References

Alberts B, Johnson A, Lewis J, Raff M, Roberts K, Walter P (2008) Molecular biology of the cell. Garland, New York, NY
Alexandrou AN (2001) Principles of fluid mechanics. Prentice-Hall, Englewood Cliffs, NJ
Askeland DR (1994) The science and engineering of materials, 3rd edn. PWS Kent, Boston, MA
Ayad S, Boot-Handford R, Humphries MJ, Kadler KE, Shuttleworth A (1994) The extracellular matrix FactsBook. Academic Press, New York, NY
Bell ET (1986) Men of mathematics. Simon & Schuster, New York, NY
Binnig G, Quate CF, Gerber C (1986) Atomic force microscope. Phys Rev Lett 56:930–933
Birk DE, Southern JF, Zycband EI, Fallon JT, Trelstad RL (1989) Collagen fiber bundles: a branching assembly unit in tendon morphogenesis. Development 107:437–443
Boorstin DJ (1985) The discoverers. Vintage Books, New York, NY
Boresi AP, Sidebottom OM, Seely FB, Smith JO (1993) Advanced mechanics of materials. John Wiley & Sons, Chichester
Boyer CB (1949) The history of the calculus. Dover, New York, NY
Butler DL, Awad HA (1999) Perspectives on cell and collagen composites for tendon repair. Clin Orthop Relat Res 367S:S324–S332
Butler DL, Goldstein SA, Guilak F (2000) Functional tissue engineering: the role of biomechanics. J Biomech Eng 122:570–575
Carrel A, Guthrie CC (1906) Results of the biterminal transplantation of veins. Am J Med Sci 132:415–422
Carter DR, Beaupré GS (2001) Skeletal function and form: mechanobiology of skeletal development, aging, and regeneration. Cambridge University Press, Cambridge
Carver W, Nagpal ML, Nachtigal M, Borg TK, Terracio L (1991) Collagen expression in mechanically stimulated cardiac fibroblasts. Circ Res 69:116–122
Comroe JH, Dripps RD (1977) The top ten clinical advances in cardio-vascular-pulomonary medicine and surgery 1945–1975 (Vols. I and II). Public Health Service Document 017-043-00084-6. US Government Printing Office, Washington, DC
Costa KD, Yin FCP (1999) Analysis of indentation: implications for measuring mechanical properties with atomic force microscopy. J Biomech Eng 121:462–471
Cowin SC (2001) Bone biomechanics handbook, 2nd edn. CRC Press, Boca Raton, FL

J.D. Humphrey, S.L. O'Rourke, *An Introduction to Biomechanics*,
DOI 10.1007/978-1-4939-2623-7

