

## **DAFTAR PUSTAKA**

- Aldag, C., Nogueira Teixeira, D., Leventhal, P.S., 2016. Skin rejuvenation using cosmetic products containing growth factors, cytokines, and matrikines: a review of the literature. *Clin. Cosmet. Investig. Dermatol.* 9, 411–419. <https://doi.org/10.2147/CCID.S116158>
- Antonopoulos, A.S., Margaritis, M., Lee, R., Channon, K., Antoniadis, C., 2012. Statins as anti-inflammatory agents in atherogenesis: molecular mechanisms and lessons from the recent clinical trials. *Curr. Pharm. Des.* 18, 1519–1530. <https://doi.org/10.2174/138161212799504803>
- Bloom, H.L., Shukrullah, I., Veledar, E., Gutmann, R., London, B., Dudley, S.C., 2010. Statins decrease oxidative stress and ICD therapies [WWW Document]. *Cardiol. Res. Pract.* <https://doi.org/10.4061/2010/253803>
- Britto, S.M., Shanthakumari, D., Agilan, B., Radhiga, T., Kanimozhi, G., Prasad, N.R., 2017. Apigenin prevents ultraviolet-B radiation induced cyclobutane pyrimidine dimers formation in human dermal fibroblasts. *Mutat. Res.* 821, 28–35. <https://doi.org/10.1016/j.mrgentox.2017.06.002>
- Burke, J.P., Watson, R.W.G., Murphy, M., Docherty, N.G., Coffey, J.C., O’Connell, P.R., 2009. Simvastatin impairs smad-3 phosphorylation and modulates transforming growth factor beta1-mediated activation of intestinal fibroblasts. *Br. J. Surg.* 96, 541–551. <https://doi.org/10.1002/bjs.6577>

- Chartoumpekis, D., Ziros, P.G., Psyrogiannis, A., Kyriazopoulou, V., Papavassiliou, A.G., Habeos, I.G., 2010. Simvastatin lowers reactive oxygen species level by Nrf2 activation via PI3K/Akt pathway. *Biochem. Biophys. Res. Commun.* 396, 463–466. <https://doi.org/10.1016/j.bbrc.2010.04.117>
- Chiu, H.-W., Chen, C.-H., Chen, Y.-J., Hsu, Y.-H., 2017. Far-infrared suppresses skin photoaging in ultraviolet B-exposed fibroblasts and hairless mice. *PLoS ONE* 12. <https://doi.org/10.1371/journal.pone.0174042>
- Dakup, P., Gaddameedhi, S., 2017. Impact of the circadian clock on UV-induced DNA damage response and photocarcinogenesis. *Photochem. Photobiol.* 93, 296–303. <https://doi.org/10.1111/php.12662>
- Davies, J.T., Delfino, S.F., Feinberg, C.E., Johnson, M.F., Nappi, V.L., Olinger, J.T., Schwab, A.P., Swanson, H.I., 2016. Current and emerging uses of statins in clinical therapeutics: a review. *Lipid Insights* 9, 13. <https://doi.org/10.4137/LPI.S37450>
- Day, R.M., Suzuki, Y.J., 2006. Cell proliferation, reactive oxygen and cellular glutathione. *Dose-Response* 3, 425–442. <https://doi.org/10.2203/dose-response.003.03.010>
- Deng, M., Li, D., Zhang, Y., Zhou, G., Liu, W., Cao, Y., Zhang, W., 2018. Protective effect of crocin on ultraviolet B-induced dermal fibroblast photoaging. *Mol. Med. Rep.* 18, 1439–1446. <https://doi.org/10.3892/mmr.2018.9150>

D’Orazio, J., Jarrett, S., Amaro-Ortiz, Scott, T., 2013. UV Radiation and the Skin.

Int. J. Mol. Sci. 14, 12222–12248.

Draelos, Z.D., 2008. Treatment of hyperpigmented photodamaged skin, in:

Shiffman, M.A., Mirrafati, S.J., Lam, S.M., Cueteaux, C.G. (Eds.), Simplified Facial Rejuvenation. Springer, Berlin, Heidelberg, pp. 83–87.

