

REFERENCES

Aimes, R.T. and Quigley, J.P. 1995. Matrix metalloproteinase-2 is an interstitial collagenase. Inhibitor-free enzyme catalyzes the cleavage of collagen fibrils and soluble native type I collagen generating the specific 3/4- and 1/4-length fragments. *J Biol Chem.*, 270: 5872-5876.

Ala-aho, R., Kähäri, V.M. 2005. Collagenases in cancer. *Biochimie.*, 87: 273-286.

Arjen R. Companjen, Vicent H.J. van der Velden, André Vooyo, Reno Debets, Robert Benner, Errol P. Prens. 2000. Human keratinocytes are major producers of IL-18: predominant expression of the unprocessed form. *European Cytokine Network*. Volume 11, Number 3, 383-90

Azzam, H.S., Thompson, E.W. 1992. Collagen-induced activation of the M(r) 72,000 type IV collagenase in normal and malignant human fibroblastoid cells. *Cancer Res.*, 52: 4540-4544.

Baggiolini, M., Walz, A., Kunkel, S.L. 1989. Neutrophil-activating peptide-1/interleukin 8, a novel cytokine that activates neutrophils. *J. Clin. Invest.*, 84: 1045-1049.

Baggiolini, M., Dewald, B., Moser, B. 1994. Interleukin-8 and related chemotactic cytokines--CXC and CC chemokines. *Adv. Immunol.*, 55: 97-179.

Bartold, P.M., Gully, N.J., Zilm, P.S., Rogers, A.H. 1991. Identification of components in *Fusobacterium nucleatum* chemostat-culture supernatants that are potent inhibitors of human gingival fibroblast proliferation. *J. Periodont. Res.*, 26: 314-322.

- Bauer, E. A., Stricklin, G. P., Jeffrey, J. J., and Eisen, A.Z. 1975. Collagenase production by human skin fibroblasts. *Biochem. Biophys. Res. Commun.*, 64: 232–240.
- Bergers, G., Brekken, R., McMahon, G., Vu, T.H., Itoh, T., Tamaki, K., Tanzawa, K., Thorpe, P., Itohara, S., Werb, Z., Hanahan, D. 2000. Matrix metalloproteinase-9 triggers the angiogenic switch during carcinogenesis. *Nat. Cell Biol.*, 2: 737–744.
- Billah, M.M., Anthes, J.C. 1990. The regulation and cellular functions of phosphatidylcholine hydrolysis. *Biochem J.*, 269: 281-291.
- Birkedal-Hansen, H. 1993. Role of matrix metalloproteinases in human periodontal diseases. *J. Periodontol.*, 64(5 Suppl): 474-484.
- Birkedal-Hansen, H., Moore, W.G., Bodden, M.K., Windsor, L.J., Birkedal-Hansen, B., DeCarlo, A., Engler, J.A. 1993. Matrix metalloproteinases: a review. *Crit. Rev. Oral Biol. Med.*, 4: 197-250.
- Birkedal-Hansen, H. 1995. Proteolytic remodeling of extracellular matrix. *Curr. Opin. Cell Biol.*, 7: 728–735.
- Bligh, E. G. and Dyer, W. J. 1959. A rapid method of total lipid extraction and purification. *Can. J. Biochem. Physiol.*, 37:911.
- Björklund, M., Koivunen, E. 2005. Gelatinase-mediated migration and invasion of cancer cells. *Biochim. Biophys. Acta.*, 25: 37–69.
- Bolcato-Bellemin, A.L., Elkaim, R., Abehsera, A., Fausser, J.L., Haikel, Y., Tenenbaum, H. 2000. Expression of mRNAs encoding for alpha and beta integrin subunits, MMPs, and TIMPs in stretched human periodontal ligament and gingival fibroblasts. *J Dent Res.*, 79: 1712-1716.

- Bolstad, A.I., Jensen, H.B., Bakken, V. 1996. Taxonomy, Biology, and Periodontal Aspects of *Fusobacteriumnucleatum*. *Clin.Microbiol. Rev.*, 1: 55–71.
- Bonventre, J. V. 1999. The 85-kD Cytosolic Phospholipase A₂ Knockout Mouse: A New Tool for Physiology and Cell Biology *J. Am. Soc. Nephrol.*, 10: 404–412.
- Bosshardt, D.D, Lang, N.P. 2005. The junctional epithelium: from health to disease. *J. Dent. Res.*, 84: 9-20.
- Brassart, B., Randoux, A., Hornebeck, W., Emonard, H. 1998. Regulation of matrix metalloproteinase-2 (gelatinase A, MMP-2), membrane-type matrix metalloproteinase-1 (MT1-MMP) and tissue inhibitor of metalloproteinases-2 (TIMP-2) expression by elastin-derived peptides in human HT-1080 fibrosarcoma cell line. *ClinExp Metastasis.*, 16: 489-500.
- Brindley, D.N, Waggoner, D.W. 1998. Mammalian lipid phosphate phosphohydrolases. *J Biol Chem.*, 273: 24281-24284.
- Brown, D.J., Bishop, P., Hamdi, H., Kenney, M.C. 1996. Cleavage of structural components of mammalian vitreous by endogenous matrix metalloproteinase-2. *Curr Eye Res.*, 15: 435-445.
- Brown, F.D., Thompson, N., Saqib, K.M., Clark, J.M., Powmer, D., Thompson, N.T. Solari, R., Wakelam, M.J., 1998. Phospholipase D₁ localised to secretory granules and lysosomes and is plasma-membrane translocated on cellular stimulation. *Curr. Biol.*, 8: 835-838.
- Chang, Y.C., Yang, S.F., Lai, C.C., Liu, J.Y., Hsieh, Y.S. 2002. Regulation of matrix metalloproteinase production by cytokines, pharmacological agents and periodontal pathogens in human periodontal ligament fibroblast cultures. *J. periodont. Res.*, 37; 196-203.

