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## **CURRICULUM VITAE**

**Name:** Imad About, PhD  
**Address :** Institut des Sciences du Mouvement (ISM), Faculty of Dentistry, 27 BVD Jean Moulin, 13385 Marseille, France  
**Date of birth:** Feb 24, 1962  
**place of birth :** Nablus, Palestine  
**Nationality:** French

### **Education:**

2004 : “Habilitation à diriger des recherches”: French diploma which enables its holder to direct a research laboratory and PhD students (Aix-Marseille University, France).  
1992: PhD Biochemistry: molecular and cellular aspects (Aix-Marseille III University).  
1987: Master’s degree of Biochemistry: cellular and molecular aspects (Aix-Marseille II University).  
1986: Master’s degree of cell biology and immunology (Aix-Marseille II University).  
1985: BSc. of Sciences: cell biology and immunology (Aix-Marseille II University).

### **University appointments:**

**From 2002:** Professor of oral biology and researcher, Faculté d’Odontologie, Aix-Marseille university, Marseille, France.  
**2000 –2002 :** Associate professor of oral biology and researcher, Faculté d’Odontologie, Université de la Méditerranée, Marseille, France.  
**1996 -2000 :** Assistant professor of oral biology and researcher, Faculté d’Odontologie, Université de la Méditerranée, Marseille, France.  
**1994 -1995:** Lecturer, Faculté d’Odontologie, Université de la Méditerranée, Marseille, France.  
**1992 -1993:** Postdoctoral Fellow, National institute of health and medical research, Marseille, France.

### **Membership in professional organizations:**

International Association of Dental Research.  
Continental European Division/International Association of Dental Research.

### **Private sector appointments:**

2011-Present Scientific consultant: Septodont.

**Honors/awards:**

**Winner of European Society of Endodontology Annual Research grant (2012)**

**Nominated for Distinguished scientist award of IADR 2015**

**Editorial appointments:**

As member of Scientific Advisory/Editorial Board

- Journal of Dental Research (2004-2010 and 2015-)
- Frontiers in Physiology (2011-)
- Journal of Endodontics (2011-)
- Bulletin du Groupement International pour la Recherche Scientifique en Stomatologie et Odontologie (2009-)

**European appointments:**

**Member of CED-IADR board (elected in 2015)**

**Patents:**

1) Significant contribution to the development of a new calcium silicate dentin substitute. Patent WO 2004/017929 A2. This dental material has been commercialized in 2010 as “Biodentine” by Septodont, France.

2) Development of a new material containing a bioactive molecule for accelerating tissue regeneration (ongoing).

**Scholarly activities:**

**1) Lecturing activities:**

**Prof. Imad ABOUT** is responsible for

- a. The discipline of basic sciences at the faculty of dentistry, Marseille, France.
- b. A Master course in Biomaterials
- c. Teaching Immunology, biochemistry, histology, anatomy, pathology, stem cells and tissue regeneration courses at the faculty of dentistry, Marseille, France.

**2) Extramural scholarly commitment:**

**Prof. Imad ABOUT** is:

- a. Frequently Invited speaker in major international conferences: IADR, AAE, ESE, APEC, PAEC, PBRG symposia ...etc (see list at the end).
- b. Lecturer to post-graduate students in prestigious universities: king's college (London), MacGill university (Motreal), Queen's university (Belfast) ...etc (see list at the end).
- c. External expert of the Hellenic Quality Assurance Agency for Higher Education, Greece (2010-).
- d. External expert of the Greek Ministry of higher Education to evaluate the faculty of dentistry of Athens, march 14-20, 2010. Athens, Greece.
- e. External member of a selection committee: section 65 to recruit associate professors, Reims University, France (2012).
- f. External expert in technology transfer in the health field for CRITT Santé Bretagne, France (2010-).

**3) National and international expert in research project funding evaluation:**

**Prof. Imad ABOUT is expert for:**

- a. Raine Medical Research Foundation. The University of Western Australia, Australia (2010-).
- b. Agence National pour la Recherche (ANR), France (2012-).
- c. Institut Français de Recherche Odontologique (IFRO), France (2005-).

**4) Reviewer for:**

Stem Cells, Journal of Dental Research, Cell and Tissue Research, Biomaterials, e Cells and Materials Journal, Acta Biomaterialia, Clinical Oral Investigation, Stem Cell Research & Therapy, The Anatomical Record, Journal of Biomedical Materials Research, International Endodontic Journal, Differentiation, Archives of Oral Biology, Journal of Oral Rehabilitation, Frontiers in Physiology, section Craniofacial Biology.

**Publications**

**Peer Reviewed Articles and book chapters (out of 92)**

- 1) El Karim I, Jeanneau C, Lundy F.T, **About I.** Biodentine™ Reduces TNF- $\alpha$ - induced TRPA1 Expression in Odontoblast-like Cells. Under revision, **J endod** **2015**.
- 2) Jeanneau C, Rufas P, Rombouts C, Giraud T, Dejou J, **About I.** Can pulp fibroblast kill cariogenic bacteria? Role of Complement activation. **J Dent Res**, **2015**. Oct 13. pii: 0022034515611074.
- 3) El Karim I, McCrudden M, Linden G, Abdullah H, Curtis T, McGahon M, **About I**, Irwin C, Lundy FT. TNF $\alpha$ -induced p38 MAPK activation regulates TRPA1 and TRPV4 activity in human odontoblast-like cells. **Am J Pathol**, **2015**: 185(11):2994-3002.

