



## CURRICULUM VITAE

### Richard Collins, Ph.D. Biomechanics and Biomedical Engineering Consultant

#### PROFILE

Demonstrated accuracy in research and scientific analysis in the fields of mechanical and biomedical engineering and regulatory assessments. Former university professor of Biomedical & Human Factors Engineering; Former Professor of Medicine; and Former Professor of Mechanical and Aerospace Engineering.

#### SPECIALIZATION SUMMARY

- Qualified as an expert witness in civil and criminal courts.
- Internationally recognized engineering and medical expertise.
- Wrongful death, medical and dental malpractice; medical device/product liability
- Injury biomechanics in automotive crashes, aircraft crashes, elevator failures, sports impacts and slips and falls.
- Head injury & spine cases due to motorcycle, bicycle collisions, along with protective helmet liability issues.
- Accident reconstruction and failure analysis for litigation involving serious personal injury and trauma
- Analyses involving motor vehicle accidents, automotive, train and aircraft accident and injury analysis and traffic safety, forklift turnovers, elevator free-falls, slips, trips and falls; sports injuries, product liability in industrial, sports, recreational and safety equipment; sports and industrial injuries, ergonomics and repetitive stress syndromes;
- Extensively published in the peer-reviewed national and international literature.

#### EXPERT SERVICES

Expertise includes analyses of vehicular, industrial, recreational, commercial, and sports-related injuries in addition to the evaluation of protective devices and safety systems, such as seat belts and helmets. Services may include:

- Summary and analysis of accident reports, witness statements, depositions, damage reports, scene photographs, etc.
- Inspection and analysis of vehicles; machinery; objects associated with an injury and the injury environment; and to identify injury causation and injury prevention factors.
- Protective devices evaluation (seat belts, air bags, clothing, guards, helmets) to identify injury causation factors.
- Evaluation of workplace hazards and equipment, to identify injury causation factors.

#### ACADEMIC CREDENTIALS

- Ph.D.** Mechanical Engineering/Aeronautical Sciences, 1966  
University of California, Berkeley, California
- M.Sc.** Aeronautical and Aerospace Engineering, 1961  
University of Toronto, Institute of Aerospace Studies, Toronto, Canada
- B.Sc.** Engineering Physics, 1959  
University of Toronto, Toronto, Canada

## INVITED SCIENTIFIC REVIEWER

- NSF (National Science Foundation) SBIR/STTR grant proposal reviewer, Panel Participant Journal of Biomechanical Engineering
- Applied Mechanics Reviews
- Canadian Heart Foundation Applications
- Mathematical and Computer Modeling - An International Journal
- International Journal of Pharmaceutics
- Cooperative Grants Program of the U.S. Civilian Research and Development Foundation for the Independent States of the Former Soviet Union
- National Medical Research Council (NMRC), Singapore

## BOARD MEMBERSHIPS

- Member, Editorial Board: Applied Microgravity Technology
- Associates Editor: Annales Françaises de Chronométrie et Microtechnique
- Scientific Committee: International Union of Theoretical and Applied Mechanics (IUTAM)
- Executive Board Program Committee: SAFE Wright Brothers Chapter
- Society of Automotive Engineers (SAE)

