“A Vision of Lifelong Mobility”

Bone and Joint Institute
for Research and Innovation in Musculoskeletal Health

2016 Annual Report Summary

Western
# Table of Contents

Table of Contents .................................................................................................................. 2
Acknowledgments ..................................................................................................................... 3
    Sponsors ............................................................................................................................... 3
    Partners & Collaborators .................................................................................................... 3
    Core Facilities & Programs ............................................................................................... 3
Message from the Scientific Director .................................................................................... 5
To Move Freely & Without Pain ............................................................................................... 6
Strength in People & Collaborations ...................................................................................... 7
Ground Breaking Initiatives & Academic Successes .............................................................. 8
The Destination of Choice for the Next Generation of MSK Leaders ................................. 9
More than a University Institute – ......................................................................................... 10
Working with External Agencies & Communities ................................................................. 10
Future of the Bone and Joint Institute .................................................................................... 11
    Year 4 (Fiscal Year 2017-18) Budget Projections .............................................................. 11
Summary ................................................................................................................................. 12
Acknowledgments

Sponsors

DIVISION OF ORTHOPAEDIC SURGERY - LONDON HEALTH SCIENCES CENTRE
FACULTY OF ENGINEERING
FACULTY OF HEALTH SCIENCES
FACULTY OF SCIENCE
FACULTY OF SOCIAL SCIENCE
LAWSON HEALTH RESEARCH INSTITUTE
OFFICE OF THE PRESIDENT – WESTERN UNIVERSITY
SCHULICH SCHOOL OF MEDICINE & DENTISTRY

Partners & Collaborators

ARTHRITIS ALLIANCE OF CANADA
ADDITIVE DESIGN IN SURGICAL SOLUTIONS CENTRE (ADEISS)
BIOMEDICAL IMAGING RESEARCH CENTRE
EMPOWER HEALTH RESEARCH INC.
FOWLER KENNEDY SPORT MEDICINE CLINIC
JL RETIREMENT LIVING
LONDON HEALTH SCIENCES CENTRE
• Master of Science in Surgery Program
ONTARIO INSTITUTE OF REGENERATIVE MEDICINE
RESEARCH WESTERN - MEDICAL INNOVATION FELLOWSHIPS PROGRAM
RICHARD IVEY SCHOOL OF BUSINESS
• Ivey International Centre for Health Innovation
ROBARTS RESEARCH INSTITUTE
ST. JOSEPH’S HEALTH CARE LONDON
THE ARTHRITIS SOCIETY
WORLDiscoveries® BUSINESS DEVELOPMENT OFFICE

Core Facilities & Programs

BIOMECHANICS LABORATORIES
• Wolf Orthopaedic Biomechanics Laboratory (WOBL)
• Roth McFarlane Hand and Upper Limb Centre (HULC)
• Bioengineering Research Laboratory at HULC

DR. SANDY KIRKLEY CENTRE FOR MUSCLOSKELETAL RESEARCH
CANADIAN CENTRE FOR ACTIVITY AND AGING
CLINICAL OUTCOMES LABORATORIES
• Pain and Quality of Life Integrative Research Laboratory (PIRL)
• HULC Clinical Research Laboratory
• Advancement of MSK Health Research Facility at Fowler Kennedy
COLLABORATIVE TRAINING PROGRAM IN MUSCULOSKELETAL HEALTH RESEARCH

FACULTY OF SCIENCE FACILITIES

• Western Nanofabrication Facility
• Surface Science Western
• Laboratory for Biomaterial Synthesis
• Integrated Microscopy Facility at the Western Biotron

MSK IMAGING LABORATORIES

• Pre-Clinical Imaging Research Centre (PIRC)
• Load-bearing Imaging, Biomechanics and Clinical Orthopaedics Research (LIBCOR) in WOBL
• Sustainable Archaeology Collaborative Initiative

NOVEL TECHNOLOGIES

• Wearable Biomechatronics Laboratory
• Organic Mechatronics and Smart Materials Laboratory
• Canadian Surgical Technologies & Advanced Robotics (CSTAR)
• Facility for Biomedical Device Design and Fabrication

