

CURRICULUM VITAE

DAVID A. CARRINO

EDUCATION

John Carroll University, Cleveland, OH	B.S.	1972	Biology
Case Western Reserve University, Cleveland, OH	Ph.D.	1977	Biochemistry

EMPLOYMENT HISTORY

1977-1979 **Veteran's Administration Medical Center**
Cleveland, Ohio
Research Associate, Metabolism Section
Department of Medicine, laboratory of Dr. Richard E. Miller.

1979-Pres **Case Western Reserve University**
Cleveland, Ohio
Department of Biology; laboratory of Dr. Arnold I. Caplan.
1979-1981 Research Associate
1981-1992 Senior Research Associate
1993-2006 Researcher
2007-present Research Professor

1989-1990 **National Institutes of Health/National Institute of Dental Research**
Bethesda, Maryland
Sabbatical stay in the laboratory of Dr. Vincent C. Hascall

HONORS/AWARDS

John Carroll University; President's Honor Award, 1968-1972; Graduated *Summa Cum Laude*, 1972
Arthritis Foundation; Arthritis Investigator Award, 1984-1986
NIH; R01; "A Window into the Aging Process," Co-Principal Investigator (Arnold I. Caplan, Principal Investigator), 7/1/05-6/30/10

PROFESSIONAL ORGANIZATIONS

Society for Glycobiology
American Society for Matrix Biology
American Society for Biochemistry and Molecular Biology

PUBLICATIONS

1. Carrino, D. and Gershman, H. (1977) "Division of Balb/c mouse 3T3 and simian virus 40-transformed 3T3 cells in cellular aggregates." *Proc. Natl. Acad. Sci. USA* **74**, 3874-3878.
2. Miller, R.E. and Carrino, D.A. (1980) "Dibutyryl cyclic AMP decreases glutamine synthetase in cultured 3T3-L1 adipocytes." *J. Biol. Chem.* **255**, 5490-5500.

3. Gershman, H., Crissman, H.A. and Carrino, D.A. (1981) "Cell cycle parameters of 3T3 cells cultured as aggregates." *In Vitro* **17**, 143-149.
4. Miller, R.E. and Carrino, D.A. (1981) "An association between glutamine synthetase activity and adipocyte differentiation in cultured 3T3-L1 cells." *Arch. Biochem. Biophys.* **209**, 486-503.
5. Shogren, R., Jamieson, A.M., Blackwell, J., Carrino, D.A. and Caplan, A.I. (1982) "Characterization of proteoglycans from chick limb bud chondrocytes by photon correlation spectroscopy." *J. Biol. Chem.* **257**, 8627-8629.
6. Carrino, D.A. and Caplan, A.I. (1982) "Isolation and preliminary characterization of proteoglycans synthesized by skeletal muscle." *J. Biol. Chem.* **257**, 14145-14154.
7. Lennon, D.P., Osdoby, P., Carrino, D.A., Vertel, B.M. and Caplan, A. I. (1983) "Isolation and characterization of chondrocytes and non-chondrocytes from high-density chick limb bud cultures." *J. Craniofac. Genet. Develop. Biol.* **3**, 235-251.
8. Carrino, D.A., Lennon, D.P. and Caplan, A.I. (1983) "Extracellular matrix and the maintenance of the differentiated state: Proteoglycans synthesized by replated chondrocytes and non-chondrocytes." *Dev. Biol.* **99**, 132-134.
9. Shogren, R.L., Blackwell, J., Jamieson, A.M., Carrino, D.A., Pechak, D.G. and Caplan, A.I. (1983) "Light scattering studies of chick limb bud proteoglycan aggregate." *J. Biol. Chem.* **258**, 14741-14744.
10. Carrino, D.A., Pechak, D.G. and Caplan, A.I. (1984) "Characterization of proteoglycans which are synthesized during skeletal muscle development," in *Molecular and Cellular Aspects of Myogenesis* (Eppenberger, H. and Perriard, J.C. ed) pp. 80-86, S. Karger Publishers, Basel, Switzerland.
11. Carrino, D.A. and Caplan, A.I. (1984) "Isolation and partial characterization of high buoyant density proteoglycans synthesized *in ovo* by embryonic chick skeletal muscle and heart." *J. Biol. Chem.* **259**, 12419-12430.
12. Carrino, D.A. and Caplan, A.I. (1985) "Isolation and partial characterization of proteoglycans synthesized *in ovo* by embryonic chick cartilage and new bone." *J. Biol. Chem.* **260**, 122-127.
13. Pechak, D.G., Carrino, D.A. and Caplan, A.I. (1985) "Electron microscopic characterization of chick embryonic skeletal muscle proteoglycans." *J. Cell Biol.* **100**, 1767-1776.
14. Carrino, D.A., Weitzhandler, M. and Caplan, A.I. (1985) "Proteoglycans synthesized during the cartilage to bone transition," in *The Chemistry and Biology of Mineralized Tissues* (Butler, W.T., ed.) pp. 197-208, EBSCO Media, Birmingham.
15. Carrino, D.A. and Caplan, A.I. (1985) "Proteoglycan synthesis during skeletal muscle development," in *UCLA Symposia on Molecular and Cellular Biology*, Vol. 29 (C. Emerson, D.A. Fischman, B. Nadal-Ginard and M.A.Q. Siddiqui, ed) pp. 117-131, Alan R. Liss, Inc., NY, NY.
16. Kujawa, M.J., Carrino, D.A. and Caplan, A.I. (1986) "Substrate-bonded hyaluronic acid exhibits a size-dependent stimulation of chondrogenic differentiation of stage 24 limb mesenchymal cells in culture." *Dev. Biol.* **114**, 519-528.
17. Ohno, H., Blackwell, J., Jamieson, A.M., Carrino, D.A. and Caplan, A.I. (1986) "Calibration of the relative molecular mass of proteoglycan subunit by column chromatography on Sepharose CL-2B." *Biochem. J.* **235**, 553-557.
18. Ohno, H., Blackwell, J., Jamieson, A.M., Pechak, D.G., Carrino, D.A. and Caplan, A.I. (1986) "Structure of native proteoglycan aggregates from chick limb bud chondrocytes." *Biopolymers* **25**, 931-946.
19. Jamieson, A.M., Blackwell, J., Reihanian, H., Ohno, H., Gupta, R., Carrino, D.A., Caplan, A.I.,