- 4) Clarke R, Monaghan K, **About I**, El Karim I, McGeown J G, Cosby S L, Curtis T M, McGarvey L, Lundy F T. Nerve growth factor and the viral mimic polyinosinic:polycytidylic acid (Poly I:C) induce TRPA1 channel hyper-responsiveness in an adult stem cell-derived sensory neuronal model: a possible mechanism for cough reflex hyper-responsiveness. **Under revision, Thorax, 2015.**
- 5) Monnier A, Rombouts C, Kouider D, **About I**, Fessi H, Sheibat-Othman N. Preparation and characterization of biodegradable polyhydroxybutyrate-co-hydroxyvalerate/polyethylene glycol blend microspheres. Submitted to **Journal of Microencapsulation, 2015.**
- 6) Rombouts C, Jeanneau C, Laurent P, **About I**. Angiogenic and osteogenic potential of xenogeneic bone filling materials: role of periodontal ligament cells. Submitted to **Clin Oral Invest, 2015.**
- 7) Cuadros C, Lorente A I, Saez S, Binimelis J, **About I**, Mercade M. Clinical and radiographic evaluation of Biodentine in pulpotomies of primary molars: a randomized clinical trial with 12 months of follow-up. **Under revision Clin Oral Invest, 2015.**
- 8) Chmilewsky F, Jeanneau C, Laurent P, **About I**. LPS Induces Pulp Progenitor Cell Recruitment via Complement Activation. **J Dent Res. 2015** Jan;94(1):166-74 (**Cover Page**).
- 9) Camps J, Jeanneau C, Laurent P; **About, I**. Bioactivity of a calcium silicate-based endodontic cement (BioRoot RCS): interactions with the human apical tissue in vitro. **J Endod. 2015** 41(9):1469-73..
- 10) Chmilewsky F, Jeanneau C, Laurent P, **About I**. Pulp fibroblasts synthesize functional complement proteins involved in initiating dentin-pulp regeneration. **Am J Pathol. 2014** Jul;184(7):1991-2000. (**Cover Page**).
- 11) Papagerakis S, Pannone G, Zheng L, **About I**, Taqi N, Nguyen NP, Matossian M, McAlpin B, Santoro A, McHugh J, Prince ME, Papagerakis P. Oral epithelial stem cells - implications in normal development and cancer metastasis. **Exp Cell Res. 2014** Jul 15;325(2):111-29.
- 12) Zheng L, Ehardt L, McAlpin B, **About I**, Kim D, Papagerakis S, Papagerakis P. The tick tock of odontogenesis. **Exp Cell Res. 2014** Jul 15;325(2):83-9.
- 13) Mitsiadis TA, Filatova A, Papaccio G, Goldberg M, **About I**, Papagerakis P. Distribution of the amelogenin protein in developing, injured and carious human teeth. **Front Physiol. 2014** Dec 10;5:477.
- 14) Camilleri J, Laurent P, **About I**. Hydration of Biodentine, Theracal LC, and a Prototype Tricalcium Silicate-based Dentin Replacement Material after Pulp Capping in Entire Tooth Cultures. **J Endod, 2014** Nov;40(11):1846-54.
- 15) Chmilewsky F, Jeanneau C, Laurent P, Kirschfink M, **About I**. Pulp progenitor cell recruitment is selectively guided by a C5a gradient. **J Dent Res, 2013** Jun;92(6):532-9 (**Cover Page**).

- 16) Mathieu S, Jeanneau C, Sheibat-Othman N, Kalaji N, Fessi H, About I. Usefulness of controlled release of growth factors in investigating the early events of dentin-pulp regeneration. *J Endod.* 2013 Feb;39(2):228-35.
- 17) Diamanti E, Mathieu S, Jeanneau C, Kittraki E, Panopoulos P, Spyrou G, **About I.** Endoplasmic reticulum stress and mineralization inhibition mechanism by the resinous monomer HEMA. *Int Endod J.* 2013 Feb;46(2):160-8.
- 18) Laurent P, Camps J, **About I.** Biodentine(TM) induces TGF- $\beta$ 1 release from human pulp cells and early dental pulp mineralization. *Int Endod J.* 2012 May;45(5):439-48 (**Cover Page**).
- 19) Pignoly C, Camps L, Susini G, **About I,** Camps J. Influence of in-office whitening gel pH on hydrogen peroxide diffusion through enamel and color changes in bovine teeth. *Am J Dent,* 2012 Apr;25(2):91-6.
- 20) Raskin A, Eschrich G, Dejous J, **About I.** In vitro Microleakage of Biodentine™ as a Dentin Substitute Compared to Fuji II LC® in Cervical Lining Restorations, *J Adhes Dent,* 2012 Dec;14(6):535-42.
- 21) El Karim IA, Linden GJ, Curtis TM, **About I,** McGahon MK, Irwin CR, Lundy FT. Human odontoblasts express functional thermo-sensitive TRP channels: Implications for dentin sensitivity. *Pain.* 2011 Oct;152(10):2211-23 (**Highlighted in Pain 2011 Oct;152(10)**).
- 22) **About I.** Dentin Regeneration in vitro: the Pivotal Role of Supportive Cells. *Adv Dent Res.* 2011; 23(3):320-4.
- 23) El Karim IA, Linden GJ, Curtis TM, **About I,** McGahon MK, Irwin CR, Killough SA, Lundy FT. Human dental pulp fibroblasts express the "cold-sensing" transient receptor potential channels TRPA1 and TRPM8. *J Endod.* 2011; 37(4):473-8.
- 24) Lundy F.T, **About I,** Curtis T.M, McGahon M.K, Linden G.J, Irwin C.R, and. PAR-2 regulates dental pulp inflammation associated with caries. *J Dent Res,* 2010; 89(7):684-8.
- 25) Kalaji N, Deloge A, Sheibat-Othman N, Boyron O, **About I,** Fessi H. Controlled release carriers of growth factors FGF-2 and TGF $\beta$ 1: synthesis, characterization and kinetic modelling. *J Biomed Nanotechnol,* 2010; 6(2):106-16.
- 26) Camps J., Pommel L, Aubut V, **About I.** Influence of acid etching on hydrogen peroxide diffusion through human dentin. *Am J Dent,* 2010; 23(3):168-70.
- 27) Aubut V, Pommel L, Verhille B, Orsière T, Garcia S, **About I,** Camps J. Biological properties of a neutralized 2.5% sodium hypochlorite solution. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod,* 2010;109(2):120-5.
- 28) Koubi S, Raskin A, Dejous J, **About I,** Tassery H, Camps J, Proust JP. Effect of dual cure composite as dentin substitute on marginal integrity of class II open-sandwich restorations. *Oper Dent.* 2010; 35(2):165-71.

