

References

Adashi, E.Y., Resnick, C.E., Packman, J.N., Hurwitz, A., Payne, D.W., 1990. Cytokine mediated regulation of ovarian function: tumor necrosis factor alpha inhibits gonadotropin-supported progesterone accumulation by differentiating and luteinized murine granulosa cells. Am. J. Obstet. Gynecol. 162, 889–896.

Alpizar, E. and Spicer, L.J., 1994. Effects of interleukin-6 on proliferation and follicle-stimulating hormone-induced estradiol production by bovine granulosa cells in vitro: dependence on size of follicle. *Biology of Reproduction*, 50(1), pp.38-43.

Andreani, C.L., Payne, D.W., Packman, J.N., Resnick, C.E., Hurwitz, A. and Adashi, E.Y., 1991. Cytokine-mediated regulation of ovarian function. Tumor necrosis factor alpha inhibits gonadotropin-supported ovarian androgen biosynthesis. *Journal of Biological Chemistry*, 266(11), pp.6761-6766.

Araki, M., Fukumatsu, Y., Katabuchi, H., Schultz, L.D., Takahashi, K., Okamura, H., 1996. Follicular development and ovulation in macrophage colony- stimulating factor-deficient mice homozygous for the osteopetrosis (op) mutation. Biol. Reprod. 54, 478–484.

Arici, A., Tazuke, S.I., Attar, E., Kliman, H.J. and Olive, D.L., 1996. Interleukin-8 concentration in peritoneal fluid of patients with endometriosis and modulation of interleukin-8 expression in human mesothelial cells. *Mol Hum Reprod*, 2(1), pp.40-45.

Bagavant, H., Sharp, C., Kurth, B., Tung, K.S.K., 2002. Induction and immunohistology of autoimmune ovarian disease in cynomolgus macaques (*Macaca fascicularis*). Am. J. Pathol. 160, 141–149.

Bauer, J., Ganter, U., Geiger, T., Jacobshagen, U., Hirano, T., Matsuda, T., Kishimoto, T., Andus, T., Acs, G. and Gerok, W., 1988. Regulation of interleukin-6 expression in cultured human blood monocytes and monocyte-derived macrophages.

Bazan, J.F., 1990. Structural design and molecular evolution of a cytokine receptor superfamily. *Proceedings of the National Academy of Sciences*, 87(18), pp.6934-6938.

Benninghoff, A.D., Thomas, P., 2006. Gonadotropin regulation of testosterone production by primary cultured theca and granulosa cells of Atlantic croaker: II.

Involvement of a mitogen-activated protein kinase pathway. *Gen. Comp. Endocrinol.* 147, 288–296.

Ben-Rafael, Z., Orvieto, R., 1992. Cytokines—involvelement in reproduction. *Fertil. Steril.* 58, 1093–1099.

Bhattacharyya, S., Sen, U., Bhattacharyya, S.P. and Mukherjee, D., 2000. Identification of maturation-inducing steroid in a freshwater perch *Anabas testudineus* and differential responses of intact follicles and denuded oocytes to cyclic AMP in oocyte maturation. *Journal of Experimental Zoology*, 287(4), pp.294-303.

Bird, S., Wang, T., Secombes, C.J., 2011. The interleukins of fish. *Dev. Comp. Immunol.* 35, 1336–1345.

Bornstein, S.R., Rutkowski, H. and Vrezas, I., 2004. Cytokines and steroidogenesis. *Molecular and cellular endocrinology*, 215(1-2), pp.135-141.

Boyle, J.J., 2005. Macrophage activation in atherosclerosis: pathogenesis and pharmacology of plaque rupture. *Current vascular pharmacology*, 3(1), pp.63-68.

Brannstrom, M., Norman, R.J., 1993. Involvement of leukocytes and cytokines in the ovulatory process and corpus luteum function. *Hum. Reprod.* 8, 1762–1775.

Brannstrom, M., Bonello, N., Wang, L.J. and Norman, R.J., 1995. Effects of tumour necrosis factor alpha (TNF alpha) on ovulation in the rat ovary. *Reproduction, Fertility and Development*, 7(1), pp.67-73.

Brännström, M. and Enskog, A., 2002. Leukocyte networks and ovulation. *Journal of reproductive immunology*, 57(1-2), pp.47-60.

Brannstrom, M., 2004. Potential role of cytokines in ovarian physiology: the case for interleukin-1. *The ovary*.

Breard, E., Benhaïm, A., Feral, C., Leymarie, P., 1998. Rabbit ovarian production of interleukin-6 and its potential effects on gonadotropin-induced progesterone secretion in granulosa and theca cells. *J. Endocrinol.* 159, 479–487.

Breuninger, L.M., Dempsey, W.L., Uhl, J. and Murasko, D.M., 1993. Hydrocortisone regulation of interleukin-6 protein production by a purified population of human peripheral blood monocytes. *Clinical immunology and immunopathology*, 69(2), pp.205-214.

Bristol, S.K. and Woodruff, T.K., 2004. Follicle-restricted compartmentalization of transforming growth factor β superfamily ligands in the feline ovary. *Biology of reproduction*, 70(3), pp.846-859.

Brocker, C., Thompson, D.C. and Vasiliou, V., 2012. The role of hyperosmotic stress in inflammation and disease. *Biomolecular concepts*, 3(4), pp.345-364.

Brogin Moreli, J., Cirino Ruocco, A.M., Vernini, J.M., Rudge, M.V.C. and Calderon, I.M.P., 2012. Interleukin 10 and tumor necrosis factor-alpha in pregnancy: aspects of interest in clinical obstetrics. *International Scholarly Research Notices*, 2012.

Bukulmez, O. and Arici, A., 2000. Leukocytes in ovarian function. *Human reproduction update*, 6(1), pp.1-15.

Buonocore, F., Randelli, E., Bird, S., Secombes, C.J., Facchiano, A., Costantini, S. and Scapigliati, G., 2007. Interleukin-10 expression by real-time PCR and homology modelling analysis in the European sea bass (*Dicentrarchus labrax* L.). *Aquaculture*, 270(1-4), pp.512-522.

Burzawa-Gerard, E., 1982. Chemical data on pituitary gonadotropins and their implication to evolution. *Canadian Journal of Fisheries and Aquatic Sciences*, 39(1), pp.80-91.

