Five questions for Richard Weir[1]

Richard Weir was born in Dublin, but at age 9, he knew he would come to the United States. He had seen Americans walking on the moon and thought everything about the United States was great, and so, he said, it was never a matter of if he would live in the States, but when.

While attending Trinity College in Dublin, he decided biomedical engineering was his calling: He loved using his hands, making and building things. He began to research U.S. universities and chose to attend Northwestern University in Chicago where he earned his master's degree and Ph.D., and later headed a lab at the Rehabilitation Institute of Chicago.

Because he and his wife didn't want their son to grow up in a big city, the family moved west to Boulder in 2008. Weir commuted to and from Chicago for a time, then interviewed for a position at the University of Colorado Boulder.

"During the interview, they kept talking about this Anschutz place. I had no idea what it was, but the Board of Regents had just approved the new bioengineering department there," he said. In January of 2011, he joined the department. And he's still doing what he loves most – building things.

In his office on the CU Anschutz Medical Campus, you'll find a Lego Darth Vader and a G.I. Joe, not necessarily because he's a toy fan, but because he finds inspiration in "weird and wonderful places" -- in this case, in the construction of the figures' hands. Much of his research focuses on creating a prosthetic hand that moves realistically and senses touch, and he has made groundbreaking discoveries in those areas. But making devices that actually work for users with high levels of amputation is just as important to him as developing his "blue sky" robotic appendages.

"I've always been intrigued by sci-fi and robots and space ships, my father was a professor of medicine at Trinity College, and I've always been someone who makes things. My friends tell me that the real reason, the deep psychological root of it all, is that I have a twin sister who lost a hand when she was 5. So my career is a kind of marriage of all of those things."

He holds the title of research associate professor and also is director of the Veterans Administration Biomechatronics Development Laboratory, is a research healthcare scientist with the VA Eastern Colorado Healthcare System, an associate research professor with the Department of Rehabilitation Medicine at Anschutz, and an adjunct professor with the Department of Integrative Physiology at CU-Boulder.

At home, he continues to build – tables, sideboards and other furniture – and because his now-grown son likes horses, fences and sheds and all the items needed for the care of the animals.

1. What does your research on prosthetics entail and what are some of your successes?

Our laboratory's goal is to ultimately be able to develop a fully articulated hand that someone who has lost a limb could don and be able to control like a natural hand but that would also have a sense of touch. That's the ultimate goal of our research, but our research basically is focused on the whole problem of replacements for persons who have lost hands and arms. It turns out to be quite a challenging problem.

We focus on a variety of ways to do this. First, the physical hand. That is where robotics comes in, but there are many hands that are actually useful that aren't fully articulated robot hands. These can be as simple as prosthetic hooks and grippers. So we aren't just aiming at the blue sky, high-flying stuff, we also work toward more practical solutions that have a more immediate application to users.

Some of the hands we've worked on include one for DARPA (Defense Advanced Research Projects Agency). The hand has an 18-degree range of freedom with motors and each motor has its own microprocessors, and each finger has its own touch sensor that includes another microprocessor for a total of 18 microprocessors. More recently, we've

been working on a 3-D, metal-printed, purely mechanical finger that will articulate when someone manually bends the finger and that will probably be more useful in the short term than our fancy robot hand for DARPA. There are some 40,000 individuals in the U.S. with limb amputation above the wrist, but there are 400,000 individuals in the U.S. who have lost a finger. And there are many full-hand prosthetic options available, but the prosthetic options for people with finger loss are far more limited.

We have some fancy 3-D printers we got from the Veterans Administration through an equipment grant and that's enabled us to think more creatively about how to better fabricate the fingers and components used in the hands. We have a metal printer, which is rare, and it allows us to fabricate designs in anthropomorphic shapes not rectilinear shapes.

Our work on components includes wrist flexion units, humeral rotators, and shoulder joints. Joints that aren't commonly available prosthetically because the market is too small, but because we are a research-funded entity, we can pursue some of these not-so-profitable component projects. So we can work on shoulder joints, for instance. Shoulder joints, oddly enough, don't exist because there are so few people who have lost an arm at the shoulder. That's a good thing really, but for those who have lost an arm at the shoulder, it's a very challenging fitting because there aren't many options.