## PROFESSIONAL EXPERIENCE (Mechanical, Aerospace and Biomedical Engineering)

- 2002 – Present**                    **Americana Safety Associates, LLC – Pittsburg, Pennsylvania**  
Senior Forensic Consultant, Biomechanics and Biomedical Engineering
- Provides expert witness and litigation support to trial attorneys in personal injury, negligence and wrongful-death law cases. Areas of specialization include, but are not limited to, high and low-speed vehicle accidents, accident reconstruction and failure analysis, biomedical engineering, mechanical safety and engineering design and specification issues.
  - Provides consultation services to business and industry on mechanical engineering safety issues, product design, mechanical engineering concerns and abatement of hazards.
  - Provides regulatory compliance and on-site inspection consultation services to business and industry to ensure compliance with all applicable U.S. federal and state safety requirements, laws and regulations.
- 2004 – 2009**                    Professor of Mechanical Engineering and Graduate Faculty Advisor, Department of Mechanical Engineering - University of Nevada, Las Vegas
- 2002 – Present**                    Senior Forensic Consultant, Biomechanics and Biomedical Engineering  
Biomechanics International. Pittsburgh, Pennsylvania
- 2001 – 2002**                    Senior Associate in Injury Causation Analysis and Litigation Support, Forensic Biomechanics  
Robson Lapina, Inc. - Cranberry Township, Pennsylvania
- 2000 – 2001**                    Research Professor of Physics and Mathematics - Wright State University, Dayton, Ohio
- 2000 – 2001**                    Visiting Professor of Mathematics - Wright State University, Dayton, Ohio
- 1995 – 1998**                    Research Professor of Biomedical and Human Factors Engineering - Wright State University,  
College of Engineering and Computer Science, Dayton, Ohio
- 1996 – 1997**                    Senior Consultant, US Air Force Armstrong Laboratory (Human Systems Division),  
Wright-Patterson Air Force Base, Dayton, Ohio
- 1994 – 1995**                    Principal Scientist, US Air Force Armstrong Laboratory  
Wright-Patterson AFB, Dayton, Ohio

**ACADEMIC EXPERIENCE**

- 2004 – 2009** Full Graduate Faculty Status and Graduate Faculty Advisor in the Department of Mechanical Engineering, University of Nevada, Las Vegas (UNLV).
- 2004 – 2005** Scientific consultant, General Electric Nuclear Energy, San José, California
- 1989 – Present:** Biodynamic International – President and CEO and Senior Consultant in Biomechanics, Biomedical and Mechanical Engineering
- 2001 – Present:** Senior Associate in Injury Causation Analysis and Litigation Support, Forensic Biomechanics Pittsburgh, Pennsylvania
- 1995 – 2001:** Wright State University, Dayton, OH - Research Professor of Biomedical and Human Factors Engineering; Visiting Professor of Mathematics; Research Professor of Physics
- 1994 – 1997:** Principal Scientist; Senior Consultant, US Air Force Armstrong Laboratory (Toxicology and Human Systems Divisions), Wright-Patterson Air Force Base, Dayton, Ohio
- 1985 – 1989** A. D. Foulis Professor of Biomedical Engineering and Professor of Mechanical Engineering University of Nova Scotia, Halifax, Canada
- 1985** Senior Scientist, Stanford Research International - Menlo Park, California
- 1983 – 1985** Senior Physicist, Physics International Company - San Leandro, California
- 1980 – 1982** Professor of Medicine, University of Besançon – France
- 1979 – 1982** Professor of Physics, Chemistry and Automation, University of Toulouse III – France
- 1975 – 1978** Professor of Biological and Medical Engineering, University of Compiègne - France  
Director of Graduate Programs in Biomedical Engineering, University of Compiègne – France
- 1976 – 1977** Consultant, Société Nationale des Poudres et Explosifs – France
- 1972 – 1975** Associate Professor of Theoretical and Applied Mechanics, University of Paris VI & VII, Paris, France and Researcher at INSERM (National Institute of Medical Research)
- 1972 – 1974** Senior Research Engineer, Geonuclear El Paso - Geneva, Switzerland
- 1966 – 1975** Assistant Professor of Applied Mechanics & Structures - University of California
- 1969 – 1972** Senior Researcher, Rand Corporation - Santa Monica, California
- 1967 – 1970** Geophysical Technology Corp., Pasadena, California
- 1963 – 1966** Junior Research Specialist, University of California - Berkeley, California
- 1962 – 1963** Associate Research Engineer, Illinois Institute of Technology Research Institute - Chicago, IL
- 1961 – 1962** Research Engineer, National Center of Scientific Research (C.N.R.S.) - Paris, France
- 1960 – 1961** Engineer, Canadian Armament Research and Development Establishment - Quebec, Canada
- 1959** Aerodynamicist, Canadair Aircraft Company - Montreal, Canada
- 1958** Aeronautical Engineer, Avro Aircraft Co. - Toronto, Canada