- 29) Tardivo D, Pommel L, La Scola B, **About I**, Camps J. Antibacterial efficiency of passive ultrasonic versus sonic irrigation. Ultrasonic root canal irrigation. **Odontostomatol Trop.** **2010**;33(129):29-35.
- 30) Hoang-Dao BT, Hoang-Tu H, Tran-Thi NN, Koubi G, Camps J, **About I**. Clinical efficiency of a natural resin fluoride varnish (Shellac F) in reducing dentin hypersensitivity. **J Oral Rehabil**, **2009**; 36(2): 124-31.
- 31) Camps J, Pommel L, Aubut V, Verhille B, Satoshi F, Lascola B, **About I**. Shelf life, dissolving action, and antibacterial activity of a neutralized 2.5% sodium hypochlorite solution. **Oral Surg Oral Med Oral Pathol Oral Radiol. Endod**, **2009**; 108(2): 66-73.
- 32) Maurin JC, Couble ML, Staquet MJ, Carrouel F, **About I**, Avila J, Magloire H, Bleicher F. Microtubule-associated protein 1b, a neuronal marker involved in odontoblast differentiation. **J Endod.** **2009**; 35(7): 992-6.
- 33) Koubi S, Raskin A, Dejou J, **About I**, Tassery H, Camps J, Proust JP. Effect of dual cure composite as dentin substitute on marginal integrity of class II open-sandwich restorations. **Oper Dent.** **2009**; 34(2): 150-6.
- 34) Téclès O, Laurent P, Aubut V, **About I**. Human tooth culture: a study model for reparative dentinogenesis and direct pulp capping materials biocompatibility. **J Biomed Mater Res B Appl Biomater.** **2008**; 85(1):180-7.
- 35) Mitsiadis TA, De Bari C, **About I**. Apoptosis in developmental and repair-related human tooth remodeling: a view from the inside. **Exp Cell Res.** **2008**; 314(4):869-77.
- 36) Laurent P, Camps J, De Méo M, Déjou J, **About I**. Induction of specific cell responses to a Ca(3)SiO(5)-based posterior restorative material. **Dent Mater.** **2008**; 24(11):1486-94.
- 37) Tran-Hung L, Laurent P, Camps J, **About I**. Quantification of angiogenic growth factors released by human dental cells after injury. **Arch Oral Biol.** **2008**; 53(1):9-13.
- 38) Hoang-Dao BT, Hoang-Tu H, Tran-Hung L, Camps J, Koubi G, **About I**. Evaluation of a natural resin-based new material (Shellac F) as a potential desensitizing agent. **Dent Mater.** **2008**;24(7):1001-7.
- 39) Camps J, de Franceschi H, Idir F, Roland C, **About I**. Time-course diffusion of hydrogen peroxide through human dentin: clinical significance for young tooth internal bleaching. **J Endod.** **2007**; 33(4):455-9.
- 40) Tran-Hung L, Mathieu S, **About I**. Role of Human Pulp Fibroblasts in Angiogenesis. **J Dent Res**, **2006**; 85: 819-823.
- 41) Susini G, **About I**, Tran-Hung L, Camps J. Cytotoxicity of Epiphany and Resilon with a root model. **Int Endod J.** **2006**, 39 : 940-4.

- 42) Wisithphrom K, Murray PE, **About I**, Windsor LJ. Interactions between cavity preparation and restoration events and their effects on pulp vitality. **Int J Periodontics Restorative Dent.** **2006**, 26:596-605.
- 43) Susini G, Pommel L, **About I**, Camps J. Lack of correlation between ex vivo apical dye penetration and presence of apical radiolucencies. **Oral Surg Oral Med Oral Pathol Oral Radiol Endod.** **2006**, 102: 19-23.
- 44) Mathieu S, El-Battari A, Dejou J, **About I**. Role of injured endothelial cells in the recruitment of human pulp cells. **Arch Oral Biol.** **2005**; 50(2):109-13.
- 45) Téclès O, Laurent P, Zygouritsas S, Burger AS, Camps J, Dejou J, **About I**. Activation of human dental pulp progenitor/stem cells in response to odontoblast injury. **Arch Oral Biol.** **2005**; 50(2):103-8.
- 46) **About I**, Camps J, Burger AS, Mitsiadis TA, Butler WT, Franquin JC. Polymerized bonding agents and the differentiation in vitro of human pulp cells into odontoblast-like cells. **Dent Mater.** **2005**; 21(2):156-63.
- 47) Camps J, Pommel L, Bukiet F, **About I**. Influence of the powder/liquid ratio on the properties of zinc oxide-eugenol-based root canal sealers. **Dent Mater.** **2004**; 20(10):915-23.
- 48) Camps J and **About I**. Cytotoxicity Testing of Endodontic Sealers: A New Method. **J Endod**, **2003**; 29: 583-586.
- 49) Murray PE, **About I**, Lumley PJ, Franquin JC, Windsor JL and Smith AJ. Odontoblast morphology and dental repair. **J Dent**, **2003**; 31: 75-82.
- 50) Camps J, **About I**, Gouirand S, Franquin J-C. Dentin permeability and eugenol diffusion after full crown preparation. **Am J Dent**, **2003**; 16: 112-116.
- 51) Pommel L, **About I**, Pashley D, Camps J, Apical leakage of four endodontic sealers. **J Endod**, **2003**; 29(3):208-10.
- 52) About I, Camps J, Mitsiadis TA, Butler W, and Franquin J-C. Influence of resinous monomers on the differentiation in vitro of human pulp cells into odontoblasts. *J Biomed Mater Res: Applied Biomaterials*, 2002; 63: 418-423.
- 53) **About I**, Proust J-P, Raffo S, Mitsiadis TA, and Franquin J-C. In vivo and in vitro expression of connexin 43 in human teeth. **Connect Tissue Res**, **2002**; 43: 232-237.
- 54) Camps J, **About I**, Thonneman B, Mitsiadis TA, Schmalz G and Franquin J-C. Two versus three dimensional in vitro differentiation of human pulp cells into odontoblast-like cells. **Connect Tissue Res**, **2002**; 43: 396-400.