2. Once these devices are built, do you also develop the means of controlling them?

That's where we get involved in the area of neural interfaces, where we are trying to figure out ways to communicate with the nervous system or the muscles in the residual limb. We've been developing something called IMES or implantable myoelectric sensors for more than 10 years. We were able to implant IMES in human subjects for the first time a year or so ago under a clinical trial led by the Alfred Mann Foundation at Walter Reed Hospital. We developed these small IMES sensors that are entirely self-contained – about 12 mm long by 2 mm in diameter. These little tube-like things are inserted inside the residual muscles of the amputated limb then we place a coil around the arm in the prosthetic socket so we can talk to implants in the body without having wires pass through the skin. It's very exciting because this allows us to pick up signals from many more muscles in the arm than you can otherwise do on the surface.

The current standard of care would be two surface electrodes, but the signal on the surface of the skin is kind of an amalgam of everything below it, so you can't really have more than one or two signals on the surface without getting cross-talk and confusion. But if you go right into the muscle, you can pick up individual muscle signals. We send them out to a prosthesis controller that then drives the joints in the hand. What we've been able to do at Walter Reed is have an individual with these implants actually drive three or four degrees of freedom simultaneously. It's something we take for granted, the ability to extend our wrist, open our hand, and move the thumb to the side all in one fluid motion. If you are using the current level of prosthetics, you have to do each one of those actions individually. But the implants allow the prosthesis user to do this full, fluid motion all in parallel, so it has been a powerful demonstration of these ideas.

The other thing that has become apparent over the years of doing this research is that if we wish to build a hand that can operate as well as your or my hand, you need a sense of touch. You can't do dexterous manipulation without it. Gripping to pick up something like a cup is very simple: you just open and close your fingers around it. But manipulating objects in your hands requires many joints under active control and also requires the ability to sense when you have made contact with an object. There has been a lot of research on how to simulate or measure touch – through vibration, for instance – but we've concluded that the best way is to talk to the sensory nerves. We've been trying to figure out ways to communicate with neurons in the nerve that doesn't involve basically impaling them with needles, which is the current approach. Now a silicon needle-type of electrode is stuck into the nerve tissue and you hope it hits a neuron so you can read the signals.

We want to send a signal into your neurons and stimulate the neuron so it can tell the brain you are touching something. We think we can do that using an optical solution and we've been collaborating with a number of researchers on the Anschutz and Boulder campuses to develop an approach that will allow us to use an optical or very small multiphoton microscope inside the limb. It essentially will shine light on an optical protein inside the neuron. When the light is at the right frequency and focused on the correct neuron, you can cause the neuron to fire an action

potential train and give a signal to the user that says, “Yep, I’ve got sensation.”

3. Can your research be applied to other medical issues, for instance, paralysis?

Yes. The Holy Grail of many, many research projects and efforts at the moment is to find a good, stable neural interface that can measure the signals coming down the motor nerve and stimulate the sensory nerves so a person thinks they are having the sense of touch. If you have a stable nerve interface, you have a way to communicate with the nervous system and you can do all sorts of very powerful things. For someone with a spinal cord injury, you could bridge the break and talk to neurons in the nervous system. You could also use it to interface with the parasympathetic nervous system to modulate the control of the pancreas or the liver or the vagus nerve – a big nerve that goes up in the brain. You could talk to the optical nerve or talk to the auditory nerve and modulate vision or hearing.

We believe that if we can get this to work properly, it would have far greater impact than just our humble interface for controlling prosthetic hands.

4. In what ways have you worked to improve the prosthetic user’s experience?

Many people live with chronic pain and we would like to address that issue through an appropriate use of electrical stimulation. So we are about to explore the use of stimulation to manage pain, which would be a very important clinical application for many people.

Socket comfort also is important. A prosthesis is made up of a socket from which all of the hardware components are suspended and is also that place that a person slips their residual limb into. Socket comfort is a very big issue for most users because a socket will get hot and sweaty in the summer and cold in winter. We’re trying to figure out ways to make the socket suspend comfortably so that it doesn’t impinge on pressure points, but also to make sure it stays cool and sweat-free.