- Chakraborti, S., Mandal, M., Das, S., Mandal, A., Chakraborti, T. 2003. Regulation of matrix metalloproteinases: an overview. *Mol Cell Biochem.*, 253: 269-285.
- Cho, H.J., Kang, J.H., Kwak, J.Y., Lee, T.S., Lee, I.S., Park, N.G., *et al.* 2007. Ascofuranone suppresses PMA-mediated matrix metalloproteinase-9 gene activation through the Ras/Raf/MEK/ERK- and AP1-dependent mechanisms. *Carcinogenesis*, 28: 1104–1110.
- Clark, J.D., Milona, N., Knopf, J.L. 1990. Purification of a 110-kilodalton cytosolic phospholipase A₂ from the human monocytic cell line U937. *Proc Natl Acad Sci U S A.*, 87: 7708-7712.
- Colley, W. C., Sung T. C., Roll, R., Jenco, J., Hammond, S. M., Altshuller, Y., Barsagi, D., Morris, A. J., Frohman, M. A.. 1997. Phospholipase D₂, a distinct phospholipase D isoform with novel regulatory properties that provokes cytoskeletal reorganization. *Curr. Biol.*, 7: 191-201.
- Cox, S.W., Eley, B.M., Kiili, M., Asikainen, A., Tervahartiala, T., Sorsa, T. 2006. Collagen degradation by interleukin-1 β -stimulated gingival fibroblasts is accompanied by release and activation of multiple matrix metalloproteinases and cysteine proteinases. *Oral Dis.*, 12: 34–40.
- Coussens, L.M., Tinkle, C.L., Hanahan, D., Werb, Z. 2000. MMP-9 supplied by bone marrow derived cells contributes to skin carcinogenesis. *Cell*, 103: 481–490.
- Creemers, L.B., Jansen, I.D., Docherty, A.J., Reynolds, J.J., Beertsen, W., Everts, V. 1998. Gelatinase A (MMP-2) and cysteine proteinases are essential for the degradation of collagen in soft connective tissue. *Matrix Biol.*, 17: 35-46.

- Cummings, R., Parinandi, N., Wang, L., Usatyuk, P., Natarajan, V. 2002. Phospholipase D/Phosphatidic acid signal transduction: Role and physiological significance in lung. *Mol. Cell Biochem.*, 234-235 ; 99-109.
- Cury, J. D., Campbell, E. J., Lazarus, C. J., Albin, R. J., Welgus, H. G. 1988. Selective up-regulation of human alveolar macrophage collagenase production by lipopolysaccharide and comparison to collagenase production by fibroblasts. *J. Immunol.*, 141: 4306–4312.
- Darveau, R.P., Belton, C.M., Reife, R.A., Lamont, R.J. 1998. Local chemokine paralysis, a novel pathogenic mechanism for *Porphyromonas gingivalis*. *Infect. Immun.*, 66: 1660-1665.
- Dennis, E. A. 1994. Diversity of group types, regulation, and function of phospholipase A₂. *J. Biol. Chem.*, 269: 13057–13060.
- Dennis, E. A. 1997. The growing phospholipase A₂ superfamily of signal transduction enzymes. *Trends Biochem. Sci.*, 22: 1–2.
- Diaz, O., Berquand, A., Dubois, M., Di Agostino, S., Sette, C., Bourgoin, S., Lagarde, M., Nemoz, G., Prigent, A.F. 2002. The mechanism of docosahexaenoic acid-induced phospholipase D activation in human lymphocytes involves exclusion of the enzyme from lipid rafts. *J Biol Chem.*, 277: 39368-39378.
- Dinarello, C.A. 1994. The biological properties of interleukin-1. *EurCyt Net.*, 5: 517–532.
- Dinarello, C.A. 2002. The IL-1 family and inflammatory diseases. *ClinExpRheumatol.*, 20(Suppl. 27): S1–S13.

- Ding, Y., Uitto, V.J., Firth, J., Salo, T., Haapasalo, M., Kontinen, Y.T., Sorsa, T. 1995. Modulation of host matrix metalloproteinases by bacterial virulence factors relevant in human periodontal diseases. *Oral Dis.*, 1: 279-286.
- Ding, Y., Haapasalo, M., Kerosuo, E., Lounatmaa, K., Kotiranta, A., Sorsa, T. 1997. Release and activation of human neutrophil matrix metallo- and serine proteinases during phagocytosis of *Fusobacteriumnucleatum*, *Porphyromonasgingivalis* and *Treponemadenticola*. *J. Clin. Periodontol.*, 24: 237-248.
- Divecha, N., Roefs, M., Halstead, J.R., Andrea, S.D., Fernandez, B.M., Oomen, L., Saqib, K.M., Wakelam, M.J., D'Santos, C. 2000. Interaction of the type I alpha PIPkinase with phospholipase: a role for the local generation of phosphatidylinositol 4,5-biphosphate in the regulation of PLD₂ activity. *EMBO J.*, 19: 5440-5449.
- Domisch, H., Winter, J., Willebrand, C., Eberhard, J., Jepsen, S. 2007. Immune regulatory functions of human beta-defensin-2 in odontoblast-like cells. *IntEndod J.*, 40: 300-307.
- Dong, W., Xiang, J., Li, C., Cao, Z., Huang, Z. 2009. Increased expression of extracellular matrix metalloproteinase inducer is associated with matrix metalloproteinase-1 and -2 in gingival tissues from patients with periodontitis. *J Periodontal Res.*, 44: 125-132.
- Du, G., Altshuler, Y.M., Vitale, N., Huang, P., Chasserot-Golaz, S., Morris, A.J., Bader, M.F., Frohman, M.A. 2003. Regulation of phospholipase D₁ subcellular cycling through coordination of multiple membrane association motifs. *J. Cell. Biol.*, 162: 305-315.