ORTHOPAEDIC SPINE CENTRE

RHEUMATOLOGY CENTRE AT ST. JOSEPH’S HOSPITAL

RORABECK BOURNE JOINT REPLACEMENT CLINIC

SKELETAL BIOLOGY LABORATORIES

• Biomaterials Science Laboratory
• Mammalian Embryonic Stem Cell Laboratory
• Photon Technology International—Horiba Fluorescence Imaging Core Facility
Message from the Scientific Director

Dr. David Holdsworth

SCIENTIFIC DIRECTOR, BONE & JOINT INSTITUTE

The work of the Institute continues to support collaborative and productive relationships among our outstanding MSK researchers at Western. Moving beyond the local community campus, this was a year for expanding our perspective by establishing formal mechanisms for our external partners to get involved. Together, we continue the important work of better understanding bone and joint disease and looking for innovative approaches that will improve the lives of the millions of people with MSK conditions who suffer around the world.

Consultations with members and partners have been key to our success in terms of improving the sharing of resources, developing proposals for new state-of-the-art facilities, submissions of major grant applications, and crucial involvement of trainees in research, educational, and collaborative opportunities.

In this 2016 annual report, we highlight the activities and related outcomes of the Institute. The summaries provided herein are meant to give a flavour of the immense amount of work produced by this group. Today, I look forward to the future because, with the continued support from Institute members, Faculties, Western University, our Affiliates, and External Partners, we have all the ingredients required to make a real difference – going beyond the lab to impact the economy, health and social care, and influence policy and practice in Canada and around the world.
To Move Freely & Without Pain

The burden of musculoskeletal (MSK) conditions continues to grow at an alarming pace, impacting over 1.7 billion people’s lives, health systems, social systems, and economies. MSK conditions don’t discriminate. They can impact anyone at any age, on any continent, in any community, at any time. At some point, everyone will be affected. Associated costs in Canada have increased by 45% over the last 20 years, reaching $33 billion per year in health-care expenditures and loss of productivity. There is an urgent need to tackle big questions surrounding the intricate components of the human body’s musculoskeletal system. We can no longer accept loss of mobility as a ‘normal part of aging’ or as a long-term consequence of trauma or genetics. We certainly cannot ignore the high price that we all pay when so many people – of all ages – cannot function through daily life without pain.

The Bone and Joint Institute (BJI) has positioned Western as a leader in MSK health research by emphasizing core values of collaborative transdisciplinary research, excellence in innovation, education and research training, as well as knowledge translation. Our work has brought together key experts from academia, the business sector, and the community-at-large to achieve a vision of ‘lifelong mobility’. With cross-cutting research themes that mobilize the strengths of our growing membership and partners, we focus on:

- enhancing active living, mobility and movement;
- investigating causes, prevention, diagnosis, and treatment options; and
- improving support systems and palliation for a wide range of MSK conditions.

MSK conditions can negatively impact mobility and self-care at any age. They affect active participation in domestic, work, community, and social activities.

BJI Research Themes
1 - basic biological and biomedical;
2 - physical sciences and engineering;
3 - clinical and health services; and
4 - population and community health.
Together, Institute members and partners view problems from multiple perspectives, capitalize on unique strengths and resources, and innovate to tackle global problems in MSK health.

**Strength in People & Collaborations**

Institute members are at various stages of their career – 93 faculty, 82 trainees, and 10 research staff – and we have a wide range of professional backgrounds and areas of research focus – basic biological and biomedical, physical sciences and engineering, clinical and health services, and population and community health. Our internal membership grew to 185 people in 2016, a growth of 40 members from 2015, and many additional staff and trainees are mentored or supervised by BJI faculty members.

Multiple community and industry partners such as the London Health Sciences Centre, Arthritis Alliance of Canada, Additive Design in Surgical Solutions Centre, and JL Retirement Living Inc. have associated themselves with our Institute. Partners bring different knowledge, skills, expertise, resources, and perspectives that are crucial to making a difference. They support awareness and capacity building, the development of meaningful products and tools, commercialization, evaluation and advancement of practice and behaviour change, and policy development. Some partners have taken official appointments in our governance structure, some have formal partnership agreements, and others participate in ad hoc activities that align with their work supported by The Arthritis Society to consumers and donors during the Arthritis Society Tour of the Wolf Orthopaedic Biomechanics Laboratory (WOBAL) October 2016.
interests. Regardless of their level of engagement, our partners are critical to breaking new ground in MSK health.