Bustin, S.A., Benes, V., Garson, J.A., Hellemans, J., Huggett, J., Kubista, M., Mueller, R., Nolan, T., Pfaffl, M.W., Shipley, G.L., Vandesompele, J., Wittwer, C.T., 2009. The MIQE guidelines: minimum information for publication of quantitative real-time PCR experiments. *Clin. Chem.* 55, 611–622.

Calogero, A.E., Nicoletti, F., Palumbo, M.A., Burrello, N., Di Mauro, M., Lunetta, M., Bendtzen, K.

and Cianci, A., 1998. Macrophage-derived cytokines in the follicular fluids of women with infertility due to immunological causes. Elevated levels of interleukin 6 and low levels of granulocyte-macrophage colony-stimulating factor. *Cytokine*, 10(10), pp.814-818.

Castellana, B., Iliev, D.B., Sepulcre, M.P., MacKenzie, S., Goetz, F.W., Mulero, V., Planas, J.V., 2008. Molecular characterization of interleukin-6 in the gilthead seabream (*Sparus aurata*). *Mol. Immunol.* 45, 3363–3370.

Chalaris, A., Garbers, C., Rabe, B., Rose-John, S. and Scheller, J., 2011. The soluble Interleukin 6 receptor: generation and role in inflammation and cancer. *European journal of cell biology*, 90(6-7), pp.484-494.

Chatterjee, P., Chiasson, V.L., Bounds, K.R. and Mitchell, B.M., 2014. Regulation of the anti-inflammatory cytokines interleukin-4 and interleukin-10 during pregnancy. *Frontiers in immunology*, 5, p.253.

Chaves-Pozo, E., Pelegrín, P., Mulero, V., Meseguer, J., García Ayala, A., 2003. A role for acidophilic granulocytes in the testis of the gilthead seabream(*Sparus aurata* L., Teleostei). *J. Endocrinol.* 179, 165–174.

Chaves-Pozo, E., Mulero, V., Meseguer, J., García-Ayala, A., 2005a. An overview of cell renewal in the testis throughout the reproductive cycle of a seasonal breeding teleost, the gilthead seabream (*Sparus aurata* L.). *Biol. Reprod.* 72, 593–601.

Chaves-Pozo, E., Liarte, S., Fernandez-Alacid, L., Abellan, E., Meseguer, J., Mulero, V., García-Ayala, A., 2008. Pattern of expression of immune-relevant genes in the gonad of a teleost, the gilthead seabream (*Sparus aurata* L.). *Mol. Immunol.* 45, 2998–3011.

Chen, Q., Wang, H., Liu, Y., Song, Y., Lai, L., Han, Q., Cao, X. and Wang, Q., 2012. Inducible microRNA-223 down-regulation promotes TLR-triggered IL-6 and IL-1 β production in macrophages by targeting STAT3.

Classics Lowry, O., Rosebrough, N., Farr, A. and Randall, R., 1951. Protein measurement with the Folin phenol reagent. *J biol Chem*, 193(1), pp.265-75.

Cohen, M.C. and Cohen, S., 1996. Cytokine function: a study in biologic diversity. *American journal of clinical pathology*, 105(5), pp.589-598.

Costa, M.M., Maehr, T., Diaz-Rosales, P., Secombes, C.J. and Wang, T., 2011. Bioactivity studies of rainbow trout (*Oncorhynchus mykiss*) interleukin-6: effects on macrophage growth and antimicrobial peptide gene expression. *Molecular immunology*, 48(15-16), pp.1903-1916.

Coutinho, A.E. and Chapman, K.E., 2011. The anti-inflammatory and immunosuppressive effects of glucocorticoids, recent developments and mechanistic insights. *Molecular and cellular endocrinology*, 335(1), pp.2-13.

Crespo, D., Bonnet, E., Roher, N., MacKenzie, S.A., Krasnov, A., Goetz, F.W., Bobe, J., Planas, J.V., 2011. Cellular and molecular evidence for a role of tumor necrosis factor alpha in the ovulatory mechanism of trout. *Reprod. Biol. Endocrinol.* 8 (34), 1–14.

Crespo, D., Mañanos, E.L., Roher, N., MacKenzie, S.A., Planas, J.V., 2012. Tumor necrosis factor alpha may act as an intraovarian mediator of luteinizing hormoneinduced oocyte maturation in trout. *Biol. Reprod.* 86, 1–12.

Crespo, D., Goetz, F.W., Planas, J.V., 2015. Luteinizing hormone induces ovulation via tumor necrosis factor α -dependent increases in prostaglandin F2 α in a nonmammalian vertebrate. *Sci. Rep.* 5, 1–12.

Crisculolo-Urbinati, E., Kuradomi, R.Y., Urbinati, E.C., Batlouni, S.R., 2012. The administration of exogenous prostaglandin may improve ovulation in pacu (*Piaractus mesopotamicus*). *Theriogenology* 78, 2087–2094.

Cui, L.L., Yang, G., Pan, J. and Zhang, C., 2011. Tumor necrosis factor α knockout increases fertility of mice. *Theriogenology*, 75(5), pp.867-876.

Day, F.T., 1889. The Fauna of British India, Including Ceylon and Burma. Fishes 1. Taylor & Francis, pp. 548.

Darnell Jr, J.E., 1997. STATs and gene regulation. *Science*, 277(5332), pp.1630-1635.

De Mola, J.R.L., Flores, J.P., Baumgardner, G.P., Goldfarb, J.M., Gindlesperger, V. and Friedlander, M.A., 1996. Elevated interleukin-6 levels in the ovarian hyper stimulation syndrome: Ovarian immunohistochemical localization of interleukin-6 signal. *Obstetrics & Gynecology*, 87(4), pp.581-587.

De Mola, J.R.L., Goldfarb, J.M., Hecht, B.R., Babbo, C.J., Baumgardner, G.P. and Friedlander, M.A., 1998. Gonadotropins Induce the Release of Interleukin-1 β , Interleukin-6 and Tumor Necrosis Factor- α from the Human Preovulatory Follicle. *American journal of reproductive immunology*, 39(6), pp.387-390.

De Waal Malefyt, R., Abrams, J., Bennett, B., Figdor, C.G. and de Vries, J.E., 1991. Interleukin 10 (IL-10) inhibits cytokine synthesis by human monocytes: an autoregulatory role of IL-10 produced by monocytes. *The Journal of experimental medicine*, 174(5), pp.1209-1220.