- Dzink, J.L., Tanner, A.C.R., Haffajee, A.D., Socransky, S.S. 1985. Gram negative species associated with destructive periodontal lesion. *J. Clin. Microbiol.*, 12: 648-659.
- Egeblad, M., Werb, Z. 2002. New functions for the matrix metalloproteinases in cancer progression. *Nat. Rev. Cancer.*, 2: 161-174.
- Ejeil, A.L., Igondjo-Tchen, S., Ghomrasseni, S., Pellat, B., Godeau, G., Gogly, B. 2003. Expression of matrix metalloproteinases (MMPs) and tissue inhibitors of metalloproteinases (TIMPs) in healthy and diseased human gingiva. *J Periodontol.*, 74: 188-195.
- Ella, K.M., Meier, K.E., Kumar, A., Zhang, Y., Meier, G.P. 1997. Utilization of alcohols by plant and mammalian phospholipase D. *Biochem Mol Biol Int.*, 1: 715-724.
- Feuille, F., Ebersole, J.L., Kesavalu, L., Stepfen, M.J., Holt, S.C. 1996. Mixed infection with *Porphyromonasegingivalis* and *Fusobacteriumnucleatum* in a murine lesion model: potential synergistic effects on virulence. *Infect. Immu.*, 64: 2094-2100.
- Flamand, N., Picard, S., Lemieux, L., Pouliot, M., Bourgoin, S.G., Borgeat, P. 2006. Effects of pyrrophenone, an inhibitor of group IVA phospholipase A₂, on eicosanoid and PAF biosynthesis in human neutrophils. *Br J Pharmacol.*, 149: 385-392.
- Folgueras, A.R., Pendás, A.M., Sánchez, L.M., López-Otín, C. 2004. Matrix metalloproteinases in cancer: from new functions to improved inhibition strategies. *Int. J. Dev. Biol.*, 48: 411-424.

Freyberg, Z., Sweeney, D., Siddhanta, A., Bourgoin, S., Frohman, M., Shield, D. 2001. Intracellular localization of phospholipase D₁ in mammalian cells. *Mol. Biol. Cell.*, 12: 943-955.

Frohman, M.A., Sung, T.C., Morris, A.J. 1999. Mammalian phospholipase D structure and regulation. *BiochimBiophysActa.*, 1439:175-186.

Funk, C.D. 2001. Prostaglandins and leukotrienes: advances in eicosanoid biology, *Science*, 294: 1871–1875.

Ghomashchi, F., Stewart, A., Hefner, Y., Ramanadham, S., Turk, J., Leslie, C.C., Gelb, M.H. 2001. A pyrrolidine-based specific inhibitor of cytosolic phospholipase A₂(α) blocks arachidonic acid release in a variety of mammalian cells. *BiochimBiophysActa.*, 1513: 160-166.

Golub, L.M., Wolff, M., Roberts, S., Lee, H.M., Leung, M., Payonk, G.S. 1994. Treating periodontal diseases by blocking tissue-destructive enzymes. *J. Am. Dent. Assoc.*, 125: 163–169.

Gorovetz, M., Baekelandt, M., Berner, A., Claes, G., Trope, C.G., Davidson, B., Reich, R. 2006. The clinical role of phospholipase A₂ isoforms in advanced-stage ovarian carcinoma. *Gynecol. Oncol.*, 103: 831–840.

Gorovetz, M., Schwob, O., Krinsky, M., Yedgar, S., Reich, R. 2008. MMP production in human fibrosarcoma cells and their invasiveness are regulated by group IB secretory phospholipase A₂ receptor-mediated activation of cytosolic phospholipase A₂. *Front. Biosci.*, 13: 1917-1925.

Granlund-Edstedt, M., Johansson, E., Claesson, R., Carlsson, J. 1993. Effect of anaerobiosis and sulfide on killing of bacteria by polymorphonuclear leukocytes. *J. Periodont. Res.*, 28: 346-353.

Green, J.A., Yamada, K.M. 2007. Three-dimensional microenvironments modulate fibroblast signalling responses. *Adv Drug Deliv Rev.*, 59: 1293–1298.

Hadler-Olsen, E., Fadnes, B., Sylte, I., Uhlin-Hansen, L., Winberg, J.O. 2011. Regulation of matrix metalloproteinase activity in health and disease. *FEBS J.*, 278: 28-45.

Hammond, S.M., Altshuller, Y.M., Sung, T.C., Rudge, S.A., Rose, K., Engebrecht, J., Morris, A.J., Frohman, M.A.. 1995. Human ADP-ribosylation factor-activated phosphatidylcholine-specific phospholipase D defines a new and highly conserved gene family. *J. Biol. Chem.*, 270: 29640-29643.

Hammond, S.M., Jenco, J.M., Nakashima, S., Cadwallader, K., Gu, Q.M., Cook, S., Nozawa, Y., Prestwich, G.D., Frohman, M.A., Morris, A.J. 1997. Characterization of two alternatively spliced forms of phospholipase D₁. Activation of the purified enzymes by phosphatidylinositol 4,5-bisphosphate, ADP-ribosylation factor, and Rho family monomeric GTP-binding proteins and protein kinase C- α . *J. Biol. Chem.*, 272: 3860-3868.

Han, Y.W., Shi, W., Huang, G.T., Kinder Haake, S., Park, N.H., Kuramitsu, H., Genco, R.J. 2000. Interactions between periodontal bacteria and human oral epithelial cells: *Fusobacterium nucleatum* adheres to and invades epithelial cells. *Infect Immun.*, 68: 3140-3146.

Havemose-Poulsen, A., Holmstrup, P. 1997. Factors affecting IL-1-mediated collagen metabolism by fibroblasts and the pathogenesis of periodontal disease: a review of the literature. *Crit Rev Oral Biol Med.*, 2: 217-236.