We build all these fancy robotic hands, but the things that actually decide whether a user will use the prosthesis are: “Do I have a lot of pain?” “Is my socket comfortable?” “Is the arm too heavy?” It doesn’t matter how fancy your system is; these three things will determine whether the system gets used.

There’s also something we’re working on called algorithm development that maps the sensing from the interface and decides which motors in the arm to drive. We’ve been developing a novel algorithm to improve the control that is available to many users. We’ve been recruiting people with amputations to participate in studies to see whether this controller design is effective.

5. What would you consider the high points in your career or personal life?

The birth of my son was one of my high points and my marriage is another. Getting our DARPA hand working is another high point. We were able to deliver a very challenging hand design in time for the 50th anniversary DARPA celebration. We were working in the hotel room the night before to try it out for the first time on a patient. The tester came in and had never seen the hand and we had to fit it right there.

Getting IMES into humans has to be a high point. That’s only taken 10 years. Research is one step forward and 27 back.

More recently, we are finally getting results from our optogenetic research. After a long and hard-fought struggle to get everything working we’ve gotten some results, so it’s been a huge relief and big deal. There was never a concrete disproving of the idea; it was always another technical hurdle or something to be tested or disproved before we could throw an idea out. Now we have data that is interesting and it’s exciting.

Jefferson Award winners contribute on campus, in communities[2]

Three members of the University of Colorado community have been named recipients of the 2016 Thomas Jefferson Award, among the highest honors given at CU, the state's largest institution of higher education.

The awardees were chosen for embodying and advancing the ideals of Jefferson, the third U.S. president and a Founding Father who greatly influenced American arts, sciences, education and public affairs. The annual Jefferson Award[3] recognizes CU faculty, staff and students who demonstrate excellence in the performance of regular responsibilities at the university while contributing outstanding service to the broader community.

The 2016 honorees are:

Faculty:

Julie Carr, Ph.D., associate professor, Department of English, University of Colorado Boulder. A gifted poet and inspiring teacher, Carr is committed to bettering the world through the arts. She is a notable scholar of Victorian poetry and contemporary feminism who has authored six books of poetry and a critical monograph on Victorian poetry; she also co-edited a volume on Romanticism and contemporary poetry. Her numerous awards include a National Endowment for the Arts Fellowship. Carr and her students bring poetry into local schools, helping children see themselves as creators and future citizens whose voices matter. She also is co-founder and associate director of Counterpath, begun as a nonprofit press for publishing experimental writing and scholarship. It now also encompasses a public gallery, event space and bookstore. In collaboration with the local community, Counterpath is developing a food-justice program and community garden. Before turning full time to poetry and education, Carr spent a decade in professional modern dance.

Staff:

Michelle Médal, M.A., program assistant II, Department of Communication, College of Liberal Arts and Sciences (CLAS), University of Colorado Denver. Praised as a master organizer, enthusiastic event planner and astute manager of money and human resources matters, Médal allows faculty, staff and students to work and learn efficiently. She has served on the Staff Council, whose Service Excellence Award (2013) is among her honors. She also received the 2012 Friend of the Department Award and the 2013 CLAS Outstanding Staff Award. Médal's commitment to community shines in the Zonta Foothills Club of Boulder, which advocates for the empowerment of young women. She served as president for two years and is currently a member of the four-state district board. Demonstrating a passion for student access, she worked at the Western Interstate Commission for Higher Education before joining CU Denver. Her long-standing CU ties include two degrees – bachelor's in English, master's in education – earned at CU-Boulder.

Student:

Arezoo Bahramirad, M.D. candidate (2017), University of Colorado School of Medicine at the Anschutz Medical Campus. A third-year medical student, Bahramirad was born and raised in Iran, earned her undergraduate degree in the Netherlands and master's degree in mathematics at the University of North Carolina Charlotte. She plans to become an innovative, compassionate doctor, but isn't waiting until then to make an impact on the community. Her volunteerism includes service at the Food Bank of the Rockies and The Medical Center of Aurora; she assisted in the emergency department during the Aurora theater shootings, caring for a dozen victims. She has helped coordinate resources to provide mental health care for patients and student peers coping with depression. At the University of Colorado Denver, where she completed pre-med studies, Bahramirad helped form a Women in Science group to encourage female and minority students to be more engaged in science classes.