Devlin, R.H. and Nagahama, Y., 2002. Sex determination and sex differentiation in fish: an overview of genetic, physiological, and environmental influences. *Aquaculture*, 208(3-4), pp.191-364.

Dienz, O., Rud, J.G., Eaton, S.M., Lanthier, P.A., Burg, E., Drew, A., Bunn, J., Suratt, B.T., Haynes, L. and Rincon, M., 2012. Essential role of IL-6 in protection against H1N1 influenza virus by promoting neutrophil survival in the lung. *Mucosal immunology*, 5(3), pp.258-266.

Drummond, A.E., Dyson, M., Le, M.T., Ethier, J.F. and Findlay, J.K., 2003. Ovarian follicle populations of the rat express TGF- β signalling pathways. *Molecular and cellular endocrinology*, 202(1-2), pp.53-57.

Eddie, S.L., Childs, A.J., Jabbour, H.N. and Anderson, R.A., 2012. Developmentally regulated IL6-type cytokines signal to germ cells in the human fetal ovary. *Molecular human reproduction*, 18(2), pp.88-95.

Engmann, L. and Benadiva, C., 2010, November. Ovarian hyperstimulation syndrome prevention strategies: luteal support strategies to optimize pregnancy success in cycles with gonadotropin-releasing hormone agonist ovulatory trigger. In *Seminars in reproductive medicine* (Vol. 28, No. 06, pp. 506-512).

Ernst, M., Inglese, M., Waring, P., Campbell, I.K., Bao, S., Clay, F.J., Alexander, W.S., Wicks, I.P., Tarlinton, D.M., Novak, U. and Heath, J.K., 2001. Defective gp130-mediated signal transducer and activator of transcription (STAT) signaling results in degenerative joint disease, gastrointestinal ulceration, and failure of uterine implantation. *The Journal of experimental medicine*, 194(2), pp.189-204.

Espey, L.L., 1994. Current status of the hypothesis that mammalian ovulation is comparable to an inflammatory reaction. *Biology of reproduction*, 50(2), pp.233-238.

Fettke, F., Schumacher, A., Canellada, A., Toledo, N., Bekeredjian-Ding, I., Bondt, A., Wuhrer, M., Costa, S.D. and Zenclussen, A.C., 2016. Maternal and fetal mechanisms of B cell regulation during pregnancy: human chorionic gonadotropin stimulates B cells to produce IL-10 while alpha-fetoprotein drives them into apoptosis. *Frontiers in immunology*, 7, p.495.

Field, S.L., Dasgupta, T., Cummings, M. and Orsi, N.M., 2014. Cytokines in ovarian folliculogenesis, oocyte maturation and luteinisation. *Molecular reproduction and Development*, 81(4), pp.284-314.

Figueiredo, C.A., Barreto, M.L., Alcantara-Neves, N.M., Rodrigues, L.C., Cooper, P.J., Cruz, A.A., Pontes-de-Carvalho, L.C., Lemaire, D.C., dos Santos Costa, R., Amorim, L.D. and Vergara, C., 2013. Coassociations between IL10 polymorphisms, IL-10 production, helminth infection, and

asthma/wheeze in an urban tropical population in Brazil. *Journal of allergy and clinical immunology*, 131(6), pp.1683-1690.

Fong, Y., Tracey, K.J., Moldawer, L.L., Hesse, D.G., Manogue, K.B., Kenney, J.S., Lee, A.T., Kuo, G.C., Allison, A.C. and Lowry, S.F., 1989. Antibodies to cachectin/tumor necrosis factor reduce interleukin 1 beta and interleukin 6 appearance during lethal bacteremia. *The Journal of experimental medicine*, 170(5), pp.1627-1633.

Fuji, H., Futami, Y., Numano, M., Yamashita, H., Harada, H., Yoshioka, Y., Kamata, M., Nishimura, T. and Murayama, S., 2004. Induction of Interleukin-6 by Proton Beam Irradiation Depends on Targeted Organ. *The Journal of JASTRO*, 16(4), pp.219-224.

Fujimori, C., Ogiwaraa, K., Hagiwaraa, A., Rajapakseb, S., Kimuraa, A., Takahashia, T., 2011. Expression of cyclooxygenase-2 and prostaglandin receptor EP4b mRNA in the ovary of the medaka fish, *Oryziaslatipes*: possible involvement in ovulation. *Mol. Cell. Endocrinol.* 332, 67–77.

Fujimori, C., Ogiwara, K., Hagiwara, A., Takahashi, T., 2012. New evidence for the involvement of prostaglandin receptor EP4b in ovulation of the medaka, *Oryzias latipes*. *Mol. Cell. Endocrinol.* 362, 76–84.

Fukuoka, M.A.S.A.T.S.U.N.E., Yasuda, K.E.I.K.O., Emi, N.O.B.U.Y.U.K.I., Fujiwara, H.I.R.O.S.H.I., Iwai, M.A.S.A.Z.U.M.I., Takakura, K., Kanzaki, H.I.D.E.H.A.R.U. and Mori, T.A.K.A.H.I.D.E., 1992. Cytokine modulation of progesterone and estradiol secretion in cultures of luteinized human granulosa cells. *The Journal of Clinical Endocrinology & Metabolism*, 75(1), pp.254-258.

Garbers, C., Hermanns, H.M., Schaper, F., Muller-Newen, G., Grotzinger, J., Rose John, S., Scheller, J., 2012. Plasticity and cross-talk of interleukin 6-type cytokines. *Cytokine Growth Factor Rev.* 23, 85–97.

Gauldie, J., Richards, C., Harnish, D., Lansdorp, P. and Baumann, H., 1987. Interferon beta 2/B-cell stimulatory factor type 2 shares identity with monocyte-derived hepatocyte-stimulating factor and

regulates the major acute phase protein response in liver cells. *Proceedings of the National Academy of Sciences*, 84(20), pp.7251-7255.

Geva, E., Lessing, J.B., Lerner-Geva, L., Azem, F., Yovel, I., Ben-Yosef, D., Barkai, U. and Amit, A., 1997. Interleukin-10 in preovulatory follicular fluid of patients undergoing in-vitro fertilization and embryo transfer. *American Journal of Reproductive Immunology*, 37(2), pp.187-190.