The Research and Business Advisory Committee was established this year to further support Institute functions. With local, regional, national, and international representatives, this committee helps align our work with academic, consumer, and partner priorities to ensure meaningful and impactful effort and outcomes.

**Ground Breaking Initiatives & Academic Successes**

In 2016, our Institute encouraged and facilitated new transdisciplinary collaborative research relationships by hosting 14 seminars and multiple workshops/project development sessions. These sessions created the time and space for internal and external experts to bring new perspectives to persistent challenges in MSK health and research. New ideas were born and old ideas were infused with new perspectives to advance the objectives of the Institute.

We awarded a total of nearly $180 K to 8 teams in the form of catalyst grants. These BJI catalyst grants support the development of early-stage ideas with potential for high impact. Our 2015 catalyst grant teams have been very productive. Some have already secured external funding to expand their research and many are publishing their results. Overall, Institute members worked individually and collaboratively to publish over 200 MSK-related papers in 2016. This does not include contributions of members to other areas of research. Node plot analysis based on co-authored publications demonstrated expanded collaboration among members of the Institute from 2015 to 2016.

BJI members held nearly $35 M in multi-year research funding and BJI played an instrumental role in launching two national initiatives: the Canadian MSK Rehab Research Network and the Canadian Musculoskeletal Consortium. Both these initiatives mobilize leading MSK groups from across the country to work synergistically as a means of advancing discoveries and innovations in MSK health. In addition, BJI members were successful in major external funding competitions, including NSERC Discovery and CIHR Project and Foundation schemes, at least in part because of the research environment created by the Institute. An additional foundation grant of $3.2 M this year brought our members’ successes in the CIHR Foundation Scheme to over $8.5 M to date. Likewise, important submissions to major competitions like the Canada
Foundation for Innovation and the Ontario Research Fund for Large Infrastructure were supported by Institute staff and incorporated the Institute’s track record, team composition, existing infrastructure, and potential societal benefits – factors that provide a competitive edge.

**The Destination of Choice for the Next Generation of MSK Leaders**

Our Collaborative Training Program in MSK Health Research (CMHR) supplemented regular Western graduate programs with an innovative and integrated curriculum focused on core concepts of: biomedical, engineering, clinical, and health services research in bone and joint health; the development of transdisciplinary research initiatives; career enhancement; and community outreach.

In 2016, CMHR engaged 62 trainees (18 doctoral, 26 masters, 11 postdoctoral, and 7 undergraduate students), 29 of whom held Transdisciplinary Bone and Joint Training Awards. We granted these awards to support exceptional trainees and their research projects, as a means of enhancing their opportunity to advance their work, to secure external funding, and to publish their studies. Tracking data indicate that approximately one third of our trainees secured external scholarship funding during their time in the program (e.g. NSERC, Arthritis Society, CIHR, OGS totalling nearly $300,000). Trainees reported over 20 peer-reviewed publications this year alone, and they presented and won awards at numerous national and international conferences. Many trainees who have completed their CMHR program continue to work in academia (e.g. faculty members: Rebecca Moyer – Dalhousie University; Emily Lalane – Western University; Ryan Willing – Western University; research staff: Sunnybrook and Fowler Kennedy), health-related fields (e.g. physiotherapists at Fowler Kennedy, Chair of Physiotherapy Specialization Certification Board of Canada), or industry (e.g. Applications Specialist at Additive Design in Surgical Solutions Centre). Many continue their studies as Doctoral, Post-Doctoral Fellows, or Medical Students at various academic centres such as University Health Network – Toronto, University of Melbourne, Western University, McGill University, and Jagiellonian University in Poland.

Beyond training opportunities, our Institute recruited two Early Career Researchers and a Manager of Research and Innovation. BJI supported the recruitment of two additional faculty in MSK-
related areas. These early career investigators will expand our strengths, support and supervise trainees, lead and contribute to collaborative projects, and have access to resources, facilities and senior MSK research mentors. Similarly, we initiated the recruitment of 3 Western Research Chairs – in Mechatronics, Exercise Mobility & Health, and MSK Health – to build on current strengths and lead the development of new research initiatives.