- Tang, L.H. and Rosenberg, L.C. (1987) "Thermal and solvent stability of proteoglycan aggregates by quasielastic laser light-scattering." *Carbohydrate Res.* **160**, 329-342.
20. Haynesworth, S.E., Carrino, D.A. and Caplan, A.I. (1988) "Characterization of the core protein of the large chondroitin sulfate proteoglycan synthesized by chondrocytes in chick limb bud cell cultures." *J. Biol. Chem.* **262**, 10574-10581.
 21. Young, H.E., Carrino, D.A. and Caplan, A.I. (1988) "Initial characterization of small proteoglycans synthesized by embryonic chick leg muscle-associated connective tissues." *Conn. Tiss. Res.* **17**, 99-118.
 22. Weitzhandler, M., Carrino, D.A. and Caplan, A.I. (1988) "Proteoglycans synthesized during the cartilage to bone transition in developing chick embryos." *Bone* **9**, 225-233.
 23. Carrino, D.A., Oron, U., Pechak, D.G. and Caplan, A.I. (1988) "Reinitiation of chondroitin sulfate proteoglycan synthesis during skeletal muscle regeneration." *Development* **103**, 641-656.
 24. Carrino, D.A. and Caplan, A.I. (1989) "Structural characterization of chick embryonic skeletal muscle chondroitin sulfate proteoglycan." *Conn. Tiss. Res.* **19**, 35-50.
 25. Carrino, D.A., Kujawa, M.J., Lennon, D.P. and Caplan, A.I. (1989) "Altered cartilage proteoglycans synthesized by chick limb bud chondrocytes cultured in serum-free defined medium." *Exp. Cell Res.* **183**, 62-71.
 26. Young, H.E., Carrino, D.A. and Caplan, A.I. (1989) "Histochemical analysis of newly synthesized and accumulated sulfated glycosaminoglycans during musculogenesis in the embryonic chick leg." *J. Morphol.* **198**, 1-19.
 27. Carrino, D.A., Lidor, C., Edelstein, S. and Caplan, A.I. (1989) "Proteoglycan synthesis in vitamin D-deficient cartilage: Recovery from vitamin D deficiency." *Conn. Tiss. Res.* **19**, 135-147.
 28. Young, H.E., Carrino, D.A. and Caplan, A.I. (1990) "Change in synthesis of sulfated glycoconjugates during muscle development, maturation and aging in CBF-1 mouse." *Mech. Ageing Develop.* **53**, 179-193.
 29. Dennis, J.E., Carrino, D.A., Schwartz, N.B. and Caplan, A.I. (1990) "Ultrastructural characterization of embryonic chick cartilage proteoglycan core protein and the mapping of a monoclonal antibody epitope." *J. Biol. Chem.* **265**, 12098-12103.
 30. Snow, D.M., Lemmon, V., Carrino, D.A., Caplan, A.I. and Silver, J. (1990) "Sulfated proteoglycans in astroglial barriers inhibit neurite outgrowth *in vitro*." *Exp. Neurol.* **109**, 111-130.
 31. Fernandez, M.S., Dennis, J.D., Drushel, R.F., Carrino, D.A., Kimata, K., Yamagata, M. and Caplan, A.I. (1991) "The dynamics of compartmentalization of embryonic muscle by extracellular matrix molecules." *Dev. Biol.* **147**, 46-61.
 32. Lennon, D.P., Carrino, D.A., Baber, M.A. and Caplan, A.I. (1991) "Generation of a monoclonal antibody against avian small dermatan sulfate proteoglycan: Immunolocalization and tissue distribution of PG-II (decorin) in embryonic tissues." *Matrix* **11**, 412-427.
 33. Carrino, D.A., Arias, J.L. and Caplan, A.I. (1991) "A spectrophotometric modification of a sensitive densitometric Safranin O assay for glycosaminoglycans." *Biochem. Intl.* **24**, 485-495.
 34. Haynesworth, S.E., Carrino, D.A., and Caplan, A.I. (1991) "Comparison of the cartilage core protein synthesized by chondrocytes of different ages." *Conn. Tiss. Res.* **25**, 311-320.
 35. Arias, J.L., Carrino, D.A., Fernandez, M.S., Rodriguez, J.P., Dennis, J.E. and Caplan, A.I. (1992) "Partial biochemical and immunochemical characterization of avian eggshell extracellular matrices." *Arch. Biochem. Biophys.* **298**, 293-302.