Giannubilo, S.R., Landi, B., Pozzi, V., Sartini, D., Cecati, M., Stortoni, P., Corradetti, A., Saccucci, F., Tranquilli, A.L. and Emanuelli, M., 2012. The involvement of inflammatory cytokines in the pathogenesis of recurrent miscarriage. *Cytokine*, 58(1), pp.50-56.

Girasole, G., Jilka, R.L., Passeri, G., Boswell, S., Boder, G., Williams, D.C. and Manolagas, S.C., 1992. 17 beta-estradiol inhibits interleukin-6 production by bone marrow-derived stromal cells and osteoblasts in vitro: a potential mechanism for the antiosteoporotic effect of estrogens. *The Journal of clinical investigation*, 89(3), pp.883-891.

Goetz, F.W., Cetta, F., 1983. Ovarian and plasma levels in naturally ovulating brook trout (*Salvelinus fontinalis*) and the effects of indomethacin on prostaglandin levels. *Prostaglandins* 26, 387–395.

Glenney, G.W. and Wiens, G.D., 2007. Early diversification of the TNF superfamily in teleosts: genomic characterization and expression analysis. *The Journal of Immunology*, 178(12), pp.7955-7973.

Gorospe, W.C., Hughes Jr, F.M. and Spangelo, B.L., 1992. Interleukin-6: effects on and production by rat granulosa cells in vitro. *Endocrinology*, 130(3), pp.1750-1752.

Gorospe, W.C., Spangelo, B.L., 1993. Interlukin-6 production by rat granulose cells in vitro effects of cytokines, follicle-stimulating hormone, and cyclic 3',5'- adenosine monophosphate. *Biol. Reprod.* 48, 538–543.

Goto, J., Suganuma, N., Takata, K., Kitamura, K., Asahina, T., Kobayashi, H., Muranaka, Y.,

Furuhashi, M. and Kanayama, N., 2002. Morphological analyses of interleukin-8 effects on rat ovarian follicles at ovulation and luteinization in vivo. *Cytokine*, 20(4), pp.168-173.

Gottschall, P.E., Katsuura, G. and Arimura, A., 1989. Interleukin-1 suppresses follicle-stimulating hormone-induced estradiol secretion from cultured ovarian granulosa cells. *Journal of reproductive immunology*, 15(3), pp.281-290.

Grayfer, L., Hodgkinson, J.W., Hitchen, S.J. and Belosevic, M., 2011. Characterization and functional analysis of goldfish (*Carassius auratus* L.) interleukin-10. *Molecular immunology*, 48(4), pp.563-571.

Grayfer, L., Andino, F.D.J., Chen, G., Chinchar, G.V. and Robert, J., 2012. Immune evasion strategies of ranaviruses and innate immune responses to these emerging pathogens. *Viruses*, 4(7), pp.1075-1092.

Guchhait, R., Chatterjee, A., Gupta, S., Debnath, M., Mukherjee, D., Pramanick, K., 2018a. Molecular mechanism of mercury-induced reproductive impairments in banded gourami, *Trichogaster fasciata*. *Gen. Comp. Endocrinol.* 255, 40–48.

Guchhait, R., Chatterjee, A., Mukherjee, D., Pramanick, K., 2018b. Seasonal ovarian development in relation to the gonadotropins, steroids, aromatase and steroidogenic factor 1 (SF-1) in the banded gourami, *Trichogaster fasciata*. *Gen. Comp. Endocrinol.* 268, 40–49.

Haegeman, G., Content, J., Volckaert, G., Deryck, R., Tavernier, J. and Fiers, W., 1986. Structural analysis of the sequence coding for an inducible 26-kDa protein in human fibroblasts. *European journal of biochemistry*, 159(3), pp.625-632.

Haider, S. and Knöfler, M., 2009. Human tumour necrosis factor: physiological and pathological roles in placenta and endometrium. *Placenta*, 30(2), pp.111-123.

Hagiwara, A., Ogiwara, K., Katsu, Y., Takahashi, T., 2014. Luteinizing hormone-induced expression

of Ptger4b, a prostaglandin E2 receptor indispensable for ovulation of the Medaka *Oryzias latipes*, is regulated by a genomic mechanism involving nuclear progestin receptor. *Biol. Reprod.* 90, 1–14.

Hammadeh, M.E., Ertan, A.K., Baltes, S., Braemert, B., Rosenbaum, P., Schmidt, W. and Georg, T., 2001. Association between interleukin concentration in follicular fluid and intracytoplasmic sperm injection (ICSI) outcome. *American Journal of Reproductive Immunology*, 45(3), pp.161-167.

Hanna, N., Hanna, I., Hleb, M., Wagner, E., Dougherty, J., Balkundi, D., Padbury, J. and Sharma, S., 2000. Gestational age-dependent expression of IL-10 and its receptor in human placental tissues and isolated cytotrophoblasts. *The Journal of Immunology*, 164(11), pp.5721-5728.

Harun, N.O., Costa, M.M., Secombes, C.J. and Wang, T., 2011. Sequencing of a second interleukin-10 gene in rainbow trout *Oncorhynchus mykiss* and comparative investigation of the expression and modulation of the paralogues in vitro and in vivo. *Fish & Shellfish Immunology*, 31(1), pp.107-117.

Hehnke, K.E., Christenson, L.K., Ford, S.P. and Taylor, M., 1994. Macrophage infiltration into the porcine corpus luteum during prostaglandin F_{2α}-induced luteolysis. *Biology of reproduction*, 50(1), pp.10-15.

Hickey, M.M. and Simon, M.C., 2006. Regulation of angiogenesis by hypoxia and hypoxia-inducible factors. *Current topics in developmental biology*, 76, pp.217-257.

Hill, M.J., Royster IV, G.D., Healy, M.W., Richter, K.S., Levy, G., DeCherney, A.H., Levens, E.D., Suthar, G., Widra, E. and Levy, M.J., 2015. Are good patient and embryo characteristics protective against the negative effect of elevated progesterone level on the day of oocyte maturation?. *Fertility and sterility*, 103(6), pp.1477-1484.

Hirano, T., Taga, T., Nakano, N., Yasukawa, K., Kashiwamura, S., Shimizu, K., Nakajima, K., Pyun, K.H. and Kishimoto, T., 1985. Purification to homogeneity and characterization of human B-cell

differentiation factor (BCDF or BSFp-2). *Proceedings of the National Academy of Sciences*, 82(16), pp.5490-5494.