- Hirabayashi, T., Murayama, T., Shimizu, T. 2004. Regulatory mechanism and physiological role of cytosolic phospholipase A₂. *Biol Pharm Bull.*, 27: 1168-1173.
- Heller, M. 1978. Phospholipase D. *Adv Lipid Res.*, 16: 267-326.
- Ho, W.T., Exton, J.H., Williger, B.T. 2003. Arfaptin 1 inhibits ADP-ribosylation factor-dependent matrix metalloproteinase-9 secretion induced by phorbol ester in HT 1080 fibrosarcoma cells. *FEBS Letters*, 537: 91-95.
- Holmlund, A., Hänström, L., Lerner, U.H. 2004. Bone resorbing activity and cytokine levels in gingival crevicular fluid before and after treatment of periodontal disease. *J Clin Periodontol.*, 31: 475-482.
- Honda, A., Nogami, M., Yokozeki, T., Yamazaki, M., Nakamura, H., Watanabe, H., Kawamoto, K., Nakayama, K., Morris, A.J., Frohman, M.A., Kanaho, Y. 1999. Phosphatidylinositol 4-phosphate 5-kinase alpha is a downstream effector of the small G protein ARF6 in membrane ruffle formation. *Cell*, 99: 521-532.
- Hu, T., Exton, J.H. 2005. 1-Butanol interferes with phospholipase D1 and protein kinase C α association and inhibits phospholipase D1 basal activity. *Biochem Biophys Res Commun.*, 327: 1047-1051.
- Huang, G.T., Haake, S.K., Park, N.H. 1998. Gingival epithelial cells increase interleukin-8 secretion in response to *Actinobacillus actinomycetemcomitans* challenge. *J. Periodontol.*, 69: 1105-1110.

- Huang, P., Altshuler, Y.M., Chunqiu, H.J., Pessin, J.E., Frohman, M.A. 2005. Insulin-stimulated plasma membrane fusion of Glut4 glucose transporter-containing vesicles is regulated by phospholipase D₁. *Mol. Biol. Cell.*, 16: 2614-2623.
- Huynh-Ba, G., Lang, N.P., Tonetti, M.S., Salvi, G.E. 2007. The association of the composite IL-1 genotype with periodontitis progression and / or treatment outcomes: a systematic review. *J Clin Periodontol.*, 34: 305–317.
- Ii, H., Hontani, N., Toshida, I., Oka, M., Sato, T., Akiba, S. 2008. Group IVA phospholipase A₂-associated production of MMP-9 in macrophages and formation of atherosclerotic lesions. *Biol Pharm Bull.*, 31: 363-368.
- Isogai, E., Isogai, H., Sawada, H., Kaneko, H., Ito, N. 1985. Microbial ecology of plaque in rats with naturally occurring gingivitis. *Infect. Immunol.*, 48: 520-527.
- Jenkins, G.M., Frohman, M.A. 2005. Phospholipase D: a lipid centric review. *Cell. Mol. Life Sci.*, 62: 2305-2316.
- Kagnoff, M.F., Eckmann, L. 1997. Epithelial cells as sensors for microbial infection. *J. Clin. Invest.*, 100: 6-10.
- Katayama, K., Kodaki, T., Nagamachi, Y., Yamashita, S. 1998. Cloning, differential regulation and tissue distribution of alternatively spliced isoforms of ADP-ribosylation-factor-dependent phospholipase D from rat liver. *Biochem. J.*, 329: 647–652.
- Kennell, W., Holt S.C. 1990. Comparative studies of the outer membranes of *Bacteroides gingivalis*, strains ATCC 33277, W50, W83, 381. *Oral Microbiol. Immunol.* 5: 121–130.

Kita, Y., Ohto, T., Uozumi, N., Shimizu, T. 2006. Biochemical properties and pathophysiological roles of cytosolic phospholipase A₂s. *Biochim Biophys Acta.*, 1761: 1317-1322.

Kivelä-Rajamäki, M., Maisi, P., Srinivas, R., Tervahartiala, T., Teronen, O., Husa, V., Salo, T., Sorsa, T. 2003. Levels and molecular forms of MMP-7 (matrilysin-1) and MMP-8 (collagenase-2) in diseased human peri-implant sulcular fluid. *J. Periodontal. Res.*, 38: 583-590.

Kobayashi, T., Onoda, N., Takagi, T., Hori, H., Hattori, S., Nagai, Y., Tajima, S., Nishikawa, T. 1996. Immunolocalizations of human gelatinase (type IV collagenase, MMP-9) and TIMP (tissue inhibitor of metalloproteinases) in normal epidermis and some epidermal tumors. *Arch. Dermatol. Res.*, 288: 239-244.

Kononen, E., Asikainen, S., Saarela, M., Karjalainen, J., Jousimies-Somer, H. 1994. The oral Gram negative anaerobic microflora in young children: longitudinal change from edentulous to dentate mouth. *Oral Microbiol. Immunol.*, 9: 136-141.

Korostoff, J.M., Wang, J.F., Sarment, D.P., Stewart, J.C., Feldman, R.S., Billings, P.C. 2000. Analysis of in situ protease activity in chronic adult periodontitis patients: expression of activated MMP-2 and a 40 kDa serine protease. *J. Periodontol.*, 71: 353-360.

Kornman, K.S., Page, R.C., Tonnerri, M.S. 1997. The host response to the microbial challenge in periodontitis: assembling the players. *Periodontol.* 2000, 14: 33-53.

- Kodaki, T., Yamashita, S. 1997. Cloning, expression and characterization of a novel Phospholipase D cDNA from rat brain. *J. Biol. Chem.*, 272: 11408–11413.
- Krisanaprakornkit, S., Weinberg, A., Perez, C.N., Dale, B.A. 1998. Expression of the peptide antibiotic human β -defensin 1 in cultured gingival epithelial cells and gingival tissue. *Infect. Immun.*, 66: 4222-4228.
- Krisanaprakornkit, S., Kimball, J.R., Weinberg, A., Darveau, R.P., Bainbridge, B.W., Dale, B.A. 2000. Inducible expression of human β -defensin-2 (hBD-2) by *Fusobacterium nucleatum* in oral epithelial cells: multiple signaling pathways and the role of commensal bacteria in innate immunity and the epithelial barrier. *Infect. Immun.*, 68: 2907-2915.
- Krisanaprakornkit, S., Chotjumlong, P., Kongtawelert, P., Reutrakul, V. 2008. Involvement of phospholipase D in regulating expression of anti-microbial peptide human beta-defensin-2. *Int. Immunol.*, 20: 21-29.
- Lee, C., Lee, J., Choi, Y.A., Kang, S.S., Baek, S.H. 2006. cAMP elevating agents suppress secretory phospholipase A₂-induced matrix metalloproteinase-2 activation. *Biochem Biophys Res Commun.*, 340: 1278-1283.
- Legate, K.R., Wickström, S.A., Fässler, R. 2009. Genetic and cell biological analysis of integrin outside-in signalling. *Genes Dev.*, 23: 397–418.
- Li, D.Q., Lokeshwar, B.L., Solomon, A., Monroy, D., Ji, Z., Pflugfelder, S.C. 2001. Regulation of MMP-9 production by human corneal epithelial cells. *Exp Eye Res.*, 73: 449-459.
- Liscovitch, M., Czarny, M., Fiucci, G., Lavie, Y., Tang, X. 1999. Localization and possible functions of phospholipase D isozymes. *Biochim Biophys Acta.*, 1439: 245-263.

