

My Personal Journey That Led to the Crossroads of Interdisciplinary Manual Medicine Research: Serendipitous Opportunities Afforded a Basic Scientist

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I distinctly remember the day it started. It was 1 week after my basic science colleagues and I moved into a grand new teaching building on the campus of an osteopathic medical school in Arizona. The offices were larger. There were fine conference rooms, the architecture simple but impressive. While it was still about 200 yards across a desert wash of sorts to get to my research laboratory, the space was built for teaching, interacting with students, and other scholarly pursuits. As I toured the new building, walking into offices I thought were mine, for I did not know the landscape well yet, I spied a large curious space across the hall from our “pod.” The entire hall-facing side of the space gleamed brightly of new glass, but nothing could be discerned about what lay on the other side as blinds were hung, lowered, and louvered shut at that moment. What could possibly be so important as to garner an entire half of a wing in this new building?

Nearly 2 weeks later, classes began and I enthusiastically prepared to meet the new osteopathic medical students, the ninth medical school class that I had the privilege to teach the fascinating discipline of physiology (yes, I am a trained physiologist!). Introductions were made, syllabi distributed, and lectures delivered. All was flowing smoothly and nervous new students, and some new faculty, were settling into a routine. I was settling into a routine, one which felt familiar and comfortable. I now remember that comfort level distantly, for I have, ever since that day, been yanked repeatedly out of it with vigor.

That is when I saw it for the first time. Before the new building opened, this space, smaller and less sophisticated than this new space, existed in a building in the corner of the campus. I never visited that old space, never knew really what happened there. But now, it was virtually right across the hall from my new office.

Curiosity got the best of me and I peeked inside. Class was clearly in session. Nearly 150 students and 15 faculty with matching polo shirts sporting the department name and logo milled around a cavernous room filled with what looked like massage tables. Video monitors of embarrassingly large dimensions were everywhere. There was a table, like the other ones, made special because it sat atop a platform with high end movie cameras ready to videotape the bizarre rituals about to unfold. The video was sent through wires to all the World Cup broadcast-worthy television screens, to a bank of video recorders, and to a small room off to the side where additional faculty and teaching fellows watched.

The “rituals” I discovered were the introductory sessions prepared and presented by the faculty of the osteopathic medicine department. A single polo shirt-clad faculty member had his subject lay on the table on his stomach and then proceeded to seemingly stretch the back. Gently at first, then with more vigor. The skin, and I presumed the muscle and everything else more internal to those structures, was stretched, held, and then stretched in a different plane. I presumed there must have been some compression of tissues happening too, evidenced by the slightest reddening of the practitioner’s face, suggesting some mild exertion. I heard the accompanied narrative, words like “fascia,” “trigger point,” “release,” and “restrictions” flying about. After the demonstration, the swarm of students broke their attention away from the “stage” and began mimicking what they saw under the watchful eyes of the remaining polo shirt-clad faculty. I was late to my weekly laboratory meeting, so I snuck back out, across the wash and back to an environment that I knew very well for the past decade and a half—the research laboratory.

These laboratory meetings always excited me, for a variety of reasons. It was *my* first laboratory since moving from Michigan. These were *my* stu-

dents that I felt a surge of pride and optimism for. These were *my* (really ours, as we never research in a vacuum) ideas. I knew why we did what we did in the laboratory. I knew every square inch of this facility. I knew every piece of equipment, able to diagnose a misaligned lens or a troublesome plate reader almost by sight alone without need for closer scrutiny. This feeling was nothing like the strangeness and unfamiliar nature of the osteopathic medicine skills laboratory that I just came from.

The presentations by the students in the research laboratory that day were quite terrific. We discussed the preliminary results obtained from an experiment designed to mimic arterial pressure waveforms in cultures of human coronary arteries. Our goal was to test the hypothesis that the stretching of the smooth muscle cells in the walls of the coronary arteries was the stimulus that caused the cells to secrete growth factors. After all, we knew from our clinical colleagues (again, it takes a village) that most patients who undergo a balloon angioplasty to clear coronary artery obstructions return within a year with symptoms of reocclusion. When examined after death, these coronary segments were found to be reoccluded. Not by a thrombus or a cholesterol plaque, but by seemingly healthy smooth muscle cells that appeared to be growing mischievously and unsettlingly into the once balloon-cleared artery. I was on the hunt for the something that may have been secreted from the cells in response to stretching (by balloon or even by regular pulsatile arterial waveforms) to cause such rebellious growth in the smooth muscle cells. After many dollars spent, hours in the laboratory, and countless collaborative meetings, we discovered that at least 1 of these substances is insulin-like growth factor-1.¹ How satisfying! Evidence of a novel mechanosensitive pathway perhaps responsible for a major clinical problem!