Hoek, V.H.K., Woodhouse, M.C., Brannstrom, M., Norman, J.R., 1998. Effects of interleukin (IL)-6 on luteinizing hormone- and IL-1 I-Induced ovulation and steroidogenesis in the rat ovary. *Biol. Reprod.* 58, 1266–1271.

Huck, B., Steck, T., Habersack, M., Dietl, J. and Kämmerer, U., 2005. Pregnancy associated hormones modulate the cytokine production but not the phenotype of PBMC-derived human dendritic cells. *European Journal of Obstetrics & Gynecology and Reproductive Biology*, 122(1), pp.85-94.

Hu, S.K., Mitcho, Y.L. and Rath, N.C., 1988. Effect of estradiol on interleukin 1 synthesis by macrophages. *International journal of immunopharmacology*, 10(3), pp.247-252.

Huising, M.O., Kruiswijk, C.P. and Flik, G., 2006. Phylogeny and evolution of class-I helical cytokines. *The Journal of endocrinology*, 189(1), pp.1-25.

Hung, Y.H., Hsieh, W.Y., Hsieh, J.S., Liu, F.C., Tsai, C.H., Lu, L.C., Huang, C.Y., Wu, C.L. and Lin, C.S., 2016. Alternative roles of STAT3 and MAPK signaling pathways in the MMPs activation and progression of lung injury induced by cigarette smoke exposure in ACE2 knockout mice.

International journal of biological sciences, 12(4), p.454.

Ihle, J.N., 1995. Cytokine receptor signalling. *Nature*, 377(6550), pp.591-594.

Ihle, J.N., 1996. STATs: signal transducers and activators of transcription. *Cell*, 84(3), pp.331-334.

Ikebuchi, K., Wong, G.G., Clark, S.C., Ihle, J.N., Hirai, Y. and Ogawa, M., 1987. Interleukin 6 enhancement of interleukin 3-dependent proliferation of multipotential hemopoietic progenitors.

Proceedings of the National Academy of Sciences, 84(24), pp.9035-9039.

Iliev, D.B., Castellana, B., MacKenzie, S., Planas, J.V., Goetz, F.W., 2007. Cloning and expression analysis of an IL-6 homolog in rainbow trout (*Oncorhynchus mykiss*). *Mol. Immunol.* 44, 1803–1807.

Ingman, W.V. and Jones, R.L., 2008. Cytokine knockouts in reproduction: the use of gene ablation to dissect roles of cytokines in reproductive biology. *Human reproduction update*, 14(2), pp.179-192.

Itoh, H., Suzuki, K. and Kawauchi, H., 1990. The complete amino acid sequences of α subunits of chum salmon gonadotropins. *General and comparative endocrinology*, 78(1), pp.56-65.

Jalabert, B., Szollosi, D., 1975. In vitro ovulation of trout oocytes: effect of prostaglandins on smooth muscle-like cells of the theca. *Prostaglandins* 9, 765–775.

Jones, S.A., Scheller, J. and Rose-John, S., 2011. Therapeutic strategies for the clinical blockade of IL-6/gp130 signaling. *The Journal of clinical investigation*, 121(9), pp.3375-3383.

Johnson, M.L., Murdoch, J., Van Kirk, E.A., Kaltenbach, J.E. and Murdoch, W.J., 1999. Tumor necrosis factor α regulates collagenolytic activity in preovulatory ovine follicles: relationship to cytokine secretion by the oocyte-cumulus cell complex. *Biology of reproduction*, 61(6), pp.1581-1585.

Kagawa, H., Gen, K., Okuzawa, K. and Tanaka, H., 2003. Effects of luteinizing hormone and follicle-stimulating hormone and insulin-like growth factor-I on aromatase activity and P450 aromatase gene expression in the ovarian follicles of red seabream, *Pagrus major*. *Biology of reproduction*, 68(5), pp.1562-1568.

Kaipia, A. and Hsueh, A.J., 1997. Regulation of ovarian follicle atresia. *Annual review of physiology*, 59(1), pp.349-363.

Kaneda, M., Odaka, T., Suetake, H., Tahara, D. and Miyadai, T., 2012. Teleost IL-6 promotes antibody production through STAT3 signaling via IL-6R and gp130. *Developmental & Comparative Immunology*, 38(2), pp.224-231.

Karakji, E.G. and Tsang, B.K., 1995. Regulation of rat granulosa cell plasminogen activator system: influence of interleukin-1 β and ovarian follicular development. *Biology of reproduction*, 53(6), pp.1302-1310.

Kasson, B.G. and Gorospe, W.C., 1989. Effects of interleukins 1, 2 and 3 on follicle-stimulating hormone-induced differentiation of rat granulosa cells. *Molecular and cellular endocrinology*, 62(1), pp.103-111.

Kawano, Y., Fukuda, J., Nasu, K., Matsumoto, H., Narahara, H. and Miyakawa, I., 2004. Synergistic effect of interleukin (IL)-1 α and ceramide analogue on the production of IL-6, IL-8, and macrophage colony-stimulating factor by endometrial stromal cells. *Fertility and sterility*, 82, pp.1043-1047.

Kawasaki, F., Kawano, Y., Kosay Hasan, Z., Narahara, H. and Miyakawa, I., 2003. The clinical role of interleukin-6 and interleukin-6 soluble receptor in human follicular fluids. *Clinical and experimental medicine*, 3, pp.27-31.

Kennedy, R.L. and Jones, T.H., 1991. Cytokines in endocrinology: their roles in health and in disease. *Journal of endocrinology*, 129(2), pp.167-178.

Khil, L.Y., Jun, H.S., Kwon, H., Yoo, J.K., Kim, S., Notkins, A.L. and Yoon, J.W., 2007. Human chorionic gonadotropin is an immune modulator and can prevent autoimmune diabetes in NOD mice. *Diabetologia*, 50, pp.2147-2155.

Kim, S., Liva, S.M., Dalal, M.A., Verity, M.A. and Voskuhl, R.R., 1999. Estriol ameliorates autoimmune demyelinating disease: implications for multiple sclerosis. *Neurology*, 52(6), pp.1230-1230.

Knight, O.M., Kraak, G.V.D., 2015. The role of eicosanoids in 17a, 20b-dihydroxy-4-pregnene-3-one-induced ovulation and spawning in Danio rerio. *Gen. Comp. Endocrinol.* 213, 50–58.

