**Approved by the Regents May 21, 2015**

PROMOTION RECOMMENDATION
The University of Michigan
School of Dentistry

Nan E. Hatch, DMD, PhD, assistant professor of dentistry, School of Dentistry, is recommended for promotion to associate professor of dentistry, with tenure, School of Dentistry.

Academic Degrees:

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| PhD | 2005 | University of Washington |
| Certificate in Orthodontics | 2002 | University of Washington |
| DMD | 1999 | Harvard School of Dental Medicine |

Professional Record:

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| 2008 – present | Assistant Professor, Orthodontics and Pediatric Dentistry, School of Dentistry, University of Michigan |
| 2005 – 2008 | Adjunct Faculty and Research Fellow, Orthodontics and Pediatric Dentistry, School of Dentistry, University of Michigan |
| 2004 – 2005 | Teaching Assistant, Biochemistry Department, University of Washington |
| 2003 – 2005 | Acting Instructor, Department of Orthodontics, University of Washington |

Teaching: Professor Hatch is a respected, highly engaged teacher and mentor. She has taught didactic and clinical courses at the pre-doctoral, graduate orthodontic and MS levels and has served as course director for two major courses for the graduate orthodontic program. She supervises patient care and clinical instruction for dental and orthodontic graduate students one day per week and has developed an engaging teaching style that is well received by students, as indicated in her uniformly excellent teaching evaluations. Professor Hatch is a dedicated teacher, showing respect, passion and patience in articulating her ideas and concepts to all levels of students. It is evident that Professor Hatch is committed to training the next generation of orthodontic clinicians and scientists.

Professor Hatch has mentored many graduate students, serving as chair of seven masters' thesis projects. She has been an active member on sixteen MS thesis committees as well as a member of one PhD thesis committee. She has mentored one post-doctoral fellow who has produced a high number of publications, which is indicative of her effective mentoring. Many masters' students that she has mentored have received several national or international research awards that include two Milo Hellman Awards, the top award given by the American Association of Orthodontists; two Thomas M. Graber Awards from the American Association of Orthodontics; and a Student Research Fellowship Award from the American Association of Dental Research. These achievements reflect highly on Professor Hatch's commitment to ensuring that her students excel in scholarship and perform novel and high caliber research.

Professor Hatch's teaching initiatives include the development of a valuable manual to guide orthodontic residents through the demanding process of developing and completing a successful MS thesis project. She received the T.M. Graber Fellowship Teaching Award, a major teaching award from the American Association of Orthodontics Foundation recognizing the quality and impact of her teaching contributions to the orthodontic profession. It is clear that Professor Hatch is a thoughtful mentor and an outstanding instructor with a strong commitment to the teaching mission of the school.

Research: Professor Hatch's main area of research is craniofacial development and bone biology. More specifically, her research focuses on understanding the biologic mechanisms for craniosynostosis and translational research on treatment strategies for this disease. Craniosynostosis is a poorly understood, debilitating genetic condition with major implications to the lives of many children and adults around the

world. The longevity of her grant support, her publication record, the quantity of submitted and invited presentations at both research and clinically focused meetings and the numerous honors and awards she has received are recognition of her national and international stature and evidence of a strong prospect for future research success.

Professor Hatch has been the PI of several extramural grants (NIH, foundation grants and corporate contracts). In 2001, Professor Hatch's research grant application was selected from an internal competition of the entire University of Michigan campus representing the university nationally for a major Hartwell Foundation grant. Professor Hatch earned this prestigious grant following a challenging national competition thus, enhancing the already strong research reputation of the university and the School of Dentistry. To date, she is the only faculty from the school to be selected through this internal competition of top-notch applicants from all health and biomedical fields to represent the university to the Hartwell Foundation. The Hartwell Foundation has found the potential clinical applications of her findings on the non-invasive management of craniosynostosis so exciting that they have invited her to submit a collaborative continuing grant to their foundation.

Professor Hatch's discoveries from investigations determine that the contribution of tissue non-specific alkaline phosphatase (TNAP) mutations to craniosynostosis. This research has led to additional studies using a reagent from Alexion Corporation to develop a potentially new, non-invasive treatment for craniosynostosis involving delivery of recombinant TNAP to patients. These investigations have resulted in the issuance of a patent to Professor Hatch. These achievements in scholarship demonstrate a logical and exceptional progress, solid trajectory, and likely future success of Professor Hatch as a biomedical researcher investigating biological precision therapies for a significant medical condition.

