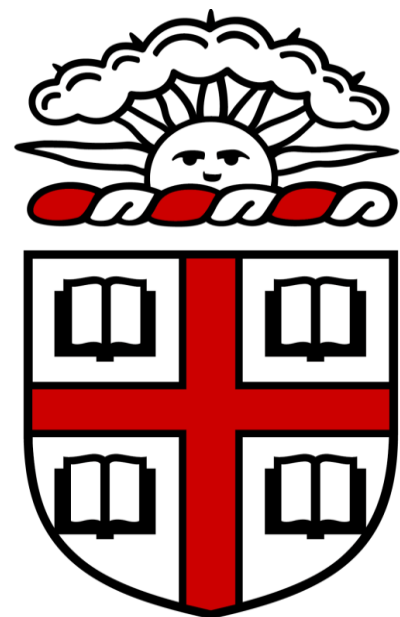




Understanding osteophyte patterns across literature as a motivation to provide insight into thumb osteoarthritis etiology



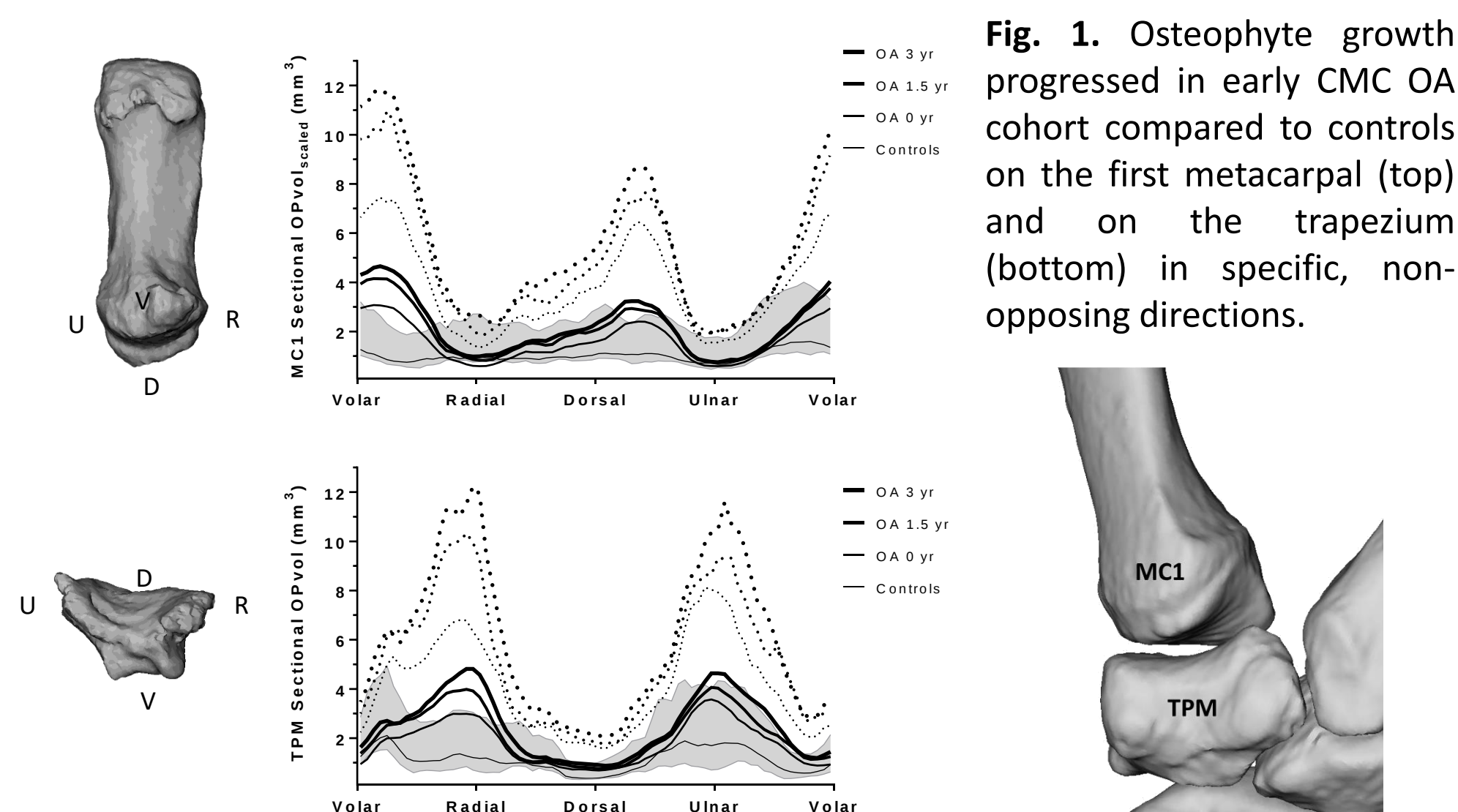
Lindsey G. Kahan, BS¹; Joseph J. Crisco, PhD¹; Arnold-Peter C. Weiss, MD²