[https://doi.org/10.1007/978-3-540-71097-4\\_8](https://doi.org/10.1007/978-3-540-71097-4_8)

Eliasson, P., Svensson, R.B., Giannopoulos, A., Eismark, C., Kjær, M., Schjerling,

P., Heinemeier, K.M., 2017. Simvastatin and atorvastatin reduce the mechanical properties of tendon constructs in vitro and introduce catabolic changes in the gene expression pattern. PloS One 12, e0172797.

<https://doi.org/10.1371/journal.pone.0172797>

Farghaly Aly, U., Abou-Taleb, H.A., Abdellatif, A.A., Sameh Tolba, N., 2019.

Formulation and evaluation of simvastatin polymeric nanoparticles loaded in hydrogel for optimum wound healing purpose. Drug Des. Devel. Ther. 13, 1567–1580. <https://doi.org/10.2147/DDDT.S198413>

Fernandez-Madrid, F., Noonan, S., Riddle, J., 1981. The “spindle-shaped” body in

fibroblasts: intracellular collagen fibrils. J. Anat. 132, 157–166.

Fisher, G.J., Wang, Z.Q., Datta, S.C., Varani, J., Kang, S., Voorhees, J.J., 1997.

Pathophysiology of premature skin aging induced by ultraviolet light. N. Engl. J. Med. 337, 1419–1428. <https://doi.org/10.1056/NEJM199711133372003>

- Franzoni, F., Quiñones-Galvan, A., Regoli, F., Ferrannini, E., Galetta, F., 2003. A comparative study of the in vitro antioxidant activity of statins. *Int. J. Cardiol.* 90, 317–321. [https://doi.org/10.1016/S0167-5273\(02\)00577-6](https://doi.org/10.1016/S0167-5273(02)00577-6)
- Gentile, M., Latonen, L., Laiho, M., 2003. Cell cycle arrest and apoptosis provoked by UV radiation-induced DNA damage are transcriptionally highly divergent responses. *Nucleic Acids Res.* 31, 4779–4790.
- Ghetti, M., Topouzi, H., Theocharidis, G., Papa, V., Williams, G., Bondioli, E., Cenacchi, G., Connelly, J.T., Higgins, C.A., 2018. Subpopulations of dermal skin fibroblasts secrete distinct extracellular matrix: implications for using skin substitutes in the clinic. *Br. J. Dermatol.* 179, 381–393. <https://doi.org/10.1111/bjd.16255>
- Gilchrest, B.A., Yaar, M., 1992. Ageing and photoageing of the skin: observations at the cellular and molecular level. *Br. J. Dermatol.* 127 Suppl 41, 25–30. <https://doi.org/10.1111/j.1365-2133.1992.tb16984.x>
- Han, H.-S., Shin, J.-S., Myung, D.-B., Ahn, H.S., Lee, S.H., Kim, H.J., Lee, K.-T., 2019. *Hydrangea serrata* (Thunb.) Ser. extract attenuate UVB-induced photoaging through MAPK/AP-1 inactivation in human skin fibroblasts and hairless mice. *Nutrients* 11. <https://doi.org/10.3390/nu11030533>
- Haslinger-Löffler, B., 2008. Multiple effects of HMG-CoA reductase inhibitors (statins) besides their lipid-lowering function. *Kidney Int.* 74, 553–555. <https://doi.org/10.1038/ki.2008.323>

- He, T., Quan, T., Fisher, G.J., 2014. Ultraviolet irradiation represses TGF- $\beta$  type II receptor transcription through a 38 base pair sequence in the proximal promoter in human skin fibroblasts. *Exp. Dermatol.* 23, 2–6.  
<https://doi.org/10.1111/exd.12389>
- Hu, M.S., Moore, A.L., Longaker, M.T., 2018. A fibroblast is not a fibroblast is not a fibroblast. *J. Invest. Dermatol.* 138, 729–730.  
<https://doi.org/10.1016/j.jid.2017.10.012>
- Juzeniene, A., Moan, J., 2012. Beneficial effects of UV radiation other than via vitamin D production. *Dermatoendocrinol.* 4, 109–117.  
<https://doi.org/10.4161/derm.20013>
- Kahan, V., Andersen, M.L., Tomimori, J., Tufik, S., 2009. Stress, immunity and skin collagen integrity: evidence from animal models and clinical conditions. *Brain. Behav. Immun.* 23, 1089–1095.  
<https://doi.org/10.1016/j.bbi.2009.06.002>
- Kamio, K., Liu, X.D., Sugiura, H., Togo, S., Kawasaki, S., Wang, X., Ahn, Y., Hogaboam, C., Rennard, S.I., 2010. Statins inhibit matrix metalloproteinase release from human lung fibroblasts. *Eur. Respir. J.* 35, 637–646.  
<https://doi.org/10.1183/09031936.00134707>
- Khoshneviszadeh, M., Ashkani-Esfahani, S., Namazi, M.R., Noorafshan, A., Geramizadeh, B., Miri, R., 2014. Topical simvastatin enhances tissue