36. Sorrell, J.M., Carrino, D.A. and Caplan, A.I. (1993) "Structural domains in chondroitin sulfate identified by anti-chondroitin sulfate monoclonal antibodies. Immunosequencing of chondroitin sulfates." *Matrix* **13**, 351-361.
37. Carrino, D.A. and Caplan, A.I. (1994) "The effects of β -D-xyloside on the synthesis of proteoglycans by skeletal muscle: Lack of effect on decorin and differential polymerization of core protein-bound and xyloside-linked chondroitin sulfate." *Matrix Biol.* **14**, 121-133.
38. Carrino, D.A., Dennis, J.E., Drushel, R.F., Haynesworth, S.E. and Caplan, A.I. (1994) "Identity of the core proteins of the large chondroitin sulfate proteoglycans synthesized by skeletal muscle and pre-chondrogenic mesenchyme." *Biochem J.* **298**, 51-60.
39. Wu, T.-M., Rodriguez, J.P., Fink, D.J., Carrino, D.A., Blackwell, J., Caplan, A.I. and Heuer, A.H. (1994) "Crystallization studies on avian eggshell membranes: Implications for the molecular factors controlling eggshell formation." *Matrix Biol.* **14**, 507-513.
40. Velleman, S.G., Yeager, J.D., Krider, H., Carrino, D.A., Zimmerman, S., and McCormick, R.J. (1996) "The avian Low Score Normal muscle weakness alters decorin expression and collagen crosslinking." *Conn. Tissue Res.* **34**, 33-39.
41. Sorrell, J.M., Carrino, D.A., and Caplan, A.I. (1996) "Regulated expression of chondroitin sulfates at sites of epithelial-mesenchymal interaction: spatio-temporal patterning identified with anti-chondroitin sulfate monoclonal antibodies." *Intl. J. Dev. Neurosci.* **14**, 233-248.
42. Carrino, D.A., Rodriguez, J.P. and Caplan, A.I. (1997) "Dermatan sulfate proteoglycans from the mineralized matrix of the avian eggshell." *Conn. Tissue Res.* **36**, 175-193.
43. Massé, P.G., Carrino, D.A., Morris, N., Wenger, L., Mahuren, J.D., and Howell, D.S. (1997) "Loss of decorin from the surface zone of articular cartilage in a chick model of osteoarthritis." *Acta Histochem.* **99**, 431-444.
44. Carrino, D.A. (1998) "Dynamic expression of proteoglycans during skeletal muscle development." *Basic Appl. Myol.* **8**, 95-106.
45. Sorrell, J.M., Carrino, D.A., Baber, M.A., and Caplan, A.I. (1999) "Versican in human fetal skin development." *Anat. Embryol.* **199**, 45-56.
46. Carrino, D.A., Sorrell, J.M., and Caplan, A.I. (1999) "Dynamic expression of proteoglycans during chicken skeletal muscle development and maturation." *Poultry Sci.* **78**, 769-777.
47. Sorrell, J.M., Carrino, D.A., Baber, M.A., Asselineau, D., and Caplan, A.I. (1999) "A monoclonal antibody which recognizes a glycosaminoglycan epitope in both dermatan sulfate and chondroitin sulfate proteoglycans of human skin." *Histochem. J.* **31**, 549-558.
48. Carrino, D.A., Sorrell, J.M., and Caplan, A.I. (2000) "Age-related changes in the proteoglycans of human skin." *Arch. Biochem. Biophys.* **373**, 91-101.
49. Dennis, J.E., Carrino, D.A., Yamashita, K., and Caplan, A.I. (2000) "Monoclonal antibodies to mineralized matrix molecules of the avian eggshell." *Matrix Biol.* **19**, 683-692.
50. Meechai, N., Jamieson, A.M., Blackwell, J., Carrino, D.A., and Bansal, R. (2001) "Non-linear viscoelasticity of concentrated solutions of aggrecan aggregate." *Biomacromolecules* **2**, 780-787.
51. Meechai, N., Jamieson, A.M., Blackwell, J., Carrino, D.A., and Bansal, R. (2002) "Viscoelastic properties of aggrecan aggregate solutions: Dependence on aggrecan concentration and ionic strength." *J. Rheol.* **46**, 685-707.
52. Naumann, A., Dennis, J.E., Awadallah, A., Carrino, D.A., Mansour, J.M., Kastenbauer, E, and Caplan, A.I. (2002) "Immunochemical and mechanical characterization of cartilage subtypes in rabbit." *J. Histochem. Cytochem.* **50**, 1049-1058.
53. Carrino, D.A., Önnérjörd, P., Sandy, J.D., Cs-Szabo, G., Scott, P.G., Sorrell, J.M., Heinegård,

