

Editor's Spotlight/Take 5

Editor's Spotlight/Take 5: The 2014 ABJS Nicolas Andry Award: The Puzzle of the Thumb: Mobility, Stability, and Demands in Opposition

Seth S. Leopold MD

Although we do not always think about it this way, every research paper we publish tells a story. By design, most papers in *Clinical Orthopaedics and Related Research*® cover the necessary ground

in a question-and-answer format. This approach, which readers tell us makes the main message easier to retain, is also a hallmark of the scientific method.

But the paper by Amy L. Ladd MD and colleagues is a story in the more conventional sense – a tale of inquiry and discovery that stretched more than a decade, resulting in a big-picture narrative about the complexities of the thumb's carpometacarpal (CMC) joint. Last year, in this space, we interviewed an author whose paper suggested that if we live long enough, the demands placed on this joint – a balance of stability and mobility, challenged by large loads – will result in degenerative arthrosis, just as sure as “death and taxes.” [6].

Dr. Ladd's program has approached the problems of the thumb CMC joint from nearly every imaginable angle: Primate-anatomy surveys, gross dissections,

microscopic analysis, multimodal imaging, and live-subject kinematic studies. Dr. Ladd also guest edited a recent symposium for our Journal [3], which investigated the joint from before birth [9] through late adulthood. In fact, the symposium explored a broad range of clinical and laboratory research, and some very interesting history on the topic [4]. When we combine this excellent symposium with the epidemiology research that extended our understanding of this joint to the final decades of life [1], and place them alongside this award-winning study, it becomes clear that this has been a very good year at *CORR*® in terms of what we have learned about this complex joint.

Dr. Ladd's paper deservedly won the 2014 Nicolas Andry Award from the Association of Bone and Joint Surgeons®, the parent company of *CORR*®. This work covers so much ground, does it with such skillful prose and effective illustrations, and uses so many fascinating examples from disciplines as diverse as history, comparative anatomy, and linguistics that for me to try to summarize or synthesize the work here would do it a disservice. Of course, like most good science – even summaries of large,

Note from the Editor-In-Chief: In “Editor's Spotlight,” one of our editors provides brief commentary on a paper we believe is especially important and worthy of general interest. Following the explanation of our choice, we present “Take Five,” in which the editor goes behind the discovery with a one-on-one interview with an author of the article featured in “Editor's Spotlight.”

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Amy L. Ladd MD

successful research programs – this paper still leaves many interesting questions unanswered. But in the event you have been wishing you could have avoided CMC arthritis by having been born a silverback gorilla, Dr. Ladd's article will relieve some of your burden: It appears that in advanced age, gorillas get basilar joint arthritis, too.

Whether you study thumb CMC joints, operate on them, or simply have one or two, Dr. Ladd's story is worth a careful look, as is the behind-the-discovery "Take 5" interview that follows with the principal investigator of this impressive clinical research

program. The story of the Andry-award-winning research program is almost as interesting as the findings they share with us about the thumb CMC joint in this issue of *CORR*®.

Take Five Interview with Amy L. Ladd MD, senior author of "The 2014 ABJS Nicolas Andry Award: The Puzzle of the Thumb: Mobility, Stability, and Demands in Opposition"

Seth S. Leopold MD: *Congratulations on your well-deserved Nicolas Andry Award, and on your extremely thoughtful article, which reflects the*

efforts of a truly multidisciplinary, international research program that stretches back more than 10 years. Many readers will envy your team, and so I would like to ask a couple of questions about it: First, what do you see as the key steps to assembling and developing a research program of this scope?

Amy L. Ladd MD: Thank you for the opportunity to comment on an array of research topics that unify under the rubric of thumb CMC arthritis. In my opinion, the success of any research collaboration requires collective vision, messy experimentation, and determination. Many of these projects stemmed from small feasibility studies with a shot-in-the-dark, "let's chip away at a big problem" sort of endeavor. The energy and passion on behalf of students, residents, and my coauthors countered the slim resources available for taking on various topics. We have endured abject failures not reported here, but we have also had lot of fun trying.