A committee of CU faculty, staff and students selects winners. Recipients receive an engraved plaque and a $2,000 honorarium.

The Thomas Jefferson Award was established at the University of Virginia in 1951 by the Robert Earll McConnell

Foundation to honor teaching faculty who exemplified the humanistic ideals associated with Jefferson. By 1962, six other institutions – including CU – had established a Jefferson Award. In 1980, the university added a student category; in 1988, the staff category was approved. Funding for the awards is derived from earnings on an endowment provided by the McConnell Foundation and from a bequest by Harrison Blair, a CU alumnus.

Proposals sought for fully online degree program[4]

The chancellors and provosts of the University of Colorado invite faculty and staff to submit proposals for the development of a new, fully online undergraduate degree program to launch in fall 2018. Proposals will be accepted from now through July 15.

The grant program provides funds to plan and develop a comprehensive, intercampus, online undergraduate degree that improves student access to the University of Colorado's educational opportunities.

Faculty selected for the grant will receive a $15,000 stipend. A staff person will be selected for each team to support the logistics of course development, and will receive a $5,000 stipend. Each grant proposal will have $200,000 for course development. Currently, there is enough funding to mount three new degree programs.

Click here for the full degree program proposal guidelines>>[5]

Some salient criteria are:
Courses must be delivered by faculty from no fewer than two campuses. Faculty members who may ultimately deliver the courses do not have to be the same faculty as those participating in the grant offering and design of the online degree program. All courses must be delivered online. Enrollment estimates must be provided by residency type with a strongly defended rationale as to the demands of the program and support for meeting enrollment estimates. In estimating enrollments, consideration must be given to retention as well as student migration from an existing program to the new program. Identification and estimate of extraordinary expenses (outside of normal operating and instructional costs) that may be required. Provide justification that demonstrates the degree is in a subject area that is in high demand in Colorado and will have high marketability outside of Colorado. Provide justification that demonstrates the degree program will allow completion from freshman year to graduation in three years, which may include summer and interim courses.
Special attention will be given to proposals that:
Include faculty participation from three campuses for both development and delivery of the program. Include a partnership with Colorado business, not-for-profit organizations, and/or governmental agencies.
Grants will be awarded by Sept. 30; final program development is due March 31, 2017. Online course development will take place during academic year 2017-18 and the initial courses will launch no later than fall 2018.

Campaign rhetoric 'impacts people's mental health'[6]

Human Resources to study classified staff compensation[7]

CU-Boulder Rec Center can help with fitness and wellness goals[8]

Getting a lesson in crisis response[9]

Gough joins NASA's Mars rover science team[10]

Lightner elected to leadership post for international accreditor [11]

Michael Lightner, vice president for academic affairs, was elected the 2016-17 President-Elect and 2017-18 President of the Accreditation Board for Engineering and Technology (ABET) at its Board of Delegates meeting last week.

ABET[12] is a not-for-profit accreditor formed and governed by a federation of 35 professional societies in engineering, engineering technology, computing and applied science whose purpose is to set the educational requirements for programs preparing student to enter these professional disciplines.

ABET's accreditation process is outcomes-based and focused on continuous quality improvement. It is known globally as the leading accreditor in these disciplines and accredits 3,569 programs in 40 disciplines at 714 colleges and universities in 29 countries.

CU retirement plan service provider adopts new name, plans stay the same [13]

In memoriam: Qinghong Zhang[14]

Employee Services team honored for CU retirement plan conversion[15]

The University of Colorado has won top honors for its work last summer modernizing and updating its retirement plans—a project that is projected to save CU faculty and staff nearly $5 million in fees each year.

Pensions & Investments (P&I) awarded CU and Innovest Portolio Solutions a third-place 2016 Eddy Award in the conversions category, which recognizes outstanding work by retirement plan sponsors in educating their participants on the plan consolidation process, including moving assets and accessing funds. Innovest, CU's independent retirement plan consultant, accepted the award on the university's behalf on March 7, during a ceremony at the P&I East Coast Defined Contribution Conference in Miami.

CU is among just four institutions of higher education recognized with a 2016 Eddy Award.