- D., and Caplan, A.I. (2003) "Age-related changes in the proteoglycans of human skin: a major catabolic fragment of decorin in adult skin." *J. Biol. Chem.* **278**, 17566-17572.
54. Sorrell, J.M., Baber, M.A., Brinon, L., Carrino, D.A., Seavolt, M., Asselineau, D., and Caplan, A.I. (2003) "Production of a monoclonal antibody, DF-5, that identifies cells at the epithelial-mesenchymal interface in normal human skin. APN/CD13 is an epithelial-mesenchymal marker in skin." *Exp.Dermatol.* **12**, 315-323.
 55. Carrino, D.A., Calabro, A., Darr, A.B., Dours-Zimmermann, M.T., Sandy, J.D., Zimmermann, D.R., Sorrell, J.M., Hascall, V.C., and Caplan, A.I. (2007) "Age-related changes in the proteoglycans of human skin: versican and decorin." In preparation.
 56. Pineau, N., Carrino, D.A., Caplan, A.I., and Breton, L. (2007) "Effect of a β -xyloside-like compound on wound healing." In preparation.
 57. Engle, J.M., Carrino, D.A., Caplan, A.I., and Apte, S.S. (2007) "Analysis of proteoglycans from human placenta." In preparation.

PRESENTATIONS AND OTHER ACCOMPLISHMENTS

- June 30, 1982: platform presentation, "Proteoglycans synthesized by skeletal muscle *in vitro* and *in vivo*." Third International Conference on Limb Development and Regeneration; University of Connecticut, Storrs, CT.
- November 5, 1987: platform presentation, "Analysis of proteoglycan core proteins by gel electrophoresis and electron microscopy." Annual meeting of the Society for Complex Carbohydrates; Bethesda, MD.
- March 3, 1995: invited departmental seminar, "The avian eggshell and its extracellular matrix as a model of biomineralization." University of Connecticut, Department of Animal Science; host: Sandra G. Velleman.
- October 26, 1995: platform presentation, "The avian eggshell extracellular matrix as a model for biomineralization." Fifth International Conference on the Chemistry and Biology of Mineralized Tissues; Kohler, WI.
- October 24-25, 1997: Co-organizer (with Ronald J. Midura, Vincent C. Hascall, and Arnold I. Caplan) of Midwest Connective Tissue Workshop; Cleveland, OH.
- August 2, 1998: invited speaker, "Dynamic expression of proteoglycans during chicken skeletal muscle development and maturation." Poultry Science Symposium, Poultry Science Ancillary Scientist Symposium on Muscle Growth and Development; Pennsylvania State University, University Park, PA. Chairpersons: Sandra G. Velleman, Ohio Agricultural Research and Development Center (OARDC), Ohio State University and Regina Vasilatos-Younken, Pennsylvania State University.
- October 25, 2000: invited departmental seminar, "Analysis of mineralized and non-mineralized connective tissue extracellular matrix." Northeastern Ohio Universities College of Medicine (NEOUCOM), Department of Biochemistry and Molecular Pathology; hosts: Donna King/William J. Landis.
- October 25, 2001: invited departmental seminar, "Proteoglycans of skin and other tissues: structures, biological roles, and age-related differences." L=Oréal Life Sciences Research; Clichy, France; host: Daniel Asselineau, L=Oréal Life Sciences Research.
- February 20, 2002: course lecture, "Small leucine-rich proteoglycans." Cleveland State University/Cleveland Clinic Foundation Graduate Course, "Biology of Extracellular Matrix." Instructor: Cahir A. McDevitt, Cleveland Clinic Foundation.