regeneration in full-thickness skin wounds in rat models. *Iran. J. Pharm. Res.*

*IJPR* 13, 263–269.

Laga, A.C., Murphy, G.F., 2009. The translational basis of human cutaneous photoaging. *Am. J. Pathol.* 174, 357–360.

<https://doi.org/10.2353/ajpath.2009.081029>

Larsen, S., Stride, N., Hey-Mogensen, M., Hansen, C.N., Bang, L.E., Bundgaard, H., Nielsen, L.B., Helge, J.W., Dela, F., 2013. Simvastatin effects on skeletal muscle: relation to decreased mitochondrial function and glucose intolerance. *J. Am. Coll. Cardiol.* 61, 44–53. <https://doi.org/10.1016/j.jacc.2012.09.036>

Lee, C.-H., Wu, S.-B., Hong, C.-H., Yu, H.-S., Wei, Y.-H., 2013. Molecular mechanisms of UV-induced apoptosis and its effects on skin residential cells: the implication in UV-based phototherapy. *Int. J. Mol. Sci.* 14, 6414–6435. <https://doi.org/10.3390/ijms14036414>

Lee, S.-J., Lee, K.B., Son, Y.H., Shin, J., Lee, J.-H., Kim, H.-J., Hong, A.-Y., Bae, H.W., Kwon, M.-A., Lee, W.J., Kim, J.-H., Lee, D.H., Jeong, E.M., Kim, I.-G., 2017. Transglutaminase 2 mediates UV-induced skin inflammation by enhancing inflammatory cytokine production. *Cell Death Dis.* 8, e3148. <https://doi.org/10.1038/cddis.2017.550>

Lim, S., Barter, P., 2014. Antioxidant effects of statins in the management of cardiometabolic disorders. *J. Atheroscler. Thromb.* 21, 997–1010. <https://doi.org/10.5551/jat.24398>

Lodish, H., Berk, A., Zipursky, S.L., Matsudaira, P., Baltimore, D., Darnell, J.,  
2000. Molecular cell biology, 4th ed. W. H. Freeman, New York.

Louneva, N., Huaman, G., Fertala, J., Jiménez, S.A., 2006. Inhibition of systemic  
sclerosis dermal fibroblast type I collagen production and gene expression by  
simvastatin. Arthritis Rheum. 54, 1298–1308.  
<https://doi.org/10.1002/art.21723>

Lund, L.P., Timmins, G.S., 2007. Melanoma, long wavelength ultraviolet and  
sunscreens: controversies and potential resolutions. Pharmacol. Ther. 114,  
198–207. <https://doi.org/10.1016/j.pharmthera.2007.01.007>

Madi, M., Kassem, A., 2018. Topical simvastatin gel as a novel therapeutic modality  
for palatal donor site wound healing following free gingival graft procedure.  
Acta Odontol. Scand. 76, 212–219.  
<https://doi.org/10.1080/00016357.2017.1403648>

Massaro, M., Zampolli, A., Scoditti, E., Carluccio, M.A., Storelli, C., Distante, A.,  
De Caterina, R., 2010. Statins inhibit cyclooxygenase-2 and matrix  
metalloproteinase-9 in human endothelial cells: anti-angiogenic actions  
possibly contributing to plaque stability. Cardiovasc. Res. 86, 311–320.  
<https://doi.org/10.1093/cvr/cvp375>