Cowin SC, Doty SB (2007) Tissue mechanics. Springer, New York, NY
Criscione JC, Lorenzen-Schmidt I, Humphrey JD, Hunter WC (1999) Mechanical contribution of endocardium during finite extension and torsion experiments on papillary muscles. Ann Biomed Eng 27:123–130
Cui Y, Bustamante C (2000) Pulling a single chromatin fiber reveals the forces that maintain its high order structure. Proc Natl Acad Sci U S A 97:127–132
David G, Humphrey JD (2004) Redistribution of stress in a nonlinear, anisotropic membrane due to the introduction of a circular hole. J Biomech 37:1197–1203
Davidson JM, Giro MG (1986) Control of elastin synthesis: molecular and cellular aspects. In: Mecham RP (ed) Regulation of matrix accumulation. Academic Press, New York, NY, pp 177–217
Davis SE, Doss DJ, Humphrey JD, Wright NT (2000) Effects of heat-induced damage on the radial component of thermal diffusivity of bovine aorta. J Biomech Eng 122:283–286
Delp MD, Colleran PN, Wilkerosn MK, McCurdy MR, Muller-Delp J (2000) Structural and functional remodeling of skeletal muscle microvasculature is induced by simulated microgravity. Am J Physiol 278:H1866–H1873
(1988) Dorland's illustrated medical dictionary. Philadelphia, PA: WB Saunders
Ethier CR, Simmons CA (2007) Introductory biomechanics: from cells to organisms. Cambridge University Press, Cambridge
Fawcett DW (1986) Bloom and Fawcett: a textbook of histology, 11th edn. W.B. Saunders, Philadelphia, PA
Ferry JD (1980) Viscoelastic properties of polymers. John Wiley & Sons, Chichester
Findley WN, Lai JS, Onaran K (1976) Creep and relaxation of nonlinear viscoelastic materials. Dover, New York, NY
Fox RW, McDonald AT (1992) Introduction to fluid mechanics, 4th edn. John Wiley & Sons, New York, NY
Frangos JA (1993) Physical forces and the mammalian cell. Academic Press, New York, NY
Fung YC (1984) Biodynamics: circulation. Springer, New York, NY
Fung YC (1990) Biomechanics: motion, flow, stress, and growth. Springer, New York, NY
Fung YC (1993) Biomechanics: mechanical properties of living tissues, 2nd edn. Springer, New York, NY
Fung YC, Liu S (1991) Changes of zero-stress state of rat pulmonary arteries in hypoxic hypertension. J Appl Physiol 70:2455–2470
Fung YC, Liu S (1992) Strain distribution in small blood vessels with zero-stress state taken into consideration. Am J Physiol 262:H544–H552
Galbraith CG, Skalak R, Chien S (1998) Shear stress induces spatial reorganization of the endothelial cell cytoskeleton. Cell Motil Cytoskeleton 40:317–330
Gelman RA, Poppke DC, Piez KA (1979) Collagen fibril formation in vitro. The role of the nonhelical terminal regions. J Biol Chem 254:11741–11745
Genovese K, Lee YU, Lee AY, Humphrey JD (2013) An improved panoramic digital image correlation method for vascular strain analysis and material characterization. J Mech Behav Biomed Mater 27:132–142
Glass L, Hunter PJ, McCulloch AD (1991) Theory of heart. Springer, New York, NY
Gooch KJ, Blunk T, Vunjak-Novakovic G, Langer R, Freed LE (1998) Mechanical forces and growth factors utilized in tissue engineering. In: Patrick CW Jr, Mikos AG, McIntire LV (eds) Frontiers in tissue engineering. Pergamon, Oxford

Han HC, Ku DN (2001) Contractile responses in arteries subjected to hypertensive pressure in seven day organ culture. Ann Biomed Eng 29:467–475

Han HC, Zhao L, Huang M, Hou LS, Huang YT (1998) Postsurgical changes of the opening angle of canine autogenous vein graft. J Biomech Eng 120:211–216

Harris AK (1994) Multicellular mechanics in the creation of anatomical structures. In: Akkas N (ed) Biomechanics of active movement and division of cells. Springer, New York, NY, pp 87–129

Harris H (1999) The birth of the cell. Yale University Press, New Haven, CT

Hinz B (2010) The myofibroblast paradigm for a mechanically active cell. J Biomech 43:146–155

Holzapfel GA, Gasser TC (2001) A viscoelastic model for fiber-reinforced composites at finite strains: continuum basis, computational aspects, and applications. Comp Meth Appl Mech Eng 190:4379–4403

Holzapfel GA, Stadler M, Schulze-Bauer CAJ (2002) A structural model for the viscoelastic behavior of arterial walls: continuum formulation and finite element analysis. Eur J Mech A Solids 21:441–463

Humphrey JD, Canham PB (2000) Structure, mechanical properties, and mechanics of intracranial saccular aneurysms. J Elast 61:49–81

Humphrey JD, Strumpf RK, Yin FCP (1990) Determination of a constitutive relation for passive myocardium: I. A new functional form. ASME J Biomech Engr 112:333–339 and II. Parameter estimation. J Biomech Eng 112:340–346

Humphrey JD, Barazotto RL, Hunter WC (1992) Finite extension and torsion of papillary muscles: theoretical framework. J Biomech 25:541–547

Humphrey JD (2001) Stress, strain and mechanotransduction in cells. J Biomech Eng 123:638–641

Humphrey JD (2002) Cardiovascular solid mechanics: cells, tissues, and organs. Springer, New York, NY