- Lopatin, D.E., Martel, L.M., Mangan, D.F. 1985. Microbe-induced lymphocyte blastogenesis enhancement after preculture. *Infect. Immun.*, 48: 159-164.
- Lopatin, D.E., Blackburn, E. 1986. Sensitization with *Fusobacterium nucleatum* targets antibody-dependent cellular cytotoxicity to mammalian cells. *Infect. Immun.*, 52: 650-656.
- Lopez, I., Arnold, R.S., Lambeth, J.D. 1998. Cloning and initial characterization of a human phospholipase D₂ (hPLD₂). ADP-ribosylation factor regulates hPLD₂. *J. Biol. Chem.*, 273: 12846-12852.
- Liu, Y.C., Lerner, U.H., Teng, Y.T. 2010. Cytokine responses against periodontal infection: protective and destructive roles. *Periodontol 2000*, 5: 163-206.
- Mäkelä, M., Salo, T., Uitto, V.J., Larjava, H. 1994. Matrix metalloproteinases (MMP-2 and MMP-9) of the oral cavity: cellular origin and relationship to periodontal status. *J. Dent. Res.*, 73: 1397-1406.
- Mäkelä, M., Larjava, H., Pirilä, E., Maisi, P., Salo, T., Sorsa, T., *et al.* 1999. Matrix metalloproteinase 2 (Gelatinase A) is related to migration of keratinocytes. *Exp Cell Res.*, 251: 67-78.
- Matrisian, L.M. 1990. Metalloproteinases and their inhibitors in matrix remodeling. *Trends Genet.*, 6: 121-125.
- McCawley, L.J., Li, S., Benavidez, M., Halbleib, J., Wattenberg, E.V., Hudson, L.G. 2000. Elevation of intracellular cAMP inhibits growth factor-mediated matrix metalloproteinase-9 induction and keratinocyte migration. *Mol. Pharmacol.*, 58: 145-151.
- McCawley, L.J., Matrisian, L.M. 2001. Matrix metalloproteinases: they're not just for matrix anymore! *Curr. Opin. Cell Biol.*, 13: 534-540.

Meikle, M.C., Atkinson, S.J., Ward, R.V., Murphy, G., Reynolds, J.J. 1989. Gingival fibroblasts degrade type I collagen films when stimulated with tumor necrosis factor and interleukin 1: evidence that breakdown is mediated by metalloproteinases. *J Periodontal Res.* 2: 207-213.

Mochan, E., Uhl, J., Newton, R. 1986. Interleukin 1 stimulation of synovial cell plasminogen activator production. *J Rheumatol.*, 13: 15-19.

Mohan, R., Rinehart, W.B., Bargagna-Mohan, P., Fini, M.E. 1998. Gelatinase B/lacZ transgenic mice, a model for mapping gelatinase B expression during developmental and injury-related tissue remodeling. *J. Biol. Chem.*, 273: 25903–25914.

Moolenaar, W.H., van Meeteren, L.A., Giepmans, B.N.G. 2004. The ins and outs of lysophosphatidic acid signaling. *Bioessays.*, 26: 870–881.

Moore, W.E.C., Holdeman, L.V., Smibert, R.M., Good, I.J., Burmeister, J.A., Palcanis, K.G., Ranney, R.R. 1982. Bacteriology of experimental gingivitis in young adult humans. *Infect. Immun.*, 38: 651-667.

Moore, W.E.C., Holdeman, L.V., Smibert, R.M., Cato, E.P., Burmeister, J.A., Palcanis, K.G., Ranney, R.R. 1984. Bacteriology of experimental gingivitis in children. *Infect. Immun.*, 46: 1-6.

Moore, L.V.H., Moore, W.E.C., Cato, E.P., Smibert, R.M., Burmeister, J.A., Best, A.M., Ranney, R.R. 1987. Bacteriology of human gingivitis. *J. Dent. Res.*, 66: 989-995.

Moore, W.E., Moore, L.V. 1994. The bacteria of periodontal diseases. *Periodontol.* 2000, 5: 66-77.

- Morris, A.J., Frohman, M.A., Engebrecht, J. 1997. Measurement of phospholipase D activity. *Anal Biochem.*, 252: 1–9.
- Müller-Wieprecht, V., Riebeling, C., Alexander, C., Scholz, F.R., Höer, A., Wieder, T., Orfanos, C.E., Geilen, C.C. 1998. Expression and regulation of phospholipase D in the human keratinocyte cell line HaCaT. *FEBS Lett.*, 425: 199-203.
- Murphy, G., Knäuper, V. 1997. Relating matrix metalloproteinase structure to function: why the ‘hemopexin’ domain? *Matrix Biol.*, 15: 511–518.
- Müssig, E., Tomakidi, P., Steinberg, T. 2005. Molecules contributing to the maintenance of periodontal tissues. Their possible association with orthodontic tooth movement. *J OrofacOrthop.*, 66: 422–433.
- Nagase, H., Woessner, J.F. Jr. 1999. Matrix metalloproteinases. *J. Biol. Chem.*, 274: 21491-21494.
- Nanci, A., Bosshardt, D.D. 2006. Structure of periodontal tissues in health and disease. *Periodontol.* 2000, 40: 11–28.
- Nanjundan, M. and Possmayer, F. 2003. Pulmonary phosphatidic acid phosphatase and lipid phosphate phosphohydrolase. *Am. J. Physiol. Lung Cell Mol. Physiol.*, 284: L1-L23.
- Nguyen, M., Arkell, J., Jackson, C.J. 2001. Human endothelial gelatinases and angiogenesis. *Int J Biochem Cell Biol.*, 33: 960-970.
- Nielsen, B.S., Sehested, M., Kjeldsen, L., Borregaard, N., Rygaard, J., Dano, K. 1997. Expression of matrix metalloproteinase-9 in vascular pericytes in human breast cancer. *Lab. Invest.*, 77: 345–355.