A major financial investments news and research publication, P&I established the Eddy Awards in 1995 to honor organizations that demonstrate best practices in educating participants about defined contribution plans, such as CU's

401(a) Retirement Plan and 403(b) Voluntary Retirement Plan.

A change several years in the making, the 2015 CU Retirement Plan upgrade addressed structural flaws and implemented cost-saving measures into its 401(a) Plan and 403(b) Plan fund lineups , and Plan administration. Following months of Plan analysis, CU modernized its 401(a) and 403(b) plans with streamlined investment menus, which contain highly rated funds from 12 different firms. It also consolidated the number of firms providing Plan administrative services from eight to one — TIAA (formerly TIAA-CREF).

That successful transition could not have happened without the involvement of the university's faculty, staff and retirees, said Peter Bowers, CU's retirement Plans manager. Employees and retirees were integral members of the initial committee that reviewed the former plans and continued to provide helpful input as TIAA moved participants' retirement plan assets into new accounts, he said.

"Faculty, staff and retirees had nearly 10,000 individual contacts of one type or another with the transition team and/or Employee Services during the entire transition, not including phone calls into Employee Services," Bowers said. "Without that involvement by our colleagues, the project could not have had near the level of success that it had."

P&I praised the university for its detailed planning and thorough multimedia approach to educating its employees about the transition from multiple vendors to one provider.

"They clearly had a plan of attack," one judge noted.

Find full details about CU's modernized retirement Plans[16] on the university's website. See a full list of Eddy Award winners on the P&I website[17].

Parallel Pairings | Wine[18]

Indulge in an incredible five-course gourmet dinner paired with specially selected wines in a unique and chic museum environment. You'll hear from our executive chef and wine connoisseur on the specific tasting notes and inspired sensory explosion prior to each course.

Exclusive after-hours access to the museum and art galleries with no crowds or distractions.

Menu

Course one | Gourmet Cheese & Fruit Display

Course two | Grilled Shrimp Cocktail, served with classic
cocktail sauce and lemon

Course three | Wilted Spinach Salad, tossed with warm virgin olive oil and lemon juice, topped with toasted pine nuts, shaved roasted garlic and pecorino cheese

Course four | Braised Osso Buco, topped with rich pan
drippings, gremolata served with cheesy polenta and miniature spring vegetables

Course five | Poached Pear in red wine, spices, stuffed with toasted almonds, chocolate and wrapped in flaky phyllo dough

$85 Per person
$150 Per couple

21 and up

Limited seating, get your tickets now![19]

CDC Epidemic Intelligence Service Regional Presentation[20]

The Colorado School of Public Health is hosting the regional presentation of the CDC's Epidemic Intelligence Service?. Students, faculty and friends of the school are invited to attend and hear tales of epidemiological investigations from MDs, RNs, DVMs and PhDs. There will also be a presentation related to the 2-year post-graduate EIS fellowship.

Lunch for students is?? provided by ColoradoSPH's Career & Employer Relations?.

Learn more on the event website.[21]

CU considers buying Uni Hill Elementary as part of BVSD partnership[22]

Hot Stuff At Auraria's Iron Art Festival Vi Iron Pour (Slideshow)[23]

CU star misses practice to save a life[24]

Graduate programs at CU among best in nation[25]

Dozens of graduate programs across the University of Colorado land highly respected rankings in this year's lists from U.S. News & World Report, spotlighting excellence in higher education across the country.

All four CU campuses are recognized for research and teaching achievement as gauged by academic experts. Fields examined include health care, engineering, law, education and business.

Below is a sampling of CU's rankings from the 2017 edition of Best Graduate Schools[26] (U.S. News Media Group), as made available in advance by U.S. News (full lists available on March 16). Some rankings include ties with other institutions:

University of Colorado Boulder
No. 1: CU-Boulder maintains the top spot nationally for atomic/molecular/optical physics. **Top 10:** CU-Boulder notches top rankings for ceramics (fifth), environmental law (eighth), aerospace/aeronautical/astronautical engineering (eighth) and education policy (10th). Another 14 CU-Boulder schools and programs hold places on the national rankings within their fields: clinical psychology (16), audiology (17), physics (18), earth sciences (23), chemistry (24), speech language pathology (24), School of Education (28), biological sciences (30), psychology (30), College of Engineering and Applied

Science (33), computer science (40), Law School (40), mathematics (46) and Leeds School of Business (59 for part-time MBA schools). Not all disciplines are ranked by the publication.