Kohase, M., Henriksen-DeStefano, D., May, L.T., Vilček, J. and Sehgal, P.B., 1986. Induction of β 2-interferon by tumor necrosis factor: a homeostatic mechanism in the control of cell proliferation. *Cell*, 45(5), pp.659-666.

- Kohase, M., May, L.T., Tamm, I., Vilcek, J. and Sehgal, P.B., 1987. A cytokine network in human diploid fibroblasts: interactions of beta-interferons, tumor necrosis factor, platelet-derived growth factor, and interleukin-1. *Molecular and cellular biology*.
- Kondo, H., Maruo, T. and Mochizuki, M., 1995. Immunohistochemical evidence for the presence of tumor necrosis factor- α in the infant and adult human ovary. *Endocrine journal*, 42(6), pp.771-780.
- Kothari, P., Pestana, R., Mesraoua, R., Elchaki, R., Khan, K.M., Dannenberg, A.J. and Falcone, D.J., 2014. IL-6-mediated induction of matrix metalloproteinase-9 is modulated by JAK-dependent IL-10 expression in macrophages. *The Journal of Immunology*, 192(1), pp.349-357.
- Krause, C.D. and Pestka, S., 2005. Evolution of the Class 2 cytokines and receptors, and discovery of new friends and relatives. *Pharmacology & therapeutics*, 106(3), pp.299-346.
- Kube, D., Platzer, C., Von Knethen, A., Straub, H., Bohlen, H., Hafner, M. and Tesch, H., 1995. Isolation of the human interleukin 10 promoter. Characterization of the promoter activity in Burkitt's lymphoma cell lines. *cytokine*, 7(1), pp.1-7.
- Langer, J.A., Cutrone, E.C. and Kotenko, S., 2004. The Class II cytokine receptor (CRF2) family: overview and patterns of receptor–ligand interactions. *Cytokine & growth factor reviews*, 15(1), pp.33-48.
- Lee, W., Haslinger, A., Karin, M. and Tjian, R., 1987. Activation of transcription by two factors that bind promoter and enhancer sequences of the human metallothionein gene and SV40. *Nature*, 325(6102), pp.368-372.
- Levitas, E., Chamoun, D., Udoff, L.C., Ando, M., Resnick, C.E. and Adashi, E.Y., 2000. Periovulatory and interleukin-1 β -dependent up-regulation of intraovarian vascular endothelial growth factor (VEGF) in the rat: potential role for VEGF in the promotion of periovulatory angiogenesis and vascular permeability. *The Journal of the Society for Gynecologic Investigation: JSGI*, 7, pp.51-60.

- Li, M.D. and Ford, J.J., 1998. A comprehensive evolutionary analysis based on nucleotide and amino acid sequences of the alpha-and beta-subunits of glycoprotein hormone gene family. *J Endocrinol*, 156(3), pp.529-542.
- Liarte, S., Chaves-Pozo, E., Garc'ia-Alcazar, A., Mulero, V., Meseguer, J., 'Garc'ia-Ayala, A., 2007. Testicular involution prior to sex change in gilthead seabream is characterized by a decrease in DMRT1 gene expression and by massive leukocyte infiltration. *Reprod. Biol. Endocrinol.* 5, 20–35.
- Lin SC, Yamate T, Taguchi Y, Borba VZ, Girasole G, O'Brien CA, et al. Regulation of the gp80 and gp130 subunits of the IL-6 receptor by sex steroids in the murine bone marrow. *J Clin Invest* 1997;100:1980–90.
- Lister, A.L., Van Der Kraak, G., 2008. An investigation into the role of prostaglandins in zebrafish oocyte maturation and ovulation. *Gen. Comp. Endocrinol.* 159, 46–57.
- Lister, A.L., Van Der Kraak, G., 2009. Regulation of prostaglandin synthesis in ovaries of sexually-mature zebrafish (*Danio rerio*). *Mol. Reprod. Dev.* 76, 1064–1075.
- Liu, Z., De Matos, D.G., Fan, H.Y., Shimada, M., Palmer, S., Richards, J.S., 2009. Interleukin-6: an autocrine regulator of the mouse cumulus cell-oocyte complex expansion process. *Endocrinology* 150, 3360–3368.
- Liu, D.T., Brewer, M.S., Chen, S., Hong, W., Zhu, Y., 2017. Transcriptomic signatures for ovulation in vertebrates. *Gen. Comp. Endocrinol.* 247, 74–86.
- Luo, Y., Zheng, S.G., 2016. Hall of fame among pro-inflammatory cytokines: interleukin-6 gene and its transcriptional regulation mechanisms. *Front. Immunol.* 7, 604.
- Lutfalla, G., Crollius, H.R., Stange-Thomann, N., Jaillon, O., Mogensen, K. and Monneron, D., 2003. Comparative genomic analysis reveals independent expansion of a lineage-specific gene family in vertebrates: the class II cytokine receptors and their ligands in mammals and fish. *BMC genomics*, 4, pp.1-15.

Machelon, V., Emilie, D., Lefevre, A., Nome, F., Durand-Gasselin, I. and Testart, J., 1994.

Interleukin-6 biosynthesis in human preovulatory follicles: some of its potential roles at ovulation.

The Journal of Clinical Endocrinology & Metabolism, 79(2), pp.633-642.

Machelon, V., Nome, F., Durand-Gasselin, I. and Emilie, D., 1995. Macrophage and granulosa interleukin-1 β mRNA in human ovulatory follicles. *Human Reproduction*, 10(8), pp.2198-2203.

Machelon, V., Nome, F. and Salesse, R., 1994. Comparative IL-6 effects on FSH and hCG-induced functions in porcine granulosa cell cultures. *Cellular and Molecular Biology (Noisy-le-Grand, France)*, 40(3), pp.373-380.

Machelon, V. and Emilie, D., 1997. Production of ovarian cytokines and their role in ovulation in the mammalian ovary. *European Cytokine Network*, 8(2), pp.137-43.

Maeda, K., Mehta, H., Drevets, D.A. and Coggeshall, K.M., 2010. IL-6 increases B-cell IgG production in a feed-forward proinflammatory mechanism to skew hematopoiesis and elevate myeloid production. *Blood, the Journal of the American Society of Hematology*, 115(23), pp.4699-4706.