To encourage, reward, and mentor the student who had a large hand in the insulin-like growth factor-1 discoveries, I encouraged her to submit

an abstract to the American Osteopathic Association's Annual Research Conference. Yearly there is a competition for best posters (basic science, clinical science, etc, categories), and always wanting to challenge students and set the bar high in a supportive way, I asked her to check the box to enroll in the competitive poster presentation sessions. It turned out that this would be my very first trip to an American Osteopathic Association meeting. You see, the research director from our college could not attend as he did every year, and the money was available to send someone from our college. I gratefully accepted the funding and got on a plane with my student, with our poster, and with enthusiasm.

On poster day, as we hung the poster on the cork board, a fellow of obvious importance (as evidenced by a bouquet of colored stickers on his name badge that included the words "plenary speaker," "research director," "conference organizer," and many others) walked purposefully toward me, looked closely at my badge, and declared, "You are a PhD." Not sure whether this was a question or a declaration, I uttered a simple "yes." After a few introductions and pleads I found myself wearing a colored sticker of my very own on my name tag. It read "Poster Competition Judge."

Now before you get any ideas, I of course recused myself from judging my student's poster.

I was paired with another PhD draftee and we had a glorious time interviewing eager, nervous, sweaty-palmed osteopathic medical students. We asked them all the same scripted questions, scribbled our impressions, and kept moving to cover all posters assigned to us in the time allotted.

Glorious. Except one thing. The last question we had to ask each presenter was, "How does your work impact the field of osteopathic medicine?" Now, some students had great answers because their very projects centered on testing different manipulative techniques on, for example, relieving low back pain. I'm fairly certain their answers were pretty

good given that I heard some familiar words in their answers like “fascia,” “trigger point,” “release,” and “restrictions.”

Hmmm ... something familiar there, but still wholly misunderstood and unseen by me.

My anxiety actually came about when I considered how my student’s presentation was going under the rigorous cross examination of another poster judge duo. How in the world would she answer that last question? Our research had *nothing* to do with osteopathic medicine or manual medicine or fascia or anything of the sort.

Or so I thought at the time.

To cut the story short, my student won first place. A plaque! Pictures! Even a cash prize! Pride swelled within me as I hugged her. After the din and the excitement abated I asked her about my nagging concern:

“How did you answer the last question?”

“Which one?” she asked.

“The one about relevance to osteopathic medicine and manual medicine and all of those other things I know nothing about and that we did not discuss and that I did not prepare you for! How did you answer that one?”

“They never asked me that one,” was her reply.

“How would you have answered that one?” I asked.

“I don’t really know,” is all she said.

That did it. I never went to sleep that night. I thought long and hard about how does stretching cardiac and vascular muscle cells and looking at growth factors and inflammatory agents have anything to do with the osteopathic medical profession. I could have left it alone. But at that time in my life, my entire family income came from my wife’s (she is a neuroscientist) and my paychecks, both drawn from an osteopathic medical school account. No, I had to answer that last question. For a lot of reasons.

I ordered coffee and dug out a fresh legal pad to answer that question. *How* does our work impact the

field? *Does* it impact the field?

Then it happened. Right there in the hotel room. It was 3:30 in the morning. I made a connection that would forever change the course of many things for me.

It was “stretch.” I stretch muscle cells in the laboratory to model a balloon in the coronary or to model an arterial pressure wave. And then I look at how the smooth muscle responds. And how the response could cause or cure disease.

It was “stretch” too that I saw on that stage, with cameras rolling and students attentive. When I saw the polo shirt-clad faculty member manipulate the person on the table in the shiny new osteopathic skills lab, I saw “stretch” and “compression” and other biophysical stimuli at play. “All” I needed to learn about was (1) what cell type are *they* stretching? (2) what disease are *they* trying to cure? (3) what cell response (growth factor?) could account for *their* curative effects? and (4) can I model *that* stretch in my laboratory?

I had reams of ideas and notes by lunch time. As I walked, bleary eyed and sleep deprived across the hotel lobby to the next plenary session, I saw the gentleman who recruited me to judge duty and shared my “the last question” anxiety of the previous day. Then I showed him some of my coffee-stained legal pad sketches from the long night before.

His eyes widened. He smiled broadly. He hurriedly ushered me into a room where several important-looking people met amongst hushed voices. They all looked up and I was introduced to people who would become and remain amazing colleagues and friends. They were from another osteopathic medical college, in Texas. There was a fledgling Osteopathic Research Center in Texas where the goal was to conduct high-quality research in manipulative treatments. Why? Because no one else was doing it, and because they were interested in it, and because the profession needed it.

Two years later, and after countless video conferences and repeated attempts to obtain grant support, my new colleagues and I were awarded a 5-year grant from the National Institutes of Health to study, among other things, possible cellular-based mechanisms responsible for osteopathic manipulative treatments.