¹Bioengineering Laboratory, Department of Orthopaedics, The Warren Alpert Medical School of Brown University, Providence, RI

²Department of Orthopaedics, The Warren Alpert Medical School of Brown University/University Orthopedics, Providence, RI

INTRODUCTION & MOTIVATION

- Clinical/radiographic evidence of carpometacarpal osteoarthritis (CMC OA) significant burden, with estimates of XR evidence to be 35.8% in people over 55 y.o. (Haugen 2011)
- Morphological changes: JSN, subluxation, osteophyte formation
- Longitudinal quantification and location-dependence of osteophyte growth with disease progression not reported



AIM

We aim to evaluate osteophyte patterns across the literature to build a comprehensive understanding of osteophytes' role in OA. We aim to drive the clinical discussion of CMC OA cohort osteophyte patterns to further develop etiological OA hypotheses and build a framework for future studies.

METHODS

Literature Review

What are the clinical implications of osteophytes?

What are the patterns of osteophytes across joints?

What are the mechanisms of osteophyte formation?

What do we know about genetic regulation and vascularity of osteophytes?

RESULTS

What are the clinical implications of osteophytes?

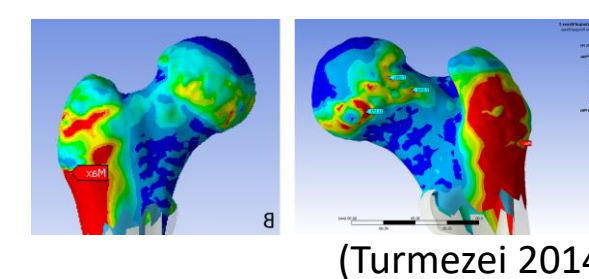
- Stabilize OA joint if on margin: added tension on lax ligaments (Brandt 1999)
- Cheilectomy led to increased varus-valgus instability (Pottenger 1990)
- Osteophyte size associated with ligament damage, potentially reparative (van Osch 1996)
- Could broaden joint surface for stability and fracture protection (van Osch 1996, Nagaosa 2002)
- Osteophytes better predict knee pain than JSN (most indicative XR measurement; Cicuttini 1996)
- Hip OA: XR OA + but pain-free: no broad signal change in bony alterations; continuous pain: broad signal changes (Kamimura 2013)
- Pain occurred with bony changes and improved when bony changes disappeared (Mikio 2014), high association of pain and OA progression by bony changes (Kato 2014, Komatsu 2015, Kroon 2018)

Takeaway: CMC OA osteophytes could cause pain more than degenerative processes do, and/or they could act to stabilize a lax joint

What are the patterns of osteophytes across joints?

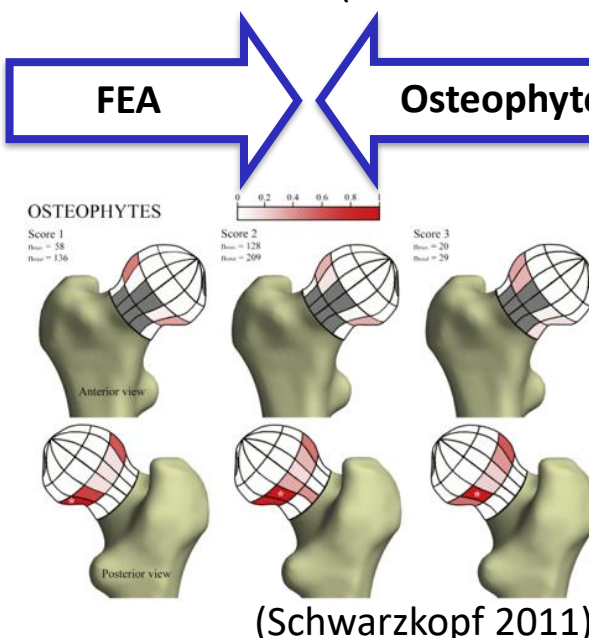
Hip

- Osteophytes in low stress articular areas (Resnick 1983) and non-weight-bearing regions (Gelse 2003, Komatsu 2015)



Hand

- Dorsal and volar MC margins (North and Rutledge 1983), associated with positional force exertion (Buckland-Wright 1991)
- Potential deviation from Wolff's law of bone adaptation to applied load (Komatsu 2015)