Offenbacher, S., Collins, J.G., Arnold, R.R. 1993. New clinical diagnostic strategies based on pathogenesis of disease. *J. Periodontal. Res.*, 28(6 Pt 2): 523-535.

Overall, C.M. 2001. Matrix metalloproteinase substrate binding domains, modules and exosites. Overview and experimental strategies. *Methods Mol Biol.*, 151: 79-120.

Oyarzún, A., Arancibia, R., Hidalgo, R., Peñafiel, C., Cáceres, M., González, M.J., Martínez, J., Smith, P.C. 2010. Involvement of MT1-MMP and TIMP-2 in human periodontal disease. *Oral Dis.*, 16: 388-395.

Page, R.C., Offenbacher, S., Schroeder, H.E., Seymour, G.J., Kornman, K.S. 1997. Advances in the pathogenesis of periodontitis: summary of developments, clinical implications and future directions. *Periodontol.2000*, 14: 216-248.

Parhamifar, L., Jeppsson, B., Sjölander, A. 2005. Activation of cPLA₂ is required for leukotriene D₄-induced proliferation in colon cancer cells. *Carcinogenesis*, 26: 1988-1998.

Park, M.H., Ahn, B.H., Hong, Y.K., Min, D.S.. 2009. Overexpression of phospholipase D enhances matrix metalloproteinase-2 expression and glioma cell invasion via protein kinase C and protein kinase A/NF-kappaB/Sp1-mediated signaling pathways. *Carcinogenesis*, 30: 356-365.

Papapanou, P.N. 1996. Periodontal diseases: epidemiology. *Ann. Periodontol.*, 1: 1-36.

Phipps, R.P., Borrello, M.A., Blieden, T.M. 1997. Fibroblast heterogeneity in the periodontium and other tissues. *J. Periodontal, Res.*, 32: 159-65.

- Prescott, S.M., Zimmerman, G.A., Stafforini, D.M., McIntyre, T.M. 2000. Platelet-activating factor and related lipid mediators, *Annu. Rev. Biochem.*, 69: 419–445.
- Reich, R., Blumenthal, M., Liscovitch, M. 1995. Role of phospholipase D in laminin-induced production of gelatinase A (MMP-2) in metastatic cells. *ClinExp Metastasis*, 13: 134–140.
- Reynolds, J.J., Hembry, R.M., Meikle, M.C. 1994. Connective tissue degradation in health and periodontal disease and the roles of matrix metalloproteinases and their natural inhibitors. *Adv Dent Res.*, 8: 312-319.
- Reynolds, J.J. 1996. Collagenases and tissue inhibitors of metalloproteinases: a functional balance in tissue degradation. *Oral Dis.*, 2: 70-76.
- Richards, D., Rutherford, R.B. 1990. Interleukin-1 regulation of procollagenase mRNA and protein in periodontal fibroblasts in vitro. *J Periodontal Res.*, 25: 222-229.
- Roberts, G.L. 2000. *Fusobacterial* infections: an underestimated threat. *Br. J. Biomed Sci.*, 57: 156-162.
- Ruhul Amin, A.R., Senga, T., Oo, M.L., Thant, A.A., Hamaguchi, M. 2003. Secretion of matrix metalloproteinase-9 by the proinflammatory cytokine, IL-1beta: a role for the dual signalling pathways, Akt and Erk. *Genes Cells*, 8: 515-523.
- Salo, T., Lyons, J.G., Rahemtulla, F., Birkedal-Hansen, H., Larjava, H. 1991. Transforming growth factor- β 1 up-regulates type IV collagenase expression in cultured human keratinocytes. *J. Biol. Chem.*, 266: 11436–11441.

- Salo, T., Mäkelä, M., Kylmäniemi, M., Autio-Harminen, H., Larjava, H. 1994. Expression of matrix metalloproteinase-2 and -9 during early human wound healing. *Lab Invest.*, 70: 176–182.
- Sapirstein, A., Bonventre, J. V. 2000. Specific physiological roles of cytosolic phospholipase A₂ as defined by gene knockouts. *Biochim. Biophys. Acta.*, 1488: 139–148.
- Sato, H., Seiki, M. 1993. Regulatory mechanism of 92 kDa type IV collagenase gene expression which is associated with invasiveness of tumor cells. *Oncogene*, 8: 395–405.
- Sato, H., Takino, T. 2010. Coordinate action of membrane-type matrix metalloproteinase-1 (MT1-MMP) and MMP-2 enhances pericellular proteolysis and invasion. *Cancer Sci.*, 10: 843-7.
- Sawicki, G., Marcoux, Y., Sarkhosh, K., Tredget, E.E., Ghahary, A. 2005. Interaction of keratinocytes and fibroblasts modulates the expression of matrix metalloproteinases-2 and -9 and their inhibitors. *Mol. Cell. Biochem.*, 269: 209-216.
- Seymour, G.J., Gemmell, E., Reinhardt, R.A., Eastcott, J., Taubman, M.A. 1993. Immunopathogenesis of chronic inflammatory periodontal disease: cellular and molecular mechanisms. *J. Periodontal. Res.*, 28(6 Pt 2): 478-486.
- Shankavaram, U.T., DeWitt, D.L., Wahl, L.M. 1998. Lipopolysaccharide induction of monocyte matrix metalloproteinases is regulated by the tyrosine phosphorylation of cytosolic phospholipase A₂. *J. Leukoc. Biol.*, 64: 221-227.