- 55) Heymann R, **About I**, Lendahl U, Franquin J-C, Öbrink B, Mitsiadis TA. E- and N-cadherin distribution in developing and functional human teeth under normal and pathological conditions. **Am J Pathol**, **2002**, 160 : 2123-2133.
- 56) Murray PE, Smyth TW, **About I**, Rémusat R, Franquin JC, Smith AJ. The effect of etching on bacterial microleakage of an adhesive composite restoration. **J Dent**, **2002**; 30: 29-36.
- 57) Murray PE, **About I**, Lumley PJ, Franquin J-C, Rémusat M, Smith AJ. Human Cavity Remaining Dentin Thickness and Pulpal Activity. **Am J Dent**, **2002**; 15: 41-46.
- 58) Camps J, **About I**, Van Meerbeek B, Franquin J-C. Efficiency and cytotoxicity of resin-based desensitizing agents, in vitro. **Am J Dent**; **2002**. 15(5): 300-304.
- 59) **About I** and Mitsiadis TA. Molecular Aspects Of Tooth Pathogenesis And Repair: In Vivo And In Vitro Models. **Adv Dent Res**, **2001**; 15: 59-62.
- 60) **About I**, Murray PE, Franquin J-C, Rémusat M, Smith AJ. The effect of cavity restoration variables on odontoblast cell numbers and dental repair. **J Dent**, **2001**; 29(2): 109-117.
- 61) **About I**, Murray PE, Franquin J-C, Rémusat M, Smith AJ. Pulpal Inflammatory Responses following non-carious Class V Cavity Restorations. **Operative Dent**, **2001**; 26, 336-342.
- 62) Murray PE, **About I**, Lumley PJ, Franquin J-C, Rémusat M, Smith AJ. Restorative pulpal and repair responses. **J Am Dent Assoc**, **2001**; 132: 482-491.
- 63) **About I**, Bottero M-J, De Denato P, Camps J, Franquin J-C and Mitsiadis TA. Human dentin production in vitro. **Exp Cell Res**, **2000**; 258: 33-41.
- 64) **About I**, Maquin D, Lendahl U, Mitsiadis E. Expression of nestin in human teeth. **Am J pathol**, **2000**; 157 (1): 287-295.
- 65) Camps J, Dejou J, Remusat M, **About I**. Factors influencing pulpal response to cavity restorations. **Dent Mater**, **2000**;16(6):432-440.
- 66) Murray PE, **About I**, Lumley PJ, Franquin J-C, Rémusat M, and Smith AJ. Human odontoblast cell numbers and dental repair. **J Dent**, **2000**; 28: 277-285.
- 67) Murray PE, **About I**, Rémusat M, Lumley PJ, Smith G, Franquin J-C, And Smith AJ. Post-operative pulpal responses and dental repair. **J Am Dent Assoc**, **2000**; 131: 321-329.
- 68) Gaillard C, Camps M, Proust J-P, **Abou Hashieh I**, Rolland P, Bois A. Copolymerisation of 1, 2 bis(2-methylpropenyloxy)ethane and divinylbenzene in aqueous suspension. Part I : Control of the diameters of the beads of 1,2 bis(2-methylpropenyloxy)ethane-divinylbenzene copolymer. **Polymer**, **2000**; 41(2):595-606.
- 69) **Abou Hashieh I**, Pommel L, Camps J. Concentration of Eugenol Apically Released from Zinc Oxide-Eugenol Based Sealers. **J Endod**, **1999**, 25 (11):713-715.



- 70) **Abou Hashieh I**, Cosset A, Franquin J-C, Camps J. In vitro Cytotoxicity of One-Step Dentin Bonding Systems. **J Endod**, **1999**; 25:89-92.
- 71) Lu Jx, **About I**, Stephan G, Dejoui J, Van Landuyt P, Fiocchi M, Lemaitre J, Proust J-P. Histological and biomechanical studies of two bone colonizable cements in rabbits. **Bone**, **1999**; 25 (2), supplement: 41S-45S.
- 72) **Abou Hashieh I**, Franquin J-C, Cosset A, Dejoui J, Camps J. Relationship between dentine hydraulic conductance and the cytotoxicity of four dentine bonding resins in vitro. **J Dent**, **1998**; 26: 473-477.
- 73) **Abou Hashieh I**, Camps J, Dejoui J, Franquin J-C. Eugenol diffusion through dentin related to dentin hydraulic conductance. **Dent Mater**, **1998**; 14: 229-236.
- 74) Franquin J-C, Rémusat M, **Abou Hashieh I**, Dejoui J. Immunocytochemical detection of apoptosis in human odontoblasts. **Eur J Oral Sci**, **1998**; 106 (S) : 384-387.
- 75) Camps J, **Abou Hashieh I**, Mathieu S, Proust J-P. Etude comparative de la biocompatibilité in vitro de deux ciments de scellement canalair. **J Biol Buccale** **1991**;(19):229-234.

#### **Book chapters/invited reviews**

- 76) **About I**. Pulp vascularization and its regulation by the microenvironment **2014**: p 61-74. in: **The Dental Pulp: Biology, Pathology, and Regenerative Therapies**. Michel Goldberg (Editor). Springer.
- 77) Chmilewsky F, Jeanneau C, Dejoui J, **About I**. Sources of dentin-pulp regeneration signals and their modulation by the local microenvironment. **J Endod**. **2014** Apr;40(4 Suppl):S19-25 (review).
- 78) **About I**. Dentin–pulp regeneration: the primordial role of the microenvironment and its modification by traumatic injuries and bioactive materials. **Endod Top**. **2013**;28(1):61–89. (**Invited review**).
- 79) **About I**. Cytotoxicity: mechanisms and in vivo studies. in: Biocompatibility or cytotoxic effects of dental composites. **Coxmoor Publishing Company, Oxford, UK, 2009** pp 91-110.
- 80) Laurent P, Aubut V, **About I**. Development of a bioactive Ca<sub>3</sub>SiO<sub>5</sub> based posterior restorative material (Biodentine™). In: Biocompatibility or cytotoxic effects of dental composites. **Coxmoor Publishing Company, Oxford, UK, 2009** pp 195-200.