More than a University Institute – Working with External Agencies & Communities

Involving key stakeholders at the right time was a focus this year as we expanded our knowledge translation (KT) activities, increased outreach, and established new partnerships. Communication of Institute activities and achievements was improved with the launch of a new website, the introduction of Town Hall events, and a revised mandate for our Communications Committee. The development and implementation of an expanded KT plan began with the establishment of the Research and Business Advisory Committee composed of local, regional, national, and international consumer, industry and academic representatives. Priorities identified for the coming years included: 1) increased communication with the public; 2) a standardised mechanism for consumer engagement; and 3) tools for the development of productive industry partnerships and commercialization processes.

The BJI sponsored key events in 2016, including the biennial Canadian Bone and Joint Conference. Some events brought external agencies, consumers, and partners into our labs to explore the product of their support and guidance first hand. Our members also participated in community events like fundraising for MSK research and youth outreach. In addition, BJI members submitted 39 invention disclosures to our technology transfer office. A total of 29 patent applications were filed since fiscal year 2015, 10 of which have been issued thus far. Ongoing improvements to performance tracking will support both reporting of member achievements and the evaluation of KT activities.
Future of the Bone and Joint Institute

Fiscal Year 2016-2017 marked the third year of funding for the BJI, and its second year of operation as a Senate-approved Institute at Western University. We project a surplus at the end of fiscal 2016-2017, resulting in a carry-forward of approximately $100,000. This surplus is due largely to transitions in spending from previous initiatives and programs. The funds carried forward will be used to sustain ongoing initiatives. The majority of our BJI partners have confirmed support for Year 4 (2017-18) of the Institute. With respect to the Cluster of Research Excellence in Musculoskeletal Health, we project total spending of approximately $1.4 M – of the $5 M total allocation – by the end of fiscal 2016-2017. This spending is consistent with our budget, which includes increased spending in future years on recruitment costs. The sustainability of Cluster operations and activities is a priority for the Institute beyond Year 5 (2018-19). Early Career Researcher tenure-track positions will be the responsibility of the host Faculties; the Western Research Chair positions will be supported through the Office of the President for a 5-year term, with the possibility of renewal.

The current surplus is being strategically allocated to Institute priorities and to sustain activities beyond Year 5. These funds are crucial to implement the original Senate-approved 5-year budget plan and to prepare for the next 5 to 10 years. Increased Bone and Joint Institute revenues beyond Year 5 will support both Institute and Cluster activities. Sustainability strategies were identified in our initial proposal, and related activities are underway. Consultations with members of our Operations Committee and Governing Board will continue throughout this process. Managing and sustaining growth will be an ongoing task for the Institute.

Year 4 (Fiscal Year 2017-18) Budget Projections

Based on current projections and expected revenue, we will secure sufficient funds to transition into the new strategic plan for Year 6 to 10 and implement activities in the 6th year of operations (pending review and approval of the Institute in Year 5). Additional funds will be required to operate beyond Year 6.
Summary

With expanded partnerships and engagement of external experts in the governance structure, the Institute is well positioned to establish a knowledge translation plan that extends from fundamental scientific discoveries to awareness and capacity building, the development of meaningful products and tools, commercialization, the examination of practice and behaviour change, and the implementation of strategies to influence policy development. The Institute enabled collaborative efforts that resulted in successful grant applications for individuals and groups at the provincial and federal levels and the publication of over 200 MSK-related peer-reviewed articles. The training and catalyst grant programs continued to encourage transdisciplinary research and contributed to implementing collaborative projects and ideas with high potential for impact.

In the coming year, BJI is looking forward to more targeted engagement of members and partners, the third BJI training awards and catalyst grant competitions, and continuing scientific and career development events. There will be a focus on recruitment and enhancing core strengths, as well as evaluation, knowledge translation, and sustainability planning. National projects will mobilize MSK experts to advance innovation in bone and joint health more broadly. Overall, Western’s Bone and Joint Institute is leading in transdisciplinary research, innovation, and education to achieve its vision of “lifelong mobility”.

To learn more about the Bone and Joint Institute, please visit: [http://boneandjoint.uwo.ca](http://boneandjoint.uwo.ca).