September 19, 2002: platform presentation, "Age-related changes in the proteoglycans of human skin." The Science and Technology of Skin Aging, Second International Symposium, sponsored by L=Oréal Recherche and Case Western Reserve University; Cleveland, OH. Scientific Organizers: Daniel Asselineau, L=Oréal Life Sciences Research and Arnold I. Caplan, Case Western Reserve University.

October 11-12, 2002: Co-organizer (with Ronald J. Midura) of Midwest Connective Tissue Workshop; Rush University Medical Center, Chicago, IL.

July 12, 2004: platform presentation, "Age-related changes in the proteoglycans of human skin: differences in structure and catabolism." Gordon Research Conference on Proteoglycans; Proctor Academy, Andover, NH. Chairperson: Anna H. Plaas, University of South Florida.

October 14, 2004: invited speaker, "Proteoglycans in skin aging." The Science and Technology of Skin Engineering, Third International Symposium, sponsored by L=Oréal Recherche; Lausanne, Switzerland. Scientific Organizer: Daniel Asselineau, L=Oréal Life Sciences Research.

March 17, 2005: invited seminar, "Age-related changes in the proteoglycans of human skin: differences in structure and catabolism." Case Western Reserve University/Cleveland Clinic Foundation Musculoskeletal Research Seminar Series; host: Thomas M. Hering.

October 3-6, 2005: invited speaker, "Proteoglycans: structures, biological roles, and potential involvement in biomineralization." University of Chile, Santiago, Chile; a series of lectures and laboratory instruction as part of a course on biomineralization; host José Luis Arias.

Midwest Connective Tissue Workshop platform presentations; Rush-Presbyterian-St. Luke=s Medical Center/Rush University Medical Center, Chicago, IL:

October 31, 1980: "Proteoglycans from non-cartilage cells"

November 14, 1986: "Immunological and structural aspects of skeletal muscle proteoglycan"

November 12, 1988: "Skeletal muscle chondroitin sulfate proteoglycan: a cell surface progenitor of the basement membrane"

November 16, 1990: "Comparison of the core proteins of the large chondroitin sulfate proteoglycans from cartilage and skeletal muscle by one-dimensional peptide mapping, rotary shadowing, and immunological probing"

November 1, 1996: "Proteoglycans in early skin development: *in vitro* analysis"

November 20, 1998: "A truncated form of decorin from postnatal human skin"

October 20, 2001: "Age-related changes in the proteoglycans of human skin"

Manuscript critiques (1988-2007): Evaluation of manuscripts and preparation of critiques for a number of journals- *Archives of Biochemistry and Biophysics* (3 manuscripts), *Biochemical Journal* (5 manuscripts), *Biochemistry* (1 manuscript), *Biotechnic and Histochemistry* (1 manuscript), *Carbohydrate Research* (1 manuscript), *Connective Tissue Research* (8 manuscripts), *Developmental Biology* (5 manuscripts), *Experimental Cell Research* (2 manuscripts), *Journal of Animal Science* (1 manuscript), *Journal of Biological Chemistry* (19 manuscripts), *Journal of Cell Biology* (1 manuscript), *Journal of Cellular Physiology* (1 manuscript), *Journal of Investigative Dermatology* (1 manuscript), *Matrix Biology* (formerly *Matrix*) (3 manuscripts), *Proceedings of the Society for Experimental Biology and Medicine* (1 manuscript).

Many of the manuscripts, particularly in the past ten years, were sent directly to me by the editors.

Grant reviews: Arthritis Foundation, Biochemistry Study Section (2004-2006)