This final collaborative work represents three main themes: (1) How the body moves, broadly known as kinematics, (2) the teleologic origins of functional movement, and (3) how function influences joint morphology. My coauthors held expertise in these areas outside of the CMC joint, and therefore with a little coaxing and dogged persistence, we embarked on further

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discovery together. In the case of my Stanford colleague Dr. Jessica Rose, director of the Motion Analysis Lab at our Packard Children's Hospital in Palo Alto, CA, USA, we refined marker-based motion analysis of the upper limb with a project-based course we both taught, *Anatomy of Movement* [10]. Two seemingly disparate marker-based motion analysis projects linked the hand and wrist to the bigger joints and trunk – one examining the elite golf swing [8] and the other examining reach and grasp [2]. From there, we transitioned to the more challenging task of examining CMC-controlled fine motion in relation to larger joints, as reported in this manuscript [7]. Dr. Elisabet Hagert from the Karolinska Institutet spent a 6-month sabbatical with me examining the histomorphology of the CMC ligaments, and that secured our ongoing collaboration of examining neuromuscular control, which now includes additional international colleagues from Germany and Spain. Dr. Joseph Crisco and Dr. Arnold-Peter Weiss at Brown University have previously deciphered the fine movements of the wrist with CT kinematics, and our collaboration came from sharing where they wanted to go next – the CMC joint, of course – combining the imaging techniques and functional questions our Stanford team had previously deliberated. This spawned several pilot grants and eventually an NIH RO1 grant, with rejection and resubmissions an

inevitable part of the process. In summary, the key steps to assembling and developing a research program are to have a vision (make it large), be willing to fail, and keep going.

Dr. Leopold: *Big questions take time to answer. Keeping a program focused and effective through long periods of time – and adapting the program to new demands, whether scientific, professional, or administrative – is essential to the sustained success of a team like yours. What advice can you offer to someone just starting out, in terms of how to keep a research program together and focused in the long-term, as the science changes (so new approaches and members need to be added), as professional demands of team members pull them in other directions, and as the funding environment grows ever more difficult?*

Dr. Ladd: Again, this begins with what I mentioned earlier – have a vision, be willing to fail, and keep going – but it goes beyond that, too. I am relatively new to the game of research rigors; my first 10 years in practice focused on resident and fellow education, as well as identifying innovative imaging techniques combined with multimedia education – not heavy on “science,” but great for comprehending institutional resources and identifying collaborators who wish to reach beyond convention. As to the specifics of whether to pursue research: Dedicate a space in your mind to the thrill of investigation.

Identifying research questions is a creative and rewarding process. As to funding: Apply for small pilot grants. Apply locally, and apply nationally. Invite students, and invite residents; consider a wide variety of potential collaborators. Writing small grants is almost as painful as writing big grants, so you might as well start from the ground up. Small grants beget big grants. Collaborate, task-share, and Skype. Use “Track Changes.” Persevere.

Dr. Leopold: *You have covered a tremendous amount of ground in your paper. What three key messages would you want the nonhand-surgeon to take away from your decade of discovery about the thumb's CMC joint?*

Dr. Ladd: Big joints and little joints share many mysteries. Therefore, we are comrades-in-arms in the need to learn more. Three key messages are: (1) The thumb is caught between a saddle joint and a ball-and-socket joint, with eccentric motion that challenges robust arthroplasty solutions. (2) Proprioception and joint neuromuscular control probably influence impingement, weakness, and subluxation, which contribute to osteoarthritis of the CMC joint – just as they do with other vulnerable big joints. (3) We have a great opportunity across the musculoskeletal system to examine the influence of genetics and environment on shape, abnormal load, and movement as causes of osteoarthritis.

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Dr. Leopold: *And how about the hand surgeon – what do you see as the major findings that either should influence a surgeon's approaches now, or findings that you expect will find clinical application sometime soon?*

Dr. Ladd: We need well-designed studies addressing the cause, development, and treatment of thumb CMC arthritis. This requires culling, assessing, and scrutinizing the literature for important measures that are worth examining further. Experts and stakeholders of CMC arthritis – surgeons, therapists, engineers, industry partners, insurers, and patients – need to contribute to determining outcomes and quality that will identify and further define cause and treatment, and ideally prevention, of arthritis. This is a formula that, incidentally, may be applied across our orthopaedic specialty.

Dr. Leopold: *Let us end with a look ahead. One of the most fascinating parts of your paper were the technological approaches – virtual reality, information science and computing, online education, and using multimodal electronic approaches to decode the thumb's mysteries still further. Would you please share with us one or two of these areas that you are especially excited about or that are especially promising?*

Dr. Ladd: The big-ticket item is patient education. Patients represent our congregation, our consumer, and our constituency. Accessible interactive resources rich in images and content provide opportunities to educate our patients in sophisticated ways, and invite our patients as team players in decision making. The beauty about image-rich, interactive content is that it may be scaled from the surgeon in practice to the resident in training to the patient in pain, a repurposing of content in a nimble way. Our team has just published a patient resource for CMC arthritis that culminates more than 10 years of efforts learned from failures, having navigated the realm of CD-ROMs, web pages with various platforms, smartphone apps. But what emerged from all of that is an interactive Apple iBook [5]. We hope this is part of the next wave that brings inquisitive, educated patients into our world of technology, discovery, and solutions.

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