Humphrey JD (2003a) Continuum biomechanics of soft tissues. Proc R Soc (Lond) 459:3–46

Humphrey JD (2003b) Continuum thermomechanics and the clinical treatment of disease and injury. Appl Mech Rev 56:231–260

Humphrey JD (2008) Vascular adaptation and mechanical homeostasis at tissue, cellular, and sub-cellular levels. Cell Biochem Biophys 50:53–78

Humphrey JD, Taylor CA (2008) Intracranial and abdominal aortic aneurysms: similarities, differences, and need for a new class of computational models. Ann Rev Biomed Eng 10:221–246

Humphrey JD, Holmes JW (2009) Style and ethics of communication in science and engineering. Morgan & Claypool, San Rafael, CA

Humphrey JD, Holzapfel GA (2012) Mechanics, mechanobiology, and modeling of human abdominal aorta and aneurysms. J Biomech 45:805–814

Ingber DE, Heidemann SR, Lamoureux P, Buxbaum RE (2000) Opposing views on tensegrity as a structural framework for understanding cell mechanics. J Appl Physiol 89:1663–1678

Johnson AT (1991) Biomechanics and exercise physiology. John Wiley & Sons, New York, NY

Johnson GA, Livesay GA, Woo SLY, Rajagopal KR (1996) A single integral finite strain viscoelastic model of ligaments and tendons. J Biomech Eng 118:221–226

Johnson MA, Beatty MF (1995) The Mullins effect in equibiaxial extension and its influence on the inflation of a balloon. Int J Eng Sci 33:223–245

Khan AS, Huang S (1995) Continuum theory of plasticity. John Wiley & Sons, New York, NY

Kucharz EJ (1992) The collagens: biochemistry and pathophysiology. Springer, Berlin

Leckband D (2000) Measuring forces that control protein interactions. Annu Rev Biophys Biomol Struct 29:1–26

Lefevre M, Rucker RB (1980) Aorta elastin turnover in normal and hypercholesterolemic japanese quail. Biochim Biophys Acta 630:519–529

Levesque MJ, Nerem RM (1985) The elongation and orientation of cultured endothelial cells in response to shear stress. J Biomech Eng 107:341–347

Lodish H, Berk A, Zipurski SL, Matsudaire P, Baltimore D, Darnell J (2000) Molecular cell biology. W.H. Freeman, New York, NY

McAnulty RJ, Laurent GJ (1987) Collagen synthesis and degradation in vivo. Evidence for rapid rates of collagen turnover with extensive degradation of newly synthesized collagen in tissues of the adult rat. Coll Relat Res 7:93–104

Milnor W (1989) Hemodynamics. Williams and Wilkens, Baltimore, MD

Moody LF (1944) Friction factors for pipe flow. Trans ASME 66:671–684

Mortensen JD, Talbot S, Burkart JA (1990) Cross-sectional internal diameters of human cervical and femoral blood vessels: relationship to subject's sex, age, and body size. Anat Rec 226:115–124

Mow VC, Hayes WC (1991) Basic orthopedic biomechanics. Raven, New York, NY

Mow VC, Ratcliff A, Woo SLY (1990) Biomechanics of diarthrodial joints. Springer, New York, Volumes 1 and 2

Mow VC, Hochmuth RM, Guilak F, Trans-Son-Tay R (1994) Cell Mechanics and cellular engineering. Springer, New York, NY

Murray CD (1926) The physiological principle of minimum work. I. The vascular system and the cost of blood volume. Proc Natl Acad Sci U S A 12:207–214

Na S, Sun Z, Meininger GA, Humphrey JD (2004) On atomic force microscopy and the constitutive behavior of cells. Biomech Model Mechanobiol 3:75–84

Niedermuller H, Skalicky M, Hofecker G, Kment A (1977) Investigations on the kinetics of collagen-metabolism in young and old rats. Exp Gerontol 12:159–168

Nigg BM, Hertzog W (1994) Biomechanics of the musculoskeletal system. John Wiley & Sons, Chichester