## AREAS OF SPECIALIZATION DETAILED

### 1. Blast waves and explosions – Published research studies in fluid mechanics and gas dynamics

- Shock Physics: Development and implementation of experimental programs for generating cylindrical explosions by strong electrical discharge into stoichiometric mixtures of hydrogen and oxygen. High speed rotating drum and multi-spark Schlieren photography. Analysis of results within a framework of wave propagation theory.
- Nuclear Explosions at the Ocean Surface: Theoretical analysis of shock wave propagation with special attention to the air-water interface.
- Shock Wave Propagation of arbitrary strength into regions of non-uniform density separated by a free surface - Analytical and numerical techniques based on the method of characteristics.
- Breakup of liquid droplets released into high-speed gas flows (2 to 5 km/sec) - analysis subsequently corroborated by experiments.
- Fluid-Shell Interactions: Theoretical analysis of the dynamic response of a submerged structure to underwater explosions - numerical computations of diffracted shock wave patterns and structural loading.

### 2. Biomedical phenomena:

#### Bioengineering/Biomechanics

- Physiological fluid dynamics, cardiovascular and pulmonary hemodynamic, uptake of volatile toxicant vapors by the respiratory tract and the skin, blood flow transport to the brain and eyes;
- Biomedical instrumentation, mathematical modeling and numerical computer-based predictions of physiological response to a wide variety of underlying complex physiological mechanisms;
- Physiologically based pharmacokinetic modeling and rheology of biological tissues;
- Flow dynamics in collapsible vessels, lubrication of articular joints, macromolecular transport in the arterial wall, fluid dynamics of the eye, and cardiac mechanics; and
- Particle deposition in the pulmonary airways, subcutaneous circulation, cardiovascular response to G-stress in both microgravity (space environment) and hyper gravity (aviation physiology).

### 3. Published Research in Biomechanics:

- Biomechanics of joint lubrication: modification of cartilage permeability and consequently, deformation and fluid transport, across the articular surfaces; determination of rheological properties of synovial fluid; development of new mathematical models for computing the criteria for formation and maintenance of a monomolecular inter-articular mucin film.
- Pulmonary circulation: developed first analytical model to demonstrate that variations in flow and pressure transmission as a function of frequency depend critically upon the capacity of the pulmonary vessels to collapse and re-open, and much less upon radial expansion of already patent vessels.
- Fluid flow in collapsible tubes: theoretical study of the fluid-wall interaction and mechanism of vessel opening and closing; application to controlled collapse of the veins, and to non-stationary flow phenomena occurring in coronary and pulmonary blood vessels.
- Cardiac mechanics: theoretical and clinical evaluation of myocardial contractility on the basis of left ventricular regional ejection dynamics using wall markers and cineangiography.
- Respiratory mechanics: development of an original computational model for periodic flow in the airways of the complete human lung and evaluation of regional particle deposition using radioisotopes as tracers.
- Auto regulation of the cerebral circulation: formulation of a model for the complete branching network of the circulation of the human brain, direct laboratory measurements of the detailed anatomy of the cerebral venous network from precision polymer casts; computation of the unsteady pressure and flow fields as a function of boundary conditions at the carotid arteries and jugular veins; assessment of the quantitative role of local CO<sub>2</sub> and O<sub>2</sub> distributions on non-invasively measured flow profiles.