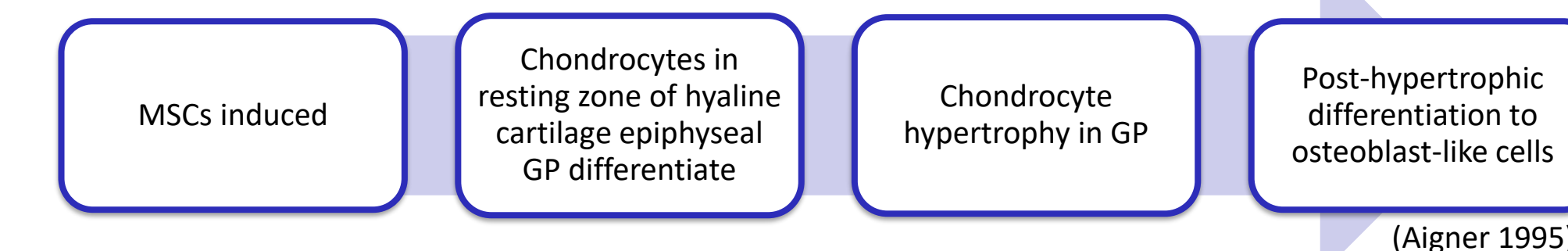


Takeaway: Association between joint stresses and osteophyte development need to be further evaluated

What are the mechanisms of osteophyte formation?

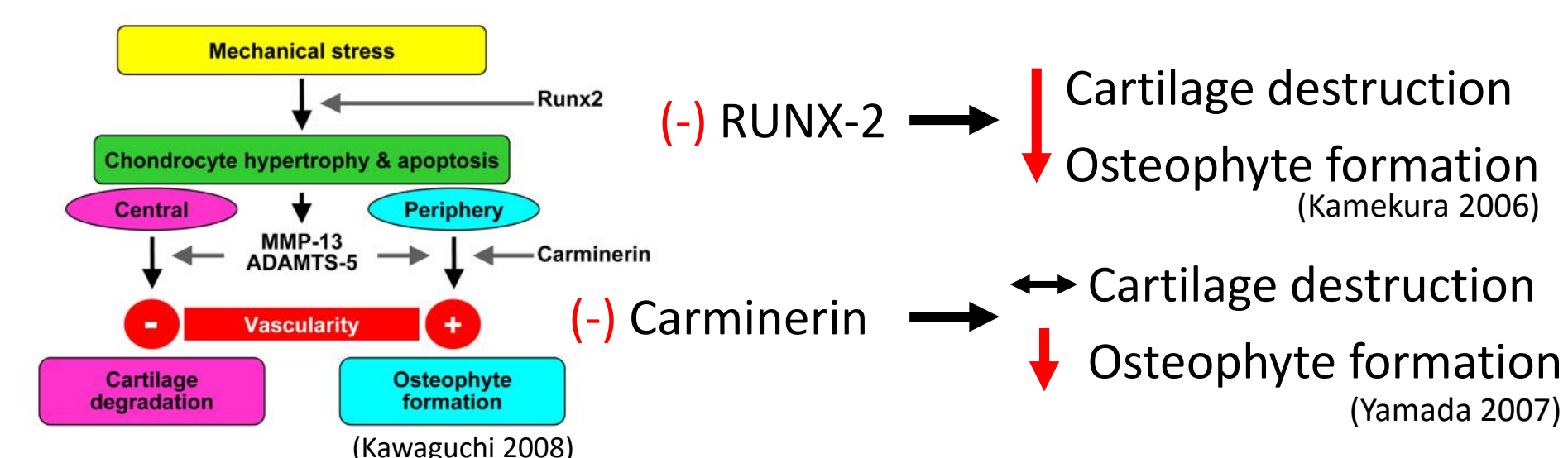
- Endochondral or intramembranous ossification (Resnick 1983)

- Postulated to be mechanical stimulus, chronic pathophysiology of ongoing repair in cartilage or ligaments (van denBerg 1999)
- Precursors: MSC chondrogenesis in periosteum or synovial lining van derKraan and van denBerg 2007)
- Cartilaginous to bony transition (Aigner 1995, Peng 2000, Hashimoto 2002)



Takeaway: What specific steps can be potentially disease-modifying?

Genetic regulation and vascularity



- VEGF regulates hypertrophic cartilage remodeling, ossification, and vascular invasion to GP cartilage (Gerber 1999)
- Vascularization peripheral to synovial membrane associated with osteophyte development (Gilbertson 1975)
- Non-union scaphoid fractures lead to osteophytes in location-dependent manner (Oura 2017), potentially vascularity-dependent

Takeaway: Cartilage-specific proteins in endochondral ossification could play significant role and act as drug target in CMC OA

Takeaway: CMC vascularity should be studied in relation to osteophytes

FUTURE DIRECTIONS

- Study the association between pain scores and osteophyte growth in CMC OA population
- Further develop etiological hypotheses for osteophyte formation in CMC OA through study of vascularity, ligamentous biomechanics, and genetic regulation