#### **Media coverage of research work (representative)**

- Interview on Marsactu regional website (and on dailymotion):  
<http://video-streaming.orange.fr/actu-politique/la-talk-science-sante-marsatu-imad-about-directeur-de-l-imeb-a-la-faculte-d-odontologie-d-aix-marseille-VID00000011VPE.html>
- Cadureso: the health professional network radio (in French)

<http://www.marsactu.fr/societe/comment-les-cellules-souches-peuvent-revolutionner-la-medecine-dentaire-31201.html>

- Web lecture on Biodentine Bioactivity (Youtube)  
<https://www.youtube.com/watch?v=l2xiGLCJrqY>
- Lettre de l'université : [http://dircom.univ-amu.fr/sites/dircom.univ-amu.fr/files/lettre\\_amu\\_n28.pdf](http://dircom.univ-amu.fr/sites/dircom.univ-amu.fr/files/lettre_amu_n28.pdf)
- French TV (France 3 channel) march, 2010: <http://mediterranee.france3.fr/info/provence-alpes/marseille-le-chercheur-qui-fait-pousser-les-dents-61759157.html?onglet=videos> (access no more available).
- Finnish science program, Prisma Studio | yle TV, Finland  
<http://areena.yle.fi/video/1299783604879> (access no more available).
- French Sud Radio: direct interview: <http://www.sudradio.fr/index.php?id=10&idcat=8> (access no more available)

### Summary of specific scientific contributions

Imad About is heading a research group which investigates the role of progenitor and non-progenitor cells in dentin regeneration, the early steps of pulp-dentin regeneration and the effects of biomaterials on these events. His recent work is focused on the role of Complement activation and the role of the produced Complement bioactive fragments in the recruitment of pulp stem cells which provide the missing link between inflammation and regeneration

The most significant contributions of **Prof Imad About** in pulp biology can be summarized under the following main points:

#### **I. Buffering capacity of dentin and its influence on pulp toxicity of restorative materials:**

i) After switching from Post-doctoral fellowship in hepatology, the first studies carried out in the dental field by **Prof Imad About** were done to investigate the toxicity of endodontic and restorative materials on cell cultures. From these studies, Imad About realized that these culture systems do not reflect the clinical situation where a residual dentin remains between the restorative material and the pulp and may reduce this toxicity. **Imad about** demonstrated that it is important not only to consider the remaining dentin thickness but also the dentin hydraulic conductance. Indeed, **Imad About** demonstrated that even when residual dentin has the same thickness, the hydraulic conductance varies from a tooth to another and this modifies the

diffusion of toxic components. Also, Imad About highlighted that the pulp pulsatile pressure need to be taken into consideration as it increases the diffusion of toxic components from the restorative materials to the pulp.

**Publications: #26, 27, 30, 31, 38, 39, 41, 48, 51, 58, 70, 75, 79.**

ii) **Prof. Imad About** developed several models simulating the presence of residual dentin, the hydraulic conductance, pulp pulsatile pressure and root sealers.

**Publications: # 26, 41, 48, 51**

iii) **Prof About** also developed a new method to measure Eugenol and its diffusion to the pulp through the dentin. This method which measures Eugenol concentration by spectrofluorimetry is based on the autofluorescence properties of Eugenol.

**Publications: # 50, 69, 72, 73**

With this method, **Prof About** established a link between Eugenol concentration diffusion and its toxicity to pulp cells.

## **II. Investigating the intimate relationships between dentin and odontoblasts and the effect of applying restorative materials:**

**Imad About** teamed up with Prof A.J Smith and P.E Murray to investigate the residual dentin/odontoblast relationships as odontoblasts provide an additional protection to the dental pulp by secreting the reactionary dentin.

**Publications: # 42, 49, 56, 57, 60, 61, 62, 65, 66, 67**

This work demonstrated that the odontoblast capacity to produce reactionary dentin depends on the cavity depth, the number of odontoblasts, the cavity conditioning treatment and the nature of the applied restorative material.

## **III. Odontoblast acts as a sensor cell of external stimuli:**

Since 2007, **Prof Imad About** established collaboration with Dr. FT Lundy and I El-Karim from Queen's university of Belfast in order to investigate the expression of transient receptor potential channels in pulp fibroblasts and in odontoblasts. Significant knowledge has been achieved with many published papers demonstrating that the odontoblast express hot, cold, chemical and mechanical sensors enabling them to sense external stimulations and transduce pain/inflammation.

**Publications: #1, 3, 4, 21, 23**

These works confirmed the third theory of dentin hypersensitivity stating that odontoblasts can act directly as sensor cells. These investigations were published in high impact papers such as Pain, J dent Res, Am J pathol, Thorax and were **highlighted in pain 2011**.

#### **IV. Differentiation of cells originating from the pulp into odontoblast like cells:**

Thinking that the majority of toxicity tests done in vitro studies are performed on cell lines, **Imad About** developed a cell culture technique based on the utilization of pulp cells, the target cells of restorative materials.

##### **Publications #63**

i) Imad About demonstrated that cells obtained from the pulp can differentiate into odontoblast-like cells and secrete a mineralized extracellular matrix having the molecular and mineral characteristics of dentin.

##### **Publications # 54, 63**

ii) This work which had a very high impact in the pulp biology field demonstrated that Connexin 43, notch 2, n-cadherin, amelogenin and microtubule-associated protein-1b are involved in the odontoblastic differentiation.

##### **Publications: # 13, 32, 53, 55, 59, 64**

iii) In 2000, **Imad About** has demonstrated that Nestin, an intermediate filament protein, can be used as a specific marker of the human secretory odontoblast. This has been published in a complete and highly cited paper demonstrating that this protein can be used as the only specific marker of the secretory human odontoblast.

##### **Publications # 64**

iv) Pulp cells allow investigating the effects of restorative materials on target cells specific functions.

One of the major interests of the utilization of target cells is that, beyond cell live/death measurement, they offer the possibility to investigate whether their specific functions are altered after a contact with a restorative material. **Imad About's** investigations clearly demonstrated that resin-based materials they inhibit the mineralization potential of these cells and their angiogenic capacity.

##### **Publications # 46, 52**

A collaboration of Prof About with Dr Diamanti and Dr Kittraki from the university of Athens demonstrated that this inhibition is due to the intracellular accumulation of DSP in the endoplasmic reticulum within the cells.

##### **Publications # 17, 37**

v) The fact that Resin-based restorative materials are toxic incited Imad About's group to develop a tricalcium silicate resin-free material to be used as a dentin substitute. With high mechanical, non-toxic and

bioactive properties, the material was patented and commercialized under the name **Biodentine in 2010 (patent 02. 10. 539)**.

**Publications # 1, 7, 9, 20, 28, 33, 36, 80.**

**V. Role of progenitor and non-progenitor cells in dentin regeneration, the early steps of pulp-dentin regeneration and the effects of biomaterials on these events.**

i) Development of entire tooth culture model:

In order to check whether pulp progenitor cells really originate from the dental pulp and can be activated by pulp injuries, **Prof About** developed a human entire tooth culture model. This allowed to directly check the activation of progenitor cells in the perivascular area and their migration to the injury site.