Ndiaye, M.A., Nihal, M., Wood, G.S., Ahmad, N., 2014. Skin, reactive oxygen  
species, and circadian clocks. Antioxid. Redox Signal. 20, 2982–2996.  
<https://doi.org/10.1089/ars.2013.5645>

- Oresajo, C., Yatskayer, M., Galdi, A., Foltis, P., Pillai, S., 2010. Complementary effects of antioxidants and sunscreens in reducing UV-induced skin damage as demonstrated by skin biomarker expression. *J. Cosmet. Laser Ther. Off. Publ. Eur. Soc. Laser Dermatol.* 12, 157–162. <https://doi.org/10.3109/14764171003674455>
- Pandel, R., Poljšak, B., Godic, A., Dahmane, R., 2013. Skin photoaging and the role of antioxidants in its prevention [WWW Document]. *Int. Sch. Res. Not.* <https://doi.org/10.1155/2013/930164>
- Park, H.M., Hwang, E., Lee, K.G., Han, S.-M., Cho, Y., Kim, S.Y., 2011. Royal jelly protects against ultraviolet B-induced photoaging in human skin fibroblasts via enhancing collagen production. *J. Med. Food* 14, 899–906. <https://doi.org/10.1089/jmf.2010.1363>
- Ricard-Blum, S., 2011. The collagen family. *Cold Spring Harb. Perspect. Biol.* 3. <https://doi.org/10.1101/cshperspect.a004978>
- Robinson, J.G., 2007. Simvastatin: present and future perspectives. *Expert Opin. Pharmacother.* 8, 2159–2127. <https://doi.org/10.1517/14656566.8.13.2159>
- Schwarz, T., 2005. Mechanisms of UV-induced immunosuppression. *Keio J. Med.* 54, 165–171. <https://doi.org/10.2302/kjm.54.165>
- Sorrell, J.M., Caplan, A.I., 2004. Fibroblast heterogeneity: more than skin deep. *J. Cell Sci.* 117, 667–675. <https://doi.org/10.1242/jcs.01005>

- Tziakas, D.N., Chalikias, G.K., Stakos, D.A., Papanas, N., Chatzikyriakou, S.V., Mitrousi, K., Maltezos, E., Boudoulas, H., 2008. Effect of statins on collagen type I degradation in patients with coronary artery disease and atrial fibrillation. *Am. J. Cardiol.* 101, 199–202. <https://doi.org/10.1016/j.amjcard.2007.07.063>
- Yamaba, H., Haba, M., Kunita, M., Sakaida, T., Tanaka, H., Yashiro, Y., Nakata, S., 2016. Morphological change of skin fibroblasts induced by UV Irradiation is involved in photoaging. *Exp. Dermatol.* 25 Suppl 3, 45–51. <https://doi.org/10.1111/exd.13084>
- Yamamoto, T., Akiyoshi, H., Yoshikiyo, K., Takahashi, T., Tanabe, Y., Kudoh, S., Imura, S., Yamamoto, N., 2013. A spectroscopic study on the effect of ultra-violet solar radiation in Antarctica on the human skin fibroblast cells. *Geosci. Front., Thematic Section: Antarctica – A window to the far off land* 4, 647–653. <https://doi.org/10.1016/j.gsf.2012.07.004>
- Zeiser, R., 2018. Immune modulatory effects of statins. *Immunology* 154, 69–75. <https://doi.org/10.1111/imm.12902>
- Zhang, J., Xu, Y., Pan, L., Chen, T., Chen, Z., Zhao, R., 2010. Effect of simvastatin on collagen I deposition in non-infarcted myocardium: role of NF- $\kappa$ B and osteopontin. *Can. J. Physiol. Pharmacol.* 88, 1026–1034. <https://doi.org/10.1139/y10-075>

Zhang, J., Yin, Zhi, Ma, L., Yin, Zhi-qiang, Hu, Y., Xu, Y., Wu, D., Permatasari, F., Luo, D., Zhou, B., 2014. The protective effect of baicalin against UVB irradiation induced photoaging: an in vitro and in vivo study. PloS One 9, e99703. <https://doi.org/10.1371/journal.pone.0099703>