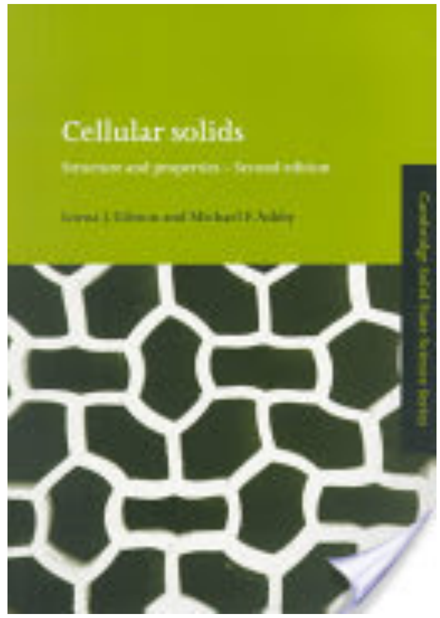
Professor Lorna J. Gibson



Lorna J. Gibson and Michael F. Ashby, Cellular Solids: Structure and Properties, Cambridge University Press, 1999, 510 pages

See:
https://dmse.mit.edu/faculty/profile/gibson
http://meche.mit.edu/sites/default/files/cv/ljgibson_CV.pdf
http://lornagibson.org/
https://www.edx.org/bio/lorna-j-gibson
http://sciencewriters2015.org/speakers/lorna-gibson

Matoula S. Salapatas Professor of Materials Science and Engineering; MacVicar Faculty Fellow
Gibson Group, Massachusetts Institute of Technology, Cambridge, Massachusetts, USA

Education:
BASc University of Toronto, 1978
PhD University of Cambridge, 1981

Research:
Many materials have a cellular structure, with either a two-dimensional array of prismatic cells, as in a honeycomb, or a three-dimensional array of polyhedral cells, as in a foam. Engineering honeycombs and foams can now be made from nearly any material: polymers, metals, ceramics, glasses and composites, with pore sizes ranging from nanometers to millimeters. Their cellular structure gives rise to a unique combination of properties which are exploited in engineering design: their low weight make them attractive for structural sandwich panels, their ability to undergo large deformations at relatively low stresses make them ideal for absorbing the energy of impacts, their low thermal conductivity make them excellent insulators, and their high specific surface area make them attractive for substrates for catalysts for chemical reactions. Cellular materials are increasingly used in biomedical applications. Open-cell titantium foams are being developed to replace trabecular bone. Porous scaffolds for regeneration of damaged or diseased tissues often resemble an open-cell foam. Cellular materials are also widespread in nature in plant and animal tissues: examples include wood, cork, plant parenchyma, trabecular bone and lung alveoli. Our group has contributed to the understanding of the mechanics of cellular

solids, as well as to their use in many of the above applications. Recently completed projects include: the design and characterization of osteochondral scaffolds for the regeneration of cartilage as well as the underlying bone; the mechanics of fluid flow through open-cell foams for protection from impacts; and low thermal conductivity aerogels for building applications. Current project include: structural bamboo products and the mechanics of balsa and balsa-inspired engineering materials.

Selected Publications:
Books:
Lorna J. Gibson and Michael F. Ashby, Cellular Solids: Structure and Properties, Cambridge University Press, 1999, 510 pages
Lorna J. Gibson, Michael F. Ashby and Brendan A. Harley, Cellular Materials in Nature and Medicine, Cambridge University Press, 2010, 309 pages

Journal Articles:
Gibson L, Ashby MF, Schajer GS, Robertson CI. 1982 The mechanics of two-dimensional cellular materials. Proc. R. Soc. Lond. A 382, 25–42. (doi:10.1098/rspa.1982.0087)
T.C. Triantafillou and L.J. Gibson (Department of Civil Engineering, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA 02139, U.S.A.), "Failure mode maps for foam core sandwich beams", Materials Science and Engineering, Vol. 95, November 1987, pp. 37-53, doi:10.1016/0025-5416(87)90496-4
Gibson L, Ashby MF, Zhang J, Triantafillou TC. 1989 Failure surfaces for cellular materials under multiaxial loads—I. Modelling. Int. J. Mech. Sci. 31, 635–663. (doi:10.1016/ S0020-7403(89)80001-3)
Triantafillou T, Zhang J, Shercliff TL, Gibson LJ, Ashby MF. 1989 Failure surfaces for cellular materials under multiaxial loads—II. Comparison of models with experiment. Int. J. Mech. Sci. 31, 665–678. (doi:10.1016/S0020-7403(89)80002-5)
G.N. Karam, L.J. Gibson: Elastic buckling of cylindrical shells with elastic cores I. Analysis. Int. J. Solids Structures, Vol 32, No. 8/9, 1995, pp.1259-1283.
G.N. Karam, L.J. Gibson: Elastic buckling of cylindrical shells with elastic cores - II. Experiments. Int. J. Solids Structures, Vol. 32, No. 8/9, 1995, pp. 1285-1306.
Gibson, L. J., Ashby, M. F., Karam, G. N., Wegst, U., Shercliff, H. R. (1995). Mechanical properties of natural materials. II. Microstructures for mechanical efficiency. Proceedings of The Royal Society of London. Series A 450:141–162.
Simone AE, Gibson LJ. The effects of cell face curvature and corrugations on the stiffness and strength of metallic foams. Acta Mater 1998;46:3929–35.
Guo XE, Gibson LJ. 1999 Behavior of intact and damaged honeycombs: a finite element study. Int. J. Mech. Sci. 41, 85–105.
Ashby, M.F., Evans, A.G., Fleck, N.A., Gibson, L.J., Hutchinson, J.W., Wadley, H.G.N., 2000. Metal Foams: a Design Guide. Butterworth-Heinemann, Boston.
J. C. Wallach and L. J. Gibson, "Defect sensitivity of a 3D truss material", Scripta Materialia 45:6 (2001), 639–644.
J. C. Wallach and L. J. Gibson, "Mechanical behavior of a three-dimensional truss material", International Journal of Solids and Structures 38 (2001), 7181–7196(16).
T. M. McCormack, R. Miller, O. Kesler and L. J. Gibson, "Failure of sandwich beams with metallic foam cores", International Journal of Solids and Structures, Vol. 38, Nos. 28-29, July 2001, pp. 4901-4920, doi:10.1016/S0020-7683(00)00327-9
Kesler O., Gibson L.J., 2002, Size effects in metallic foam core sandwich beams, Materials Science and Engineering A, 326, 228-234

Gibson, L.J., 2005. Biomechanics of cellular solids. J. Biomech. 38, 377e399
Matthew A. Dawson and Lorna J. Gibson, “Optimization of cylindrical shells with compliant cores”, International Journal of Solids and Structures, Vol. 44, Nos. 3-4, February 2007, pp. 1145-1160, doi:10.1016/j.ijsolstr.2006.06.009
Gibson LJ (2012) The hierarchical structure and mechanics of plant materials. Journal of the Royal Society, Interface / The Royal Society 9:2749–2766