This model was also used to examine the effect of restorative materials observed in vivo. While dentin regeneration was observed with tricalcium silicate materials such as Biodentine or MTA, pulp vacuolization and disorganization was observed when adhesives were applied. This work had a significant impact and made **the cover of Int J End**. This model was also used in collaboration with Prof Camilleri from the university of Malta to investigate the hydration of the materials in a situation similar to that in vivo. The results showed that hydration and setting of Biodentine was complete while the resin-containing Theracal hydration was incomplete. Thus, the model developed by **Prof Imad About** reproduces the pulp response observed in vivo. It allows not only to investigate the early steps of dentin regeneration but also the pulp response and the modifications taking place within the material itself.

**Publications # 14, 18, 34, 45, 80.**

ii) Pulp fibroblasts **induce endothelial cells to form neo-angiogenesis:**

**Prof Imad About** was the first to develop a co-culture technique of endothelial cells with pulp fibroblasts in order to understand their interrelationships under normal conditions or injury. These investigations showed that pulp fibroblasts secrete angiogenic growth factors (VEGF, PDGF, TGF $\beta$ 1 and FGF-2) under normal conditions and the secretion level of these factors significantly increased after injury. When the medium of injured fibroblasts was placed on endothelial cells, the later elongated and reorganized into a close network of capillary structures in vitro corresponding to neo-angiogenesis.

**Publications # 37, 40, 76.**

iii) **Pulp fibroblasts and endothelial cells secrete signals required for pulp/dentin regeneration.**

Some of the above secreted growth factors have been shown to have additional functions in pulp dentin regeneration. While FGF-2 induces pulp progenitor proliferation, **Prof About's** research group clearly demonstrated that TGF $\beta$ 1 was involved in the recruitment of pulp progenitor cells in addition to its known effect on odontoblastic differentiation.

**Publications # 18, 22, 44, 77, 78.**

**VI. Encapsulation of growth factors to regenerate the pulp at the periphery and not at the pulp expense:**

**Imad About** noticed that many studies used free growth factors in pulp regeneration investigations and it is well established that growth factors are unstable and can be degraded within minutes in their free form. While, during carious decay in vivo, they are released slowly and at low concentrations. Prof Imad About teamed up with Prof Fessi and Dr Shibat-Othman from the University of Lyon 1 to encapsulate growth factors into PLGA polymers. A continuous liberation was obtained over a 3 weeks period and allowed to demonstrate the effect of FGF-2 in pulp cell proliferation and the role of controlled TGF- $\beta$ 1 release in the recruitment of progenitor cells. This provided an explanation as to why progenitor cells migrate to the injury site. Beyond the continuous release of growth factors, the idea of this work is to regenerate the dentin at the pulp periphery within the dentin layer and not at the pulp expense!

**Publications # 5, 16, 25**

**VII) Pulp fibroblasts synthesize complement proteins which provide the link between inflammation and regeneration :**

In addition to the well-established role in inflammation, recent and exciting investigations of **Prof About** on the Complement system involvement in regeneration revealed pulp fibroblasts as unique cells !

So far, Imad About's group demonstrated that these cells are the only non-immune cells capable of synthesizing all complement proteins and leading to its activation. The C5a biologically active fragment, produced after activation by lipoteichoic acid of G<sup>+</sup> bacteria or Lipopolysaccharides of G<sup>-</sup> Bacteria, leads to the recruitment of progenitor cells following a C5a concentration gradient.

**These exiting data made 2 covers in J dent Res (2013, 2015) and the cover of Am J Pathol, (2014).**

**Publications # 8, 10, 15, 77.**

Ongoing research of Prof About just submitted to J dent Res demonstrated that complement activation by pulp fibroblasts leads also to the formation of the lytic membrane attack complex. After fixation and polymerization on bacteria walls (S mutans and S sanguis), this complex destroys cariogenic bacteria. This reveals a unique and, hitherto, unknown property of pulp fibroblasts.

**Publications # 2**

Thus, works of **Imad About** on complement synthesis and activation demonstrated a significant role of pulp fibroblasts in the local regulation of both pulp inflammation and regeneration.

**VIII. Other areas of contribution relevant to pulp biology and regeneration**

i) Investigations of **Imad About** on cell differentiation and dentin regeneration demonstrated a reactivation of embryonic processes during the healing process in contact with biomaterials. Indeed several genes involved in the development and odontoblastic differentiation are re-expressed during dentin regeneration. For example Nestin, Connexin 43, Ia DSP, Collagen 1, Osteonectin and N-cadherins were re-expressed under carious lesions or after cavity preparation. **Prof About** demonstrated that expression of these genes can be modulated by the application of restorative materials.

**Publications # 12, 13, 18, 32, 53, 55, 59, 78.**

ii) While investigating the pulp volume on ageing, **Prof Imad About** demonstrated that pulp volume decreases on ageing due to the reduction of pulp fibroblast and odontoblast numbers by apoptosis.

**Publications # 35, 75.**

Overall, the works of **Prof Imad About over the past 16** years have had tremendous impact on the field of pulp biology. **Imad About** developed several original study models, investigated different aspects related to pulp biology, physiology and function under physiological and pathological conditions. All this brought a significant knowledge which brought a significant step forward in patients' therapy (Biodentine development) and hopefully will set the basis of pulp tissue engineering and regeneration.

**National and international collaborations :**

Prof. Seung-Hyuk Chung, University d'Illinois, Chicago, USA.

Pr Petros Papagerakis, University of Michigan, USA.

Pr. A. J. Smith, School of Dentistry, University of Birmingham, UK.

Pr. Michael Kirschfink, Institute of Immunology, University of Heidelberg, Germany.

Dr F. T. Lundy et Dr I. El Karim, School of Medicine and Dentistry, Queen's University of Belfast, Belfast, UK.

Pr. Thimios Mitsiadis, Institute for Oral Biology, University of Zurich, Switzerland.

Pr. W.T. Butler, Department of Basic Sciences, University of Texas, Houston, USA.

Pr D.H. Pashley, School of Dentistry, Medical College of Georgia, Augusta, USA.

Dr P. E. Murray, Nova Southeastern University, Fort Lauderdale, Floride, USA.

Pr G. Schmaltz et Dr B. Thonneman, Dept. Operative Dentistry, Regensburg, Germany.

Pr H Fessi et Dr N Sheibat-Othman. Laboratoire d'Automatique et de Génie des Procédés LAGEP, University of LYON 1.