In addition to being the PI on the major Hartwell Foundation grant, Professor Hatch has been the PI of a R03 grant from the NIH/NIDCR and currently is the PI on grants from the American Association of Orthodontics Foundation and from Alexion Pharmaceuticals, International. She also has a major research supplement from an R01 and participates in a MCubed project together with colleagues from the University of Michigan College of Engineering. The latter studies are to develop 3D printed patent cranial sutures and calvarial bone as a potential replacement for synostotic sutures. Additionally, Professor Hatch recently submitted an R01 proposal to the NIH to further support her work on molecular and cellular mechanisms of premature cranial suture fusion. Professor Hatch's colleagues both within and outside the School of Dentistry find her to be an incredibly supportive and well informed collaborator.

From the time of her appointment as an assistant professor, Professor Hatch has authored 14 peer-reviewed publications and two book chapters. She is first author on four published papers in high impact journals, e.g., *Journal of Bone and Mineral Research*, *Cells Tissues Organs*, and senior author on five of them, e.g., *J Cell Biochem*, *J Biol Chem*, *Calc Tissue Int*, and *Am J Orthod Dentofacial Orthop*. Given her considerable teaching and clinical responsibilities, Professor Hatch has had a solid publication history. She vests her energies in publishing quality comprehensive and substantial manuscripts in medium to high impact journals. She has been an invited speaker at 27 national/international scientific and professional conferences and has been recognized with major research awards. These include the John Haddad Young Investigator Award, the Harold M. Frost Young Investigator Award from the American Society for Bone and Mineral Research and the Dewel Memorial Research Award from the American Association of Orthodontics Foundation. Most significantly, Professor Hatch was awarded the most prestigious dental research award, the Hatton Award, both from the American Association of Dental Research (AADR) and the International Association for Dental Research (IADR). These awards, together with those won by students she has mentored, are unique distinctions that demonstrate unequivocally that Professor Hatch is an outstanding dentist-scientist.

Professor Hatch clearly is a talented faculty member with a strong commitment to academics and scholarship. She has successfully competed for major NIH and other grants during a very challenging time for research funding. She is recognized internationally as a leader in the fields of biologic mechanisms for normal and abnormal craniofacial growth and biomedical approaches to orthodontic therapies. Her systematic and insightful work is making a positive impact toward the understanding of critical issues related to the pathobiology of craniosynostosis and orthodontic tooth movement. Professor Hatch's contributions to research and scholarship are substantial and deliver significant advances in orthodontics and the understanding of specific craniofacial anomalies.

Recent and Significant Publications:

Hatch NE, Yan L and Franceschi RT (2009). FGF2 simulated expression of the pyrophosphate generating enzyme, PC-1, is mediated by Runx2. *J Bone Min Res*, 24(4):652-62. PMCID: PMC2659512.

Nam HK, Li J, Li Y, Kragor A and Hatch NE (2011). Ectonucleotide pyrophosphatase phosphodiesterase-1 (Enpp1) regulates osteoblast differentiation via a catalysis independent mechanism. *J Biol Chem*, 286(45):39059-71. PMCID: PMC3234731.

Hudson, JB, Hatch* NE, Hayami T, Shin JM, Stolina M, Kostenuik PJ and Kapila* S (2012). Local delivery of recombinant osteoprotegerin enhances post-orthodontic tooth stability. *Calcif Tissue Int* 90(4):330-42. PMID: 22382900. *co-senior authors.

Liu J, Nam HK, Wang E and Hatch NE (2013). Further analysis of the crouzon mouse, effects of the $FGFR2^{C342Y}$ mutation are cranial bone dependent. *Calc Tissue Int* 92(5):451-466. PMCID: 3631296.

Liu J, Nam HK, Campbell C, Gasque KC, Millán JL, Hatch NE (2014). Tissue-nonspecific alkaline phosphatase deficiency causes abnormal craniofacial bone development in the Alpl(-/-) mouse model of infantile hypophosphatasia. *Bone*, 67C:81-94. PMID: 25014884.