Malizia, B.A., Wook, Y.S., Penzias, A.S. and Usheva, A., 2010. The human ovarian follicular fluid level of interleukin-8 is associated with follicular size and patient age. *Fertility and sterility*, 93(2), pp.537-543.

Manova, K., Nocka, K., Besmer, P. and Bachvarova, R.F., 1990. Gonadal expression of c-kit encoded at the W locus of the mouse. *Development*, 110(4), pp.1057-1069.

Martoriati, A., Lalmanach, A.C., Goudet, G. and Gérard, N., 2002. Expression of interleukin-1 (IL-1) system genes in equine cumulus-oocyte complexes and influence of IL-1 β during in vitro maturation. *Biology of reproduction*, 67(2), pp.630-636.

Martoriati, A., Caillaud, M., Goudet, G. and Gérard, N., 2003. Inhibition of in vitro maturation of equine oocytes by interleukin 1 β via specific IL-1 receptors. *Reproduction*, 126, pp.509-15.

Martioriati, A. and Gérard, N., 2003. Interleukin-1 (IL-1) system gene expression in granulosa cells: kinetics during terminal preovulatory follicle maturation in the mare. *Reproductive Biology and Endocrinology*, 1, pp.1-10.

Matsusaka, T., Fujikawa, K., Nishio, Y., Mukaida, N., Matsushima, K., Kishimoto, T. and Akira, S., 1993. Transcription factors NF-IL6 and NF-kappa B synergistically activate transcription of the inflammatory cytokines, interleukin 6 and interleukin 8. *Proceedings of the National Academy of Sciences*, 90(21), pp.10193-10197.

Matsumi, H., Yano, T., Osuga, Y., Kugu, K., Tang, X., Xu, J.P., Yano, N., Kurashima, Y., Ogura, T., Tsutsumi, O. and Koji, T., 2000. Regulation of nitric oxide synthase to promote cytostasis in ovarian follicular development. *Biology of reproduction*, 63(1), pp.141-146.

McNatty, K.P., Juengel, J.L., Reader, K.L., Lun, S., Myllymaa, S., Lawrence, S.B., Western, A., Meerasahib, M.F., Mottershead, D.G., Groome, N.P. and Ritvos, O., 2005. Bone morphogenetic protein 15 and growth differentiation factor 9 co-operate to regulate granulosa cell function in ruminants. *Reproduction*, 129(4), pp.481-487.

Molyneaux, K.A., Schaible, K. and Wylie, C., 2003. GP130, the shared receptor for the LIF/IL6 cytokine family in the mouse, is not required for early germ cell differentiation, but is required cell-autonomously in oocytes for ovulation.

Murdoch, W.J., Colgin, D.C., Ellis, J.A., 1997. Role of tumor necrosis factor-alpha in the ovulatory mechanism of ewes. *J. Anim. Sci.* 75, 1601–1605.

Moreau, P., Adrian-Cabestre, F., Menier, C., Guiard, V., Gouraud, L., Dausset, J., Carosella, E.D. and Paul, P., 1999. IL-10 selectively induces HLA-G expression in human trophoblasts and monocytes. *International immunology*, 11(5), pp.803-811.

Mosmann, T.R. and Moore, K.W., 1991. The role of IL-10 in crossregulation of TH1 and TH2 responses. *Immunology today*, 12(3), pp.A49-A53.

- Murayama, C., Kaji, A., Miyauchi, K., Matsui, M., Miyamoto, A. and Shimizu, T., 2010. Effect of VEGF (vascular endothelial growth factor) on expression of IL-8 (interleukin-8), IL-1 β and their receptors in bovine theca cells. *Cell biology international*, 34(5), pp.531-536.
- Muzzio, D., Zygmunt, M. and Jensen, F., 2014. The role of pregnancy-associated hormones in the development and function of regulatory B cells. *Frontiers in endocrinology*, 5, p.39.
- Nagahama, Y., 1983. 6 The functional morphology of teleost gonads. In *Fish physiology* (Vol. 9, pp. 223-275). Academic Press.
- Nagahama, Y., Yoshikuni, M., Yamashita, M. and Tanaka, M., 1994. 13 regulation of oocyte maturation in fish. In *Fish physiology* (Vol. 13, pp. 393-439). Academic Press.
- Nagahama, Y., Yoshikuni, M., Yamashita, M., Tokumoto, T. and Katsu, Y., 1995. 4 Regulation of oocyte growth and maturation in fish. *Current topics in developmental biology*, 30, pp.103-145.
- Nagahama, Y. and Yamashita, M., 2008. Regulation of oocyte maturation in fish. *Development, growth & differentiation*, 50, pp.S195-S219.
- Nishino, E., Matsuzaki, N., Masuhiro, K., Kameda, T., Taniguchi, T., Takagi, T., Saji, F. and Tanizawa, O., 1990. Trophoblast-derived interleukin-6 (IL-6) regulates human chorionic gonadotropin release through IL-6 receptor on human trophoblasts. *The Journal of Clinical Endocrinology & Metabolism*, 71(2), pp.436-441.
- O'Farrell, A.M., Liu, Y., Moore, K.W. and Mui, A.L.F., 1998. IL-10 inhibits macrophage activation and proliferation by distinct signaling mechanisms: evidence for Stat3-dependent and-independent pathways. *The EMBO journal*, 17(4), pp.1006-1018.
- Ogiwara, T., Takahashi, T., 2017. Involvement of the nuclear progestin receptor in LH-induced expression of membrane type 2-matrix metalloproteinase required for follicle rupture during ovulation in the medaka, *Oryzias latipes*. *Mol. Cell Endocrinol.* 450, 54–63.
- Okuda, K., Sakumoto, R., 2003. Multiple roles of TNF super family members in corpus luteum function. *Reprod. Biol. Endocrinol.* 1, 95.

Pancarci, S.M., Ari, U.C., Atakisi, O., Güngör, Ö., Çiğremiş, Y. and Bollwein, H., 2012. Nitric oxide concentrations, estradiol-17 β progesterone ratio in follicular fluid, and COC quality with respect to perifollicular blood flow in cows. *Animal reproduction science*, 130(1-2), pp.9-15.

Papanicolaou, D.A., Petrides, J.S., Tsigos, C., Bina, S., Kalogeras, K.T., Wilder, R., Gold, P.W., Deuster, P.A. and Chrousos, G.P., 1996. Exercise stimulates interleukin-6 secretion: inhibition by glucocorticoids and correlation with catecholamines. *American Journal of Physiology-Endocrinology and Metabolism*, 271(3), pp.E601-E605.