Dr Efthymia Kitraki, Department of Basic Sciences and Oral Biology, School of Dentistry Athens, Greece

Pr H Magloire, Institut de Génomique fonctionnelle, UMR CNRS 5242, INSERM ERI 16, Lyon

Pr. Mohammed S. Ali-Shtayeh, Biodiversity and environmental research center, Til, Palestine.

**Invited speaker in international conferences**

- 1) Pulp Biology and Regeneration Group Symposium 2016. Potential therapeutic strategy of targeting pulp fibroblasts in dentin-pulp regeneration, **Nagoya, Japan**, June 26-28, 2016.
- 2) International Association of Dental Research, Pulp fibroblast is on the cross roads of inflammation and regeneration, Seoul, **South Korea**, June 22-25, 2016.
- 3) 13th International Congress of the Turkish Endodontic Society. What is new in dentin-pulp regeneration? **Urgup, Cappadocia, Turkey**, May 27-29, 2016.
- 4) Guided Bone Regeneration Symposium. Angiogenic and osteogenic potential of xenogenic bone filling materials. **Alba, Italy**, May 14, 2016.
- 5) Association dentaire Française 2015. Bioactivité des biomatériaux à base de silicate tricalciques: Biodentine. **Paris**, Nov 26, 2015.
- 6) 4th Pan Arab Endodontic Conference. Tricalcium silicates as dentin substitute for dentin pulp regeneration. **Hammamet, Tunisia**. Oct 29 -30, 2015.
- 7) Asian Pacific Endodontic Confederation. Dentin and pulp regeneration updated. **Amman, Jordan**, April 8-10, 2015.
- 8) Origin of dentin-pulp regeneration signals. 1<sup>st</sup> Annual Dental Health conference. **Marseille** Feb 27, 2015.
- 9) International Dental Conference & Arab Dental Exhibition (AEEDC). Direct pulp capping with Tri-calcium silicates and pulp regeneration. **Dubai, United Arab Emirates**. Feb, 17-19 2015.
- 10) International Association of Dental Research. Tri-calcium silicates in direct pulp capping and consequences of their modification by adding resins. **Cape Town, South Africa**. June 25-28, 2014,



- 11) The dental Association of the Arctic Circle (DAAC). Direct pulp capping with Tri-calcium silicates and pulp regeneration. **Oulu, Finland** June 6, 2014.
- 12) American Association of Endodontics. Dentin pulp regeneration signals and their modulation by the local microenvironment and restorative materials. April 30-May 4, 2014, **Washington, USA**.
- 13) Turkish Endodontic Society meeting. Direct pulp capping with Tri-calcium silicates and pulp regeneration. May 15-17 2014, **Istanbul, Turkey**.
- 14) The 8th International Palestinian Dental Congress. Future stem cell therapies in dentistry: from pulp regeneration to tooth replacement by tissue engineering. **Ramallah, Palestine**, April 9-11, 2014.
- 15) American Association of Dental Research. Direct Pulp Capping with Calcium Silicate and its Consequences. **Charlotte, USA** March 20, 2014.
- 16) Association des chirurgiens-dentistes de la région d'Aubagne. Que peut-on espérer de la thérapie cellulaire en odontologie? **Gémenos, France**, Jan 15, 2014.
- 17) 1st International Congress of Endodontics. Biodentine: A tri-calcium silicate bioactive dentin substitute. **Athens, Greece** 29 nov-1 dec, 2013,.
- 18) 3<sup>rd</sup> Pan Arab Endodontic Conference. Future Stem Cell Therapies: From Pulp Regeneration to Tooth Replacement. **Beirut, Lebanon**, Nov 28-30, 2013.
- 19) The 16th International Dental Congress. Direct pulp capping with Tri-calcium silicates and pulp regeneration. **Cairo, Egypt** Nov 5-8, 2013.
- 20) La journée scientifique de la Société Française d'endodontie (SFE). Que peut on espérer de la thérapie cellulaire? **Paris** oct 10, 2013.
- 21) International Association of Dental Research, Continental European Division. Direct pulp capping with calcium silicate and its consequences. **Florence, Italy** Sept 4-7, 2013.
- 22) 16<sup>th</sup> Biennial congress de la European Society of Endodontology. **Lisbon, Portugal**. Sep 12-14 2013,
- 23) Journées Dentaires Internationales du Québec (JDIQ).Matériaux bioactifs et régénération pulpo-dentinaire. **Montréal, Canada**. May 27, 2013.

- 24) Jordanian Society of Endodontics. The future of stem cell therapy: pulp regeneration or tooth replacement. **Amman, Jordan**, April 4, 2013
- 25) Jordanian Society of Endodontics. The added value of bioactive dentine substitutes. **Amman, Jordan**, April 5, 2013
- 26) Palestinian Dental Association. Continuing dental education Program. The added value of bioactive dentine substitutes. **Ramallah, Palestine** April 9, 2013.
- 27) Pulp Biology Research Group Symposium (PBRG).Sources of Dentin Pulp Regeneration Signals and their Modulation by the Local Microenvironment. **San Francisco, USA**. March 24-26 2013.
- 28) 18th Symposium of the Hellenic Society of Endodontics.Biodentine bioactivity: pulp cells specific responses and dentin regeneration. Dec 1-2, 2012, **Thessaloniki, Greece**
- 29) Société Française d'endodontie Que peut-on espérer de la thérapie cellulaire?. **Paris** Nov 16, 2012.
- 30) Spanish Endodontics Congress. Stem cell use in dental tissues regeneration: advancements in recent research and future challenges. **Cadiz, Spain**, Nov 1-4, 2012.
- 31) Pulp-Biodentine interactions consequences and clinical significance. International Association for Dental Research (PER-IADR). **Helsinki, Finland**, Sep16, 2012.
- 32) 7th Palestinian and 40th Arab dental conference. Stem cells in Dentin/pulp regeneration: advancements in recent research and future challenges. **Bethlehem, Palestine**, April 4-6, 2012.
- 33) 15th Biennial Congress de la European Society of Endodontology. Stem cells : definition, sources, classification/hierarchy. **Rome, Italy** Sep 14-17, 2011.
- 34) Continental European Division at the International Association of Dental Research. Pulp cells response and dentin regeneration at reactionary and reparative dentin induced by tri-calcium silicate technology symposium. **Budapest, Hungaria**, August 31 – sept 3, 2011.
- 35) Biodentine™: un substitut dentinaire bioactif. Célébration du partenariat qui a donné naissance à la valorisation du Biodentine. **Marseille**, July 4, 2011.
- 36) Société d'Odontologie Pédiatrique du Sud-Est. Les cellules souches en Odontologie et dans la thérapie cellulaire de demain. **Marseille**, June 16, 2011.

