 AM – 6:00 PM	7:00 AM – 6:00 PM	7:00 AM – 5:30 PM
Resource Center Bookstore MCC, Academy Hall D	1:00 – 6:00 PM	7:00 AM – 6:00 PM	7:00 AM – 6:00 PM	7:00 AM – 6:00 PM	7:00 AM – 5:30 PM
Scientific Exhibits MCC, Academy Hall E	1:00 – 6:00 PM	7:00 AM – 6:00 PM	7:00 AM – 6:00 PM	7:00 AM – 6:00 PM	7:00 AM – 5:30 PM
Scientific Program, Podium Presentations, Symposia See pages 16 – 40 MCC, Rooms TBD	1:30 – 3:30 PM 4:00 – 6:00 PM	8:00 – 10:00 AM 10:30 AM – 12:30 PM 1:30 – 3:30 PM 4:00 – 6:00 PM	8:00 – 10:00 AM 10:30 AM – 12:30 PM 1:30 – 3:30 PM 4:00 – 6:00 PM	8:00 – 10:00 AM 10:30 AM – 12:30 PM 1:30 – 3:30 PM 4:00 – 6:00 PM	
Social Program Registration MCC, Hall A Lobby	11:00 AM – 7:00 PM	7:00 AM – 6:00 PM	7:00 AM – 6:00 PM	7:00 AM – 6:00 PM	7:00 AM – 1:00 PM
Specialty Day MCC					Times Vary see page 47
Technical Exhibits MCC, Halls A - G		9:00 AM – 5:00 PM	9:00 AM – 5:00 PM	9:00 AM – 5:00 PM	

MCC – Morial Convention Center