Nimni ME (1992) Collagen in cardiovascular tissue. In: Hastings GW (ed) Cardiovascular biomaterials. Springer, New York, NY

Ninomiya Y, Olsen BR, Ooyama T (1998) Extracellular matrix-cell interaction: molecules to disease. Karger, Basel

Oberhauser AF, Marszalek PE, Erickson HP, Fernandez JM (1998) The molecular elasticity of the extracellular matrix protein tenascin. Nature 393:181–185

Özkaya N, Nordin M (1999) Fundamentals of biomechanics: equilibrium, motion, and deformation. Springer, New York, NY

Panfilov AV, Holden AV (1997) Computational biology of the heart. John Wiley & Sons, London

Pioletti DP, Rakotomanana LR (2000) Non-linear viscoelastic laws for soft biological tissues. Eur J Mech A Solids 19:749–759

Popov EP (1999) Engineering mechanics of solids. Prentice-Hall, Englewood Cliffs, NJ

Pries AR, Secomb TW, Gaehtgens P (1995) Design principles of vascular beds. Circ Res 77:1017–1023

Provenzano PP, Lakes RS, Corr DT, Vanderby R Jr (2002) Application of nonlinear viscoelastic models to describe ligament behavior. Biomech Model Mechanobiol 1:45–57

Radmacher M, Tillmann RW, Fitz M, Gaub HE (1992) From molecules to cells: Imaging soft samples with the atomic force microscope. Science 257:1900–1905

Ratner BD (2003) Biomaterials science: introduction to materials in medicine. Academic Press, San Diego, CA

Roark RJ, Young WC (1975) Formulas for stress and strain. McGraw-Hill, New York, NY

Robert L, Hornbeck W (1989) Elastin and elastases, vol I. CRC Press, Boca Raton, FL

Roesler H (1987) The history of some fundamental concepts in bone biomechanics. J Biomech 20:1025–1034

Rosen LE, Hollis TM, Sharma MG (1974) Alterations in bovine endothelial histidine decarboxylase activity following exposure to shearing stresses. Exp Mol Pathol 20:329–343

Rubin CT, Lanyon L (1985) Regulation of bone mass by mechanical loading: the effect of peak strain magnitude. Calcif Tissue Int 37:441–447

Shah AD, Humphrey JD (1999) Finite strain elastodynamics of saccular aneurysms. J Biomech 32:593–599

Simon DD, Horgan CO, Humphrey JD (2012) Mechanical restrictions on biological responses by adherent cells within collagen gels. J Mech Behav Biomed Mater 14:216–226

Skalak R, Chien S (1987) Handbook of bioengineering. McGraw-Hill, New York, NY

Slattery JC (1981) Momentum, energy, and mass transfer in continua. Krieger, New York

Stamenovic D, Ingber DE (2002) Models of cytoskeletal mechanics of adherent cells. Biomech Model Mechanobiol 1:95–108

Sten-Knudsen O (1953) Torsional elasticity of the isolated cross striated muscle fibre. Acta Physiol Scand 28:7–240

Strang G (1986) Introduction to applied mathematics. Wellesley-Cambridge Press, Boston, MA

Suresh S (2007) Biomechanics and biophysics of cancer cells. Acta Biomater 3:413–438

Tanner RI (1985) Engineering rheology. Oxford University Press, Oxford

Ten Cate AR, Deporter DA (1975) The degradative role of the fibroblast in the remodelling and turnover of collagen in soft connective tissue. Anat Rec 182:1–14

Timoshenko SP, Goodier JN (1970) Theory of elasticity, 3rd edn. McGraw-Hill, New York, NY

Truesdell C, Noll W (1965) The nonlinear field theories of mechanics. In: Flugge S (ed) Handbuch der Physik. Springer, Berlin, Vol. III/3

Tsao Y-MD, Boyd E, Wolf DA, Spaulding G (1994) Fluid dynamics within a rotating bioreactor in space and earth environments. J Spacecraft Rockets 31:937–943

Usami S, Chen HH, Zhao Y, Chien S, Skalak R (1993) Design and construction of a linear shear stress flow chamber. Ann Biomed Eng 21:77–83