Service: Professor Hatch has served on seven committees at the School of Dentistry including the Nominations and Elections Committee, Advanced Dental Education Review Committee, Dental Informatics Research Focus Group, "Grand Rounds" Vision Committee and "Pathways" Vision Committee. She has also served on many committees at the department level, including the Moyers Symposium Committee, Craniofacial Fellowship Program Accreditation Committee and several orthodontic faculty search committees. Professor Hatch has served nationally on the Editorial Board from the *American Journal of Orthodontics* and *Dentofacial Orthopedics*, and for the *Frontiers of Craniofacial Biology*. Additionally, she has served as ad hoc reviewer for several scientific journals.

Professor Hatch has been heavily involved in professional organizations. She has served as the organizer and chair of several symposia both in the International Association of Dental Research (IADR) and the American Association of Dental Research (AADR) meetings, as well as in the American Association of Orthodontists. She is a board member of the Great Lakes Association of Orthodontists, a member of the College of Diplomates of the American Board of Orthodontists, and organizer of the Orthodontic Networking Educators Group. Currently, she is the president-elect of the Craniofacial Biology Group, a component of the International Association of Dental Research (IADR). In addition, she has been an invited speaker for seven continuing education courses. Professor Hatch is a recognized and well respected orthodontic, craniofacial scientist who is acknowledged by her peers at all levels.

External Reviewers:

Reviewer (A): "The most significant element gleaned from Dr. Hatch's statement about teaching is her understanding that she is in a unique position to translate scientific information about mechanisms of bone biology and craniofacial development to dental students and postgraduate residents. She is in an excellent position to skip back and forth between clinical phenotypes and the molecular pathogenesis of the disease."

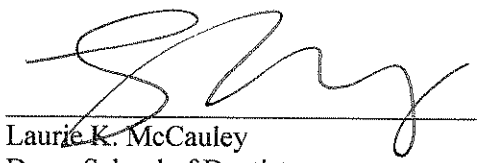
Reviewer (B): "Dr. Hatch is well established and demonstrates scholarly abilities that impact her field of orthodontics/molecular & cell biology. She clearly functions well as an independent investigator with very high potential."

Reviewer (C): "Her students have received a number of national awards (e.g., Milo Hellman award by the AAO) which is considered an outstanding achievement. She has mentored a large body of students over the last eight years and continues to mentor postdoctoral fellows in her laboratory. I have attended a number of her lectures at the Moyers Symposium and she has great insight and is eloquent in her delivery. I can only assume that she prepares excellent lectures for the students that she teaches.

Reviewer (D): "Individuals with Dr. Hatch's educational background; clinical, research and service experience and accomplishments are exceedingly rare. I personally cannot think of any orthodontic faculty in North America at a comparable stage of career who has the profile of Dr. Hatch. In particular, she has the clinical qualifications, a well-rounded teaching portfolio, as well as the notable developing research and scholarly accomplishments that make her highly portable and potentially a highly sought-after dental academic."

Reviewer (E): "Her research career trajectory is clearly rising in my opinion, which I view as critical in making a positive recommendation in a promotion and tenure decision."

Summary of Recommendation: Professor Hatch has made significant strides in her academic and professional career during her time in rank as an assistant professor. She has the credentials and skills to continue as a very active and engaged faculty member of the University of Michigan for many years to come. She has demonstrated clear evidence of research productivity and recognition of her work by peers in the field. Professor Hatch has been the PI on several extramural grants during her time in rank that have resulted in numerous research awards, a patent, and very significant publications. Indeed, she is unique, as she is one of the very few orthodontists in the country who has been able to successfully compete for NIH funding. Her record of funding and publications demonstrate the capacity, collaborations, variety of funding sources and exceptional quality needed to continue to develop and sustain a research program in molecular and developmental biology. In addition, she is a superb mentor, as her students' awards demonstrate. She is engaged and respected in her specialty and at the national and international levels, which is remarkable at this early stage in her career. It is with the support of the School of Dentistry's Executive Committee that I recommend Nan E. Hatch, DMD, PhD for promotion to associate professor of dentistry, with tenure, School of Dentistry.



Laurie K. McCauley
Dean, School of Dentistry

May 2015