- Simon, C., Simon, M., Vucelic, G., Hicks M.J., Plinkert, P.K., Koitschev, A., Zenner, H.P. 2001. The p38 SAPK pathway regulates the expression of the MMP-9 collagenase via AP-1-dependent promoter activation. *Exp Cell Res.*, 271: 344-355.
- Singer, R.E., Bucker, B.A. 1981. Butyrate and propionate: important components of toxic dental plaque extracts. *Infect. Immun.*, 32: 458-463.
- Smith, P.C., Munöz, V.C., Collados, L., Oyarzun, A.D. 2004. In situ detection of matrix metalloproteinase-9 (MMP-9) in gingival epithelium in human periodontal disease. *J. Periodont. Res.*, 39: 87-92.
- Socransky, S.S., Haffajee, A.D. 1991. Microbial mechanisms in the pathogenesis of destructive periodontal diseases: a critical assessment. *J. Periodontal. Res.*, 26(3 Pt 2): 195-212.
- Sorsa, T., Ding, Y.L., Ingman, T., Salo, T., Westerlund, U., Haapasalo, M., Tschesche, H., Konttinen, Y.T. 1995. Cellular source, activation and inhibition of dental plaque collagenase. *J. Clin. Periodontol.*, 22: 709-717.
- Sorsa, T., Tjäderhane, L., Salo, T. 2004. Matrix metalloproteinases (MMPs) in oral diseases. *Oral Dis.*, 10: 311-318.
- Sorsa, T., Tjäderhane, L., Konttinen, Y.T., Lauhio, A., Salo, T., Lee, H.M., Golub, L.M., Brown, D.L., Mäntylä, P. 2006. Matrix metalloproteinases: contribution to pathogenesis, diagnosis and treatment of periodontal inflammation. *Ann. Med.*, 38: 306-321.
- Stähle-Bäckdahl, M., Parks, W.C. 1993. 92-kD gelatinase is actively expressed by eosinophils and stored by neutrophils in squamous cell carcinoma. *Am. J. Pathol.*, 142: 995-1000.

Stähle-Bäckdahl, M., Inoue, M., Guidice, G.J., Parks, W.C. 1994. 92-kD gelatinase is produced by eosinophils at the site of blister formation in bullous pemphigoid and cleaves the extracellular domain of recombinant 180-kD bullous pemphigoidautoantigen. *J. Clin. Invest.*, 93: 2022–2030.

Stahelin, R.V., Ananthanarayanan, B., Blatner, N.R., Singh, S., Bruzik, K.S., Murray, D. Cho, W. 2004. Mechanism of membrane binding of phospholipase D₁ PX domain. *J. Biol. Chem.*, 279: 54918-54926.

Steed, P.M., Clark, K.L., Boyar, W.C., Lasala D.J. 1998. Characterization of human PLD₂ and the analysis of PLD isoform splice variants. *FASEB J.*, 12: 1309-1317.

Steffensen, B., Häkkinen, L., Larjava, H. 2001. Proteolytic events of wound-healing--coordinated interactions among matrix metalloproteinases (MMPs), integrins, and extracellular matrix molecules. *Crit Rev Oral Biol Med.*, 12: 373-398.

Steinbrenner, H., Ramos, M.C., Stuhlmann, D., Sies, H., Brenneisen, P. 2003. UVA-mediated downregulation of MMP-2 and MMP-9 in human epidermal keratinocytes. *BiochemBiophys Res Commun.*, 308: 486-491.

Steinbrenner, H., Ramos, M.C., Stuhlmann, D., Mitic, D., Sies, H., Brenneisen, P. 2005. Tumor promoter TPA stimulates MMP-9 secretion from human keratinocytes by activation of superoxide-producing NADPH oxidase. *Free Radic Res.*, 39: 245-253.

Stevens, R.H., Hammond, B.F. 1988. The comparative cytotoxicity of periodontal bacteria. *J. Periodontol.*, 59: 741-749.

Strongin, A.Y., Collier, I., Bannikov, G., Marmer, B.L., Grant, G.A., Goldberg, G.I.

1995. Mechanism of cell surface activation of 72-kDa type IV collagenase.

Isolation of the activated form of the membrane metalloprotease. *J Biol Chem.*, 270: 5331-5338.

Sung, T.C., Zhang, Y., Morris, A.J., Frohman, M.A. 1999. Structural analysis of human phospholipase D₁. *J. Biol. Chem.*, 274: 3659-3666.

Svanborg, C., Godaly, G., Hedlund, M. 1999. Cytokine responses during mucosal infections: role in disease pathogenesis and host defence. *Curr. Opin. Microbiol.*, 2: 99-105.

Takada, H., Mihara, J., Morisaki, I., and Hamada, S. 1991. Induction of interleukin-1 and -6 in human gingival fibroblast cultures stimulated with *Bacteroides* lipopolysaccharides. *Infect. Immun.*, 59: 295-301.

Tervahartiala, T., Pirilä, E., Ceponis, A., Maisi, P., Salo, T., Tuter, G., Kallio, P., Törnwall, J., Srinivas, R., Kontinen, Y.T., Sorsa, T. 2000. The in vivo expression of the collagenolytic matrix metalloproteinases (MMP-2, -8, -13, and -14) and matrilysin (MMP-7) in adult and localized juvenile periodontitis. *J Dent Res.*, 79: 1969-1977.

Torrunguang, K., Bandhaya, P., Likittanasombat, K., Grittayaphong, C. 2009.

Relationship between the presence of certain bacterial pathogens and periodontal status of urban Thai adults. *J Periodontol.*, 80: 122-129.

The American Academy of Periodontology 1996. Consensus report. Periodontal diseases: pathogenesis and microbial factors. *Ann. Periodontol.*, 1: 926-932.

Thomas, J.T., Poomsawat, S., Lewis, M.P., Hart, I.R., Speight, P.M., Marshall, J.F.

2001. $\alpha v\beta 6$ integrin upregulates matrix metalloproteinase 9 and promotes migration of normal oral keratinocytes. *J Invest Dermatol.*, 116: 898–904.

Tou, J.S., Gill, J.S. 2005. Lysophosphatidic acid increases phosphatidic acid formation, phospholipase D activity and degranulation by human neutrophils. *Cell Signal.*, 17: 77-82.

Tou, J.S., Xu, M., Wang, F. 1999. Formation of phosphatidic acid and subclasses of phosphatidylethanol in human neutrophils upon interleukin-8 stimulation. *Cell Signalling*, 11:137.