Vaughn J, Czipura A, Humphrey JD (2002) Measurement of the finite strain dependent permeability of biomembranes. J Biomech 35:287–291

Wagenseil J, Mecham RP (2012) Elastin in large artery stiffness and hypertension. J Cardiovasc Trans Res 5:264–273

Waldman LK, Fung YC, Covell JW (1985) Transmural myocardial deformation in the canine left ventricle: normal in vivo three-dimensional finite strains. Circ Res 57:152–163

Weibel ER (1963) Morphometry of the human lung. W.B. Saunders, Philadelphia, PA

Wells PB, Thomsen S, Jones MA, Baek S, Humphrey JD (2005) Histological evidence for the role of mechanical stress in modulating thermal denaturation of collagen. Biomech Model Mechanobiol 4:201–210

West JB (1979) Repiratory physiology: the essentials. Williams and Wilkens, Baltimore, MD

Wiebers DO et al (1998) Unruptured intracranial aneurysms: risk of rupture and risks of surgical intervention. International study of unruptured intracranial aneurysms investigators. N Engl J Med 339:1725–1733

Wineman AS, Rajagopal KR (2000) Mechanical properties of polymers: an introduction. Cambridge University Press, Cambridge

Wolf DA, Schwarz RP (1991) Analysis of gravity-induced particle motion and fluid perfusion flow in the NASA-designed rotating zero-head-space tissue culture vessel. NASA Technical Paper 3143. NASA, Washington, DC

Wolff J (1986) The law of bone remodeling. Springer, Berlin

Wylie CR, Barrett LC (1982) Advanced engineering mathematics. McGraw Hill, New York, NY

Zamir M (2000) The physics of pulsatile flow. Springer, New York, NY

Zhu C, Bao G, Wang N (2000) Cell mechanics: mechanical response, cell adhesion, and molecular deformation. Annu Rev Biomed Eng 2:189–226

Zubkov YN, Nokiforov BM, Shustin VA (1984) Balloon catheter technique for dilatation of constricted cerebral arteries after aneurysmal SAH. Acta Neurochir 70:65–79

Zwolak RM, Adams MC, Clowes AW (1987) Kinetics of vein graft hyperplasia: association with tangential stress. J Vasc Surg 5:126–136

About the Authors

Jay D. Humphrey is John C. Malone Professor and Chair of Biomedical Engineering at Yale University. He received the Ph.D. degree in Engineering Science and Mechanics from The Georgia Institute of Technology and completed a post-doctoral fellowship in Cardiovascular Research at The Johns Hopkins University. He has authored a book titled *Cardiovascular Solid Mechanics: Cells, Tissues, and Organs*, co-authored a book titled *Style and Ethics of Communication in Science and Engineering*, co-edited a book titled *Cardiovascular Soft Tissue Mechanics*, and authored or co-authored chapters for over 20 other books or encyclopedias as well as over 225 archival technical papers. He served as founding co-Editor In Chief for the international journal *Biomechanics and Modeling in Mechanobiology* and has served as Associate Editor for five other technical journals. He is a Fellow of the American Society of Mechanical Engineers (Bioengineering Division) and the American Institute of Medical and Biological Engineers, and currently serves as Chair of the United States National Committee on Biomechanics.

Sherry L. O'Rourke is a Technical Field Engineer at Medtronic, plc in the Cardiac Rhythm Disease Management Division. She received the B.S. and M.S. degrees in Biomedical Engineering from Texas A&M University and co-authored an archival paper on the biomechanics of the lens capsule of the eye, which is important in understanding device design for cataract surgery. Since graduation she has spent her professional life dedicated to designing, developing, and teaching programs to help physicians, residents, and nurses ensure that patients receive the maximum benefit from pacemakers and implantable defibrillators that are designed for those suffering from chronic heart disease.

J.D. Humphrey, S.L. O'Rourke, *An Introduction to Biomechanics*,
DOI 10.1007/978-1-4939-2623-7

Index

J.D. Humphrey, S.L. O'Rourke, *An Introduction to Biomechanics*,
DOI 10.1007/978-1-4939-2623-7