- 37) 2<sup>ème</sup> Rencontres Régionales: Recherche-Industrie–Clinique Matériaux et Implants, Tissus et Substituts Osseux: Techniques et Evolutions. Cellules progénitrices et régénération dentinaire: interaction avec les biomatériaux. **Marseille** Mai 25-26, 2011.
- 38) International Association of Dental Research. Progenitor and non-progenitor cells interactions and their roles in dentin and pulp regeneration. **Khartoum**, Sudan, feb 27, 2011.
- 39) International Association of Dental Research Pulp Biology and Regeneration Group Symposium. Tissue Injury and Pulp Regeneration. In Vitro Dentin Generation: The Pivotal Role of Supportive Cells. **Geneva, Switzerland** July, 18-20, 2010.
- 40) Journées de recherche Rhodaniennes. Cellules progénitrices pulpaire et régénération dentinaire. **Lyon, France** June 7, 2010.
- 41) 10<sup>ème</sup> Congrès International de Chirurgie Dentaire. Cellules progénitrices pulpaire : rôles dans la médecine de régénération tissulaire. **Marseille, France** March 10, 2010.
- 42) Cellules souches et régénération dentaire et pulpaire. Société Francophone de Biomateriaux dentaires (SFBD). **Avignon, France**, Jan 22, 2010.
- 43) 81<sup>ème</sup> réunion scientifique de la Société Française d'Orthopédie dento Faciale (SFODF). Risques biologiques liés aux matériaux de collage en orthodontie. **Lille, France**. May 28-30, 2009.
- 44) Journée Institut Français de Recherche Odontologique : Cellules Souches Pulpaire. Cellules périvasculaires et étapes précoces de la régénération dentinaire. **Paris** Sep 15, 2008.
- 45) Congrès de l'Association Dentaire Française. INTERFACES INSERM-ODONTOLOGIE. Toxicité in vitro des monomères libres des résines composites, des adhésifs et des ciments verre ionomère modifié par addition de résine. **Paris**, nov 20-23, 2007.
- 46) 8<sup>ème</sup> Congrès International de Chirurgie Dentaire. Développement et mise au point d'un nouveau matériau de restauration directe des dents postérieures. **Marseille-Provence**, March 16-18, 2006.
- 47) Pulp cells and dentin regeneration. Dentin-pulp complex meeting, **Dusseldorf, Germany** Sep 18-20, 2005

- 48) Développement d'un nouveau biomatériau : cicatrisation et régénération pulpaire au contact des biomatériaux dentaires. Journées Françaises de Recherche Odontologiques. **Toulouse, France** Oct 20-21, **2005**
- 49) Human pulp stem cells and reparative dentin production. Cellular and Molecular Basis of Regeneration. **Castelvechio Pascoli, Italy**, August 29 - Sept 5, 2002.
- 50) Human Dentin Production *In Vitro*. COST ACTION B8 (Odontogenesis), **Berlin, Germany**, Nov 19-20, 1999.
- 51) Evaluation de la cytocompatibilité des biomatériaux dentaire. Matériaux avancés et génie biomédical, **Marseille** Dec. 9, 1999.

**Invited speaker to foreign universities:**

- 1) Leuven catholic university. Origin of dental pulp regeneration signals and their modifications under restorative materials. **Leuven, Belgium**, March 25, 2015.
- 2) Ain Shams University. Update of dentin and pulp regeneration: origin of regeneration signals and effects of pulp capping materials. 1<sup>st</sup> international congress. **Cairo, Egypt**, October, 22 2014.
- 3) Lebanese University. Pulp Stem cells and dentin regeneration: origin of the activation signals. 2<sup>nd</sup> STEMS Congress. **Beirut, Libanon** May, 28-29, 2014.
- 4) Al-Quds University. The future of stem cell therapy: pulp regeneration or tooth replacement. **Abu Dis, Palestine** April 9, 2013.
- 5) McGill University, Continuing dental education. Strategies to Preserve Pulp Vitality in Children and Adults: update on dentin and pulp regeneration. **Montreal, Canada**. March 22, 2014.
- 6) King's College London. Human entire tooth culture use to show how a restorative material can kill the pulp or induce its regeneration. **London, UK**. June 21, 2013.
- 7) Universitat Internacional de Catalunya. Tricalcium silicate-based dentin substitutes Facultat Odontologia. **Barcelona, Spain**, Sept 20, 2012.
- 8) Universitat Internacional de Catalunya. The pivotal role of progenitor/stem cells in dentin/pulp tissue regeneration: advancement in recent research, Facultat Odontologia,. **Barcelona, Spain**, Dec 15, 2011.

- 9) University of Khartoum. Dental Pulp Stem Cells & their Potential Use in Future Cell Therapy & Tissue Engineering. Medical and Health Research Annual Meeting, **Khartoum, Sudan**, Feb 25-26, 2011.
- 10) University of Aleppo. The 7th International Dental Meeting of Faculty of Dentistry. Pulp progenitor cells: their roles in future cell therapy and tissue regeneration. **Aleppo, Syria** April 5-7, 2011.
- 11) Queen's University Belfast, School of Medicine, Dentistry and Biomedical Sciences, United Kingdom. A new insight to the early steps of dentin regeneration. **Belfast, UK** Mai 14, 2008.
- 12) University of Athens, Greece. School of dentistry. The primordial role of pulp cells in the early steps of dentin regeneration. **Athens, Greece**. Jan 31, 2008.
- 13) The Hebrew University-Hadassah, School of Dental Medicine, Jerusalem. Israel. A new insight to the early events of dentin regeneration. **Jerusalem** oct 26, 2008.
- 14) Differentiation of human odontoblasts in vitro. Cost Short term missions, **Birmingham, UK** Nov 25, 1998.

**Overall:**

Imad About published 140 scientific articles, book chapters, invited reviews and abstracts.

He contributed in 130 national and international congresses

He received 65 invitations as speaker in international meetings and universities