Since then, my research team has published a number of papers describing modeled myofascial release, counterstrain, and other techniques in human fibroblasts and muscle cells that result in all manners of cellular responses—from changes in gene expression profiles to changes in tissue architecture to cellular differentiation (which combined are not really all that distinct as we know now that one can easily cause the other and vice versa).²⁻⁷

Since then, I have been asked to present at all 3 Fascia Research Congresses: Boston, Amsterdam, and Vancouver. These 3 venues were without

question some of the most thrilling and humbling experiences I have ever had. It was at these conferences that I truly understood that manual medicine is not at all practiced by nor owned (scientifically or philosophically) by a single group of clinicians or practitioners. No—it is much broader than this indeed.

Since then, I have learned so much only to now feel so completely uneducated about manual therapies. I have learned though that this could be interpreted (at least by me during my most humbling times) as an advantage, for I am able to remain as unbiased as possible in my approach to understand potential cell and molecular bases of manual medicine efficacy. I can legitimately be viewed as having “no skin in the game.”

One thing I have discovered with clarity during the Fascia Research Congress meetings is that all manual medicine practitioners (osteopathic phy-

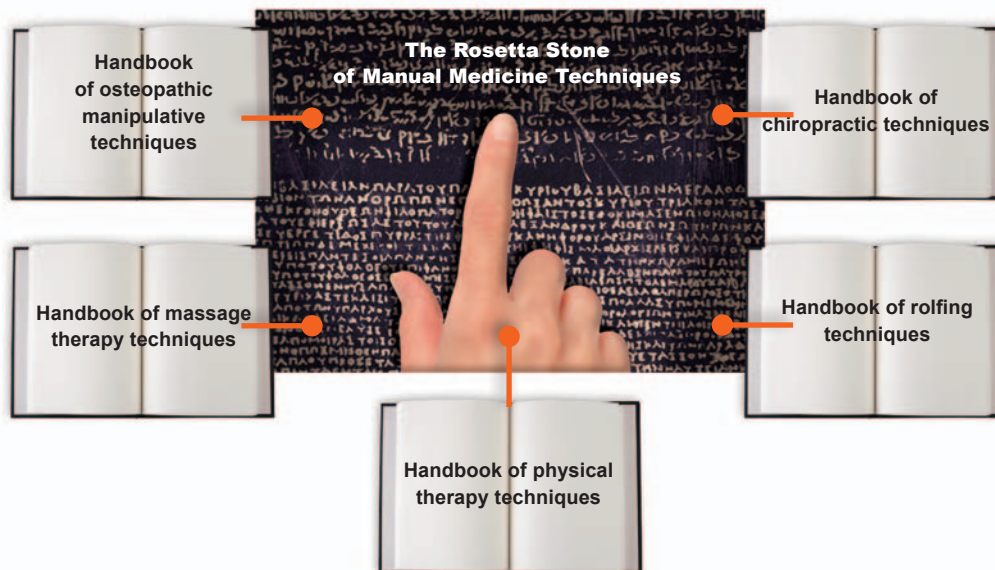


Figure. Practitioners of manual medicine techniques currently use individualized glossaries of maneuvers that ultimately may describe similar or identical treatment modalities. To enhance the construction of an evidence base to describe clinical efficacy, our goal should be the establishment of a unified set of terms.

sicians, chiropractors, rolfers, massage therapists, physical therapists, kinesiologists, etc) stretch cells and tissues. Whether they call it stretch or not. They also compress cells and tissues. And torque them. And shear them, too. Many techniques, from my basic science perspective, can be relatively easy to describe in biophysical terms such as these. If they were, I would imagine that despite being called different names, many of these techniques used around the world really create the same (or nearly the same) effects on tissues and cells.

After all, you can order a “pop” in Michigan and a “soda” in Arizona and you will be served the same type of beverage.

Given this, we should agree to develop a single system of describing manual treatments that all its practitioners agree with and can understand—a Rosetta Stone of sorts for manual medicine techniques (*Figure*). That way, we can pool knowledge gained to better and more quickly build the evidence base for their clinical efficacy.

To bring things full circle, I must tell you that what I learned after researching modeled manual therapies in vitro for the past 12 years has now recatalyzed my old flame—the biophysics of cardiovascular tissues and their ability to “heal” themselves. Wouldn’t you know that what we learned in the field of manual medicine is now focusing my efforts in a new direction in cardiovascular medicine? This is how it all started—but in reverse!

If one looks long enough, looks hard enough, and is willing to peek into new rooms or ask questions with no easy answers, one will be truly rewarded.

Do I think I have contributed to the manual medicine research base? Yes, I believe I have, albeit in a very, very small way.

Do I think I have learned something in the process of pulling myself out of my comfort zone? More than I could ever have imagined.

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