Trabandt, A., Müller-Ladner, U., Kriegsmann, J., Gay, R.E., Gay, S. 1995. Expression of proteolytic cathepsins B, D, and L in periodontal gingival fibroblasts and tissues. *Lab Invest.*, 73: 205-212.

Tsuboi, K., Sugimoto, Y., Ichikawa, A. 2002. Prostanoid receptor subtypes, Prostaglandins. *Other Lipid Mediators.*, 68–69: 535–556.

Uitto, V.J., Overall, C.M., McCulloch, C. 2003. Proteolytic host cell enzymes in gingival crevice fluid. *Periodontol.2000*, 31: 77-104.

Valentin, E., Ghomashchi, F., Gelb, M. H., Lazdunski, M., and Lambeau, G. 1999. On the diversity of secreted phospholipases A₂. Cloning, tissue distribution, and functional expression of two novel mouse group II enzymes. *J. Biol. Chem.*, 274: 31195–31202.

Van Dyke, T.E., Serhan, C.N. 2003. Resolution of Inflammation: A New Paradigm for the Pathogenesis of Periodontal Diseases. *J. Dent. Res.*, 82: 82-90.

Van den Bosch, H. 1980. Intracellular phospholipases A. *Biochim Biophys Acta.*, 604: 191-246.

- Verraes, S., Hornebeck, W., Polette, M., Borradori, L., Bernard, P. 2001. Respective contribution of neutrophil elastase and matrix metalloproteinase 9 in the degradation of BP180 (type XVII collagen) in human bullous pemphigoid. *J. Invest. Dermatol.*, 117: 1091–1096.
- Visse, R., Nagase, H. 2003. Matrix metalloproteinases and tissue inhibitors of metalloproteinases: structure, function, and biochemistry. *Circ. Res.*, 92: 827–839.
- Wahl, L.M., Wahl, S.M., Mergenhagen, S.E., Martin, G.R. 1974. Collagenase production by endotoxin-activated macrophages. *Proc. Natl. Acad. Sci. USA*, 71: 3598–3601.
- Wahl, L.M., Wahl, S.M., Mergenhagen, S.E., Martin, G.R. 1975. Collagenase production by lymphokine-activated macrophages. *Science*, 187: 261–263.
- Wahl, L.M., Lampel, L.L. 1987. Regulation of human peripheral blood monocyte collagenase by prostaglandins and anti-inflammatory drugs. *Cell Immunol.*, 105: 411–422.
- Werb, Z., Mainardi, C.L., Vater, C.A., Harris, E.D. Jr. 1977. Endogenous activation of latent collagenase by rheumatoid synovial cells. Evidence for a role of plasminogen activator. *N Engl J Med.*, 296: 1017-1023.
- Westerlund, U., Igman, T., Lukinmaa, P.L., Salo, T., Kjeldsen, L., Borregaard, N., Tjaderhane, L., Konttinen, Y.T., Sorsa T. 1996. Human neutrophil gelatinase and associated lipocalin in adult and localized juvenile periodontitis. *J. Dent. Res.*, 75: 1553–1563.
- Westermarck, J., Kähäri, V.M. 1999. Regulation of matrix metalloproteinase expression in tumor invasion. *FASEB J.*, 13: 781-792.

Wilhelm, S.M., Collier, I.E., Marmer, B.L., Eisen, A.Z., Grant, G.A., Goldberg, G.I.

1989. SV40-transformed human lung fibroblasts secrete a 92-kDa type IV collagenase which is identical to that secreted by normal human macrophages.

J. Biol. Chem., 264: 17213–17221.

Williger, B.T., Reich, R., Neeman, M., Bercovici, T., Liscovitch, M. 1995. Release

of gelatinaseA (matrix metalloproteinase 2) induced by photolysis of caged phosphatidic acid in HT 1080 metastatic fibrosarcoma cells. *J Biol Chem.*,

270: 29656–29659.

Williger, B.T., Ho, W.T., Exton, J.H. 1999. Phospholipase D mediates matrix

metalloproteinase-9 secretion in Phorbol Ester-stimulated human fibrosarcoma

cells. *J. Biol. Chem.*, 274: 735-738.

Winkler, J.R., John, S.R., Kramer, R.H., Hoover, C.I., Murray, P.A. 1987. Attachment

of oral bacteria to a basement-membrane-like matrix and to purified matrix

proteins. *Infect. Immun.*, 55: 2721-2726.

Woessner, J.F. Jr. 1991. Matrix metalloproteinases and their inhibitors in connective

tissue remodeling. *FASEB J.*, 5: 2145-2154.

Xie, H., Gibbons, R.J., Hay, D.I. 1991. Adhesive properties of strains of

Fusobacteriumnucleatum of the subspecies *nucleatum*, *vincentii* and

polymorphum. *Oral Microbiol.Immunol.*, 6: 257-263.

Yan, M., Noguchi, K., Ruwanpura, S.M., Ishikawa, I. 2005. Cyclooxygenase-2-

dependent prostaglandin (PG) E₂ downregulates matrix metalloproteinase-3

production via EP2/EP4 subtypes of PGE₂ receptors in human periodontal

ligament cells stimulated with interleukin-1 α . *J Periodontol.*, 6: 929-935.

Yang, S.F., Freer, S., Benson, A.A. 1967. Transphosphatidylation by phospholipase
D.J Biol Chem., 242: 477-844.

Zhang, J., Xu, Z., Jin, J., Zhu, T., Ma, S. 2000. Induction of Ro/SSA antigen
expression on keratinocyte cell membrane by heat shock and phorbol 12-
myristate 13-acetate as well as estradiol and ultraviolet B. *J Dermatol Sci.* 24:
92-98.

Zhou, J., Windsor, L.J. 2006. *Porphyromonasgingivalis* affects host collagen
degradation by affecting expression, activation, and inhibition of matrix
metalloproteinases. *J Periodontal Res.*, 41: 47-54.

Zhou, X.J., Sugerman, P.B., Savage, N.W., Walsh, L.J. 2001. Matrix
metalloproteinases and their inhibitors in oral lichen planus. *J. Cutan. Pathol.*,
28: 72-82.