University of Colorado Anschutz Medical Campus

School of Medicine

Top 10: The school ranks fourth nationally for pediatrics, fifth for family medicine and sixth for rural medicine. The school ranks 11th nationally for primary care and 35th overall for research.

College of Nursing

Top 10: The informatics program ranks sixth; pediatric nurse practitioner, eighth. The college is 21st for doctor of nursing practice; the nursing master's degree is 23rd .

Graduate School

Top 10: The master's program for physician assistant ranks fifth. Among master's/doctorate programs in physical therapy, the program ranks 15th.

Skaggs School of Pharmacy and Pharmaceutical Sciences

The school ranks 22nd nationally for the doctor of pharmacy program.

University of Colorado Denver

Schools and programs ranking: health care management (23), School of Public Affairs (34), biological sciences (75), the Business School's part-time MBA program (89) and the School of Education and Human Development (99).

University of Colorado Colorado Springs

The doctorate of nursing practice at the Helen and Arthur E. Johnson Beth-El College of Nursing and Health Sciences ranks 70th; the nursing master's degree, 78th. The part-time MBA is No. 111.

Rankings are based on two types of data: expert opinions about program quality, and statistical indicators that measure the quality of a school's faculty, research and students. The publication aims to provide a tool to students and parents who are comparing college programs at accredited public and private universities in the United States.

The 2017 Best Graduate Schools includes rankings in graduate school disciplines as well as part-time MBA and part-time law school programs. For the first time, U.S. News ranks Doctor of Nursing Practice programs alongside master's programs in nursing. DNP programs, which are rapidly growing, prepare nurses for the highest level of clinical practice. Detailed statistical data will be displayed on searchable directory pages on usnews.com, as well as in the Best Graduate Schools 2017 print guidebook, on sale at newsstands on April 5.

Links

[1] https://connections.cu.edu/spotlights/five-questions-richard-weir[2] https://connections.cu.edu/stories/jefferson-award-winners-contribute-campus-communities[3] https://www.cu.edu/office-academic-affairs/awards-grants/thomas-jefferson-award[4] https://connections.cu.edu/stories/proposals-sought-fully-online-degree-program[5] http://www.cu.edu/online-degree-grant/grant-guidelines[6] https://connections.cu.edu/stories/campaign-rhetoric-impacts-peoples-mental-health[7] https://connections.cu.edu/stories/human-resources-study-classified-staff-compensation[8] https://connections.cu.edu/stories/cu-boulder-rec-center-can-help-fitness-and-wellness-goals[9] https://connections.cu.edu/stories/getting-lesson-crisis-response[10] https://connections.cu.edu/people/gough-joins-nasa-s-mars-rover-science-team[11] https://connections.cu.edu/people/lightner-elected-leadership-post-international-accreditor[12] http://www.abet.org/[13] https://connections.cu.edu/stories/cu-retirement-plan-service-provider-adopts-new-name-plans-stay-same[14] https://connections.cu.edu/people/memoriam-qinghong-zhang[15] https://connections.cu.edu/people/employee-services-team-honored-cu-retirement-plan-conversion[16] https://www.cu.edu/employee-services/retirement-plans[17] http://www.pionline.com/assets/special-report-pages/2016-eddy/2016-eddy.html[18] https://connections.cu.edu/events/parallel-pairings-l-wine[19] http://southdenver.cu.edu/events/event/parallel-pairings/[20] https://connections.cu.edu/events/cdc-epidemic-intelligence-service-regional-presentation[21] http://www.ucdenver.edu/academics/colleges/PublicHealth/About/activitiesandevents/Pages/CDC-EIS-Regional-Presentation.aspx[22] https://connections.cu.edu/itn/cu-considers-buying-uni-hill-elementary-part-bvsd-partnership[23] https://connections.cu.edu/itn/hot-stuff-aurarias-iron-art-festival-vi-iron-pour-slideshow[24] https://connections.cu.edu/itn/cu-star-misses-practice-save-life[25]

https://connections.cu.edu/stories/graduate-programs-cu-among-best-nation[26] http://www.usnews.com/grad