**AREAS OF SPECIALIZATION** - continued

- Passive and active control of the coronary circulation: mathematical model for blood flow in the complete coronary circulation subjected to high gravitational loading.
- Development of an artificial cartilage: embedded fixed electrical charges in a cross-linked polymer matrix to simulate the natural osmotic swelling pressure.
- Cardiovascular response to G-stress in microgravity (space) and hyper gravity (aerial combat) with autonomic nervous system involvement.
- Biodynamic of the eye: characterization of the material properties of the ocular tissues (corneo-scleral envelope, aqueous humor) and the role of relaxation coefficients in the auto regulation of intraocular pressure with consequences for glaucoma.
- Uptake of volatile vapors by inhalation: construction of a mathematical model for the estimation of the uptake by the pulmonary airflow of volatile (toxic) vapors in the lower respiratory tract. Account taken of the lipophilicity of the chemicals and their concentrations at the alveolar level. Solutions computed for a variety of breathing and cardiac cycles. Of particular interest are short-term exposures to acutely toxic vapors.
- Dermal absorption of volatile vapors: computational model for the solution of the diffusion equation for a highly anisotropic lipid bilayer medium. Particular account taken of the variation in path length and permeability coefficients in the estimation of the penetration of toxic chemicals into and out of the skin, with eventual uptake of the chemical by the venous circulation draining from the skin into the systemic circulation.
- Controlled release drug delivery from implanted ceramic and polymeric capsules:  
Mathematical modeling and computer simulations can be very effective in improving and optimizing the performance of the self-regulating release of therapeutic drugs into specific regions of the body. Development of a reliable computational design tool for predicting the resulting pharmacokinetic dose distributions as a function of time and space. Of primary importance in such models are the time-varying effective permeability of the capsule to the various molecules composing the drug, the effective solubility and diffusion coefficients of the drug and its metabolites in the surrounding tissues and fluids and the uptake of the drug at the target organ.
- Forensic Biomechanics: analysis of trauma-related failures of: **a)** soft tissues: ligament, tendon, muscle, cervical and thoracolumbar spine, and articulations such as the knee, hip and shoulder joints; **b)** hard tissues: skull fractures, closed head injuries; and **c)** medical device failure analysis.

**CURRENT AND PAST AFFILIATIONS**

- American Society of Mechanical Engineers (ASME) - U.S.A.
- Biomedical Engineering Society (BMES) - U.S.A.
- Biological Engineering Society - U.K.
- Société de Biomécanique - France
- American Society of Engineering Education (ASEE) - U.S.A.
- American Association for the Advancement of Science (AAAS) - U.S.A.
- Association for the Advancement of Modeling & Simulation Techniques in Enterprises - France
- American Institute of Aeronautics and Astronautics (AIAA) - U.S.A.
- Canadian Medical and Biological Engineering Society (CMBES) - Canada
- European Society of Biomechanics - Netherlands
- Canadian Aeronautics and Space Institute (CASI) – Canada
- Canadian Society of Aviation Medicine (CSAM) - Canada
- Canadian Applied Mathematics Society - Canada
- Aerospace Medical Association/Life Sciences & Biomedical Engineering Branch (LSBEB) – U.S.A.
- The Society of Automobile Engineers (SAE)

**HONORS – Cited In**

- International Who's Who of Contemporary Achievement – 1984
- Who's Who in the World, Sixth Edition - 1982-1983
- Men of Achievement, Ninth Edition - 1982
- Who's Who in the World, Fifth Edition - 1980-1981
- Who's Who in Western Europe - 1978-1979
- NATO-AGARD Scientific Consultant (Europe) - 1972-1973
- American Men of Science - 1969

**RESEARCH PUBLICATIONS – Books and Chapters**

- Collins, R. and T.J. van der Werff. 1980. Mathematical Models of the Dynamics of the Human Eye, Springer-Verlag, Berlin, Heidelberg, New York.
- Collins, R.: Guest editor. 1978. "Physiological Mechanisms and Therapies - Engineering Formulations and Techniques".

**INTERNATIONAL SCIENTIFIC JOURNAL PUBLICATIONS AND REPORTS**

**1960 – 2009** Dr. Collins has authored/co-authored 120 international scientific journal publications and reports. (Detailed publication and reports listing shall be provided upon request.)

**CONTRIBUTIONS TO CONFERENCES, SEMINARS AND SYMPOSIA**

**1967 – 2009** Dr. Collins has contributed to 200 presentations in the following 38 countries. (Detailed presentation listing shall be provided upon request.)

Armenia	Austria	China	Hong Kong	Poland	Switzerland
Australia		Czech Republic	India	Russia	Thailand
Azerbaijan		Denmark	Israel	Scotland	Trinidad
Belgium		England	Italy	Singapore	Turkey
Bulgaria		France	Japan	South Africa	Ukraine
Brunei		Georgia	Malaysia	Spain	United States
Canada		Germany	Norway	Sweden	Venezuela
		Greece			
		Holland			

**NATIONALITY AND CITIZENSHIP**

- Birthplace - Toronto, Canada
- Citizen - United States of America

**AVAILABILITY**

Dr. Collins is available for nationwide and international assignments through Americana Safety Associates, LLC