Patino, R., Yoshizaki, G., Bolamba, D., Thomas, P., 2003. Role of arachidonic acid and protein kinase C during maturation-inducing hormone-dependent meiotic resumption and ovulation in ovarian follicles of Atlantic croaker. *Biol. Reprod.* 68, 516–523.

Paul, S., Pramanick, K., Kundu, S., Roy Moulik, S., Pal, P., Mukherjee, D., 2013. Involvement of PI3 kinase and MAP kinase in IGF-I and insulin-induced ovarian steroidogenesis in common carp Cyprinuscarpio. *Gen. Comp. Endocrinol.* 181, 98–106.

Penny, L.A., Armstrong, D., Bramley, T.A., Webb, R., Collins, R.A. and Watson, E.D., 1999. Immune cells and cytokine production in the bovine corpus luteum throughout the oestrous cycle and after induced luteolysis. *Reproduction*, 115(1), pp.87-96.

Piazzon, M.C., Savelkoul, H.F., Pietretti, D., Wiegertjes, G.F. and Forlenza, M., 2015. Carp II10 has anti-inflammatory activities on phagocytes, promotes proliferation of memory T cells, and regulates B cell differentiation and antibody secretion. *The Journal of Immunology*, 194(1), pp.187-199.

Pinto, R.D., Nascimento, D.S., Reis, M.I., do Vale, A. and Dos Santos, N.M., 2007. Molecular characterization, 3D modelling and expression analysis of sea bass (*Dicentrarchus labrax* L.) interleukin-10. *Molecular Immunology*, 44(8), pp.2056-2065.

Pitzel, L., Jarry, H. and Wuttke, W., 1993. Effects and interactions of prostaglandin F2 alpha, oxytocin, and cytokines on steroidogenesis of porcine luteal cells. *Endocrinology*, 132(2), pp.751-756.

Pramanick, K., Kundu, S., Paul, S., Mallick, B., Roy Moulik, S., Pal, P., Mukherjee, D., 2014.

Steroid-induced oocyte maturation in Indian shad *Tenualosa ilisha* (Hamilton 1822) is dependent on phosphatidylinositol 3 kinase but not MAP kinase activation. *Mol. Cell. Endocrinol.* 390, 26–33.

Poli, V., Balena, R., Fattori, E., Markatos, A., Yamamoto, M., Tanaka, H., Ciliberto, G.,

Rodan, G.A. and Costantini, F., 1994. Interleukin-6 deficient mice are protected from bone

loss caused by estrogen depletion. *The EMBO journal*, 13(5), pp.1189-1196.

Qiao, J. and Feng, H.L., 2011. Extra-and intra-ovarian factors in polycystic ovary syndrome: impact on oocyte maturation and embryo developmental competence. *Human reproduction update*, 17(1), pp.17-33.

Rao, X., Huang, X., Zhou, Z., Lin, X., 2013. An improvement of the 2^Δ (-delta delta CT) method for quantitative real-time polymerase chain reaction data analysis. *Biostat. Bioinform. Biomath.* 3, 71–85.

Raghupathy, R. and Kalinka, J., 2008. Cytokine imbalance in pregnancy complications and its modulation. *Front Biosci*, 13(1), pp.985-94.

Ray, A., Steven Laforge, K. and Sehgal, P.B., 1990. On the mechanism for efficient repression of the interleukin-6 promoter by glucocorticoids: enhancer, TATA box, and RNA start site (Inr motif) occlusion. *Molecular and Cellular Biology*, 10(11), pp.5736-5746.

Richards, J.S., Liu, Z., Shimada, M., 2008. Immune-like mechanisms in ovulation. *Trends Endocrinol. Metab.* 19, 191–196.

Richards, J.S. and Pangas, S.A., 2010. The ovary: basic biology and clinical implications. *The Journal of clinical investigation*, 120(4), pp.963-972.

Rolle, L., Memarzadeh Tehran, M., Morell-García, A., Raeva, Y., Schumacher, A., Hartig, R., Costa, S.D., Jensen, F. and Zenclussen, A.C., 2013. Cutting edge: IL-10-producing regulatory B cells in early human pregnancy. *American journal of reproductive immunology*, 70(6), pp.448-453.

Rose-John, S., Heinrich, P.C., 1994. Soluble receptors for cytokines and growth factors: generation and biological function. *Biochem. J.* 300, 281–290.

Rosselli, M., Keller, R.J. and Dubey, R.K., 1998. Role of nitric oxide in the biology, physiology and pathophysiology of reproduction. *Human reproduction update*, 4(1), pp.3-24.

Roth, I., Corry, D.B., Locksley, R.M., Abrams, J.S., Litton, M.J. and Fisher, S.J., 1996. Human placental cytotrophoblasts produce the immunosuppressive cytokine interleukin 10. *The Journal of experimental medicine*, 184(2), pp.539-548.

Roth, I. and Fisher, S.J., 1999. IL-10 is an autocrine inhibitor of human placental cytotrophoblast MMP-9 production and invasion. *Developmental Biology*, 205(1), pp.194-204.

Runesson, E., Boström, E.K., Janson, P.O. and Brännström, M., 1996. Endocrinology and paracrinology: the human preovulatory follicle is a source of the chemotactic cytokine interleukin-8. *MHR: Basic science of reproductive medicine*, 2(4), pp.245-250.

Russell, S.H., Small, C.J., Stanley, S.A., Franks, S., Ghatei, M.A., Bloom, S.R., 2001. The in vitro role of tumour necrosis factor- α and interleukin-6 in the hypothalamicpituitary gonadal axis. *J. Neuroendocrinol.* 13, 296–301.

Sacks, G.P., Clover, L.M., Bainbridge, D.R.J., Redman, C.W.G. and Sargent, I.L., 2001. Flow cytometric measurement of intracellular Th1 and Th2 cytokine production by human villous and extravillous cytotrophoblast. *Placenta*, 22(6), pp.550-559.

Sakumoto, R., Komatsu, T., Kasuya, E., Saito, T. and Okuda, K., 2006. Expression of mRNAs for interleukin-4, interleukin-6 and their receptors in porcine corpus luteum during the estrous cycle. *Domestic Animal Endocrinology*, 31(3), pp.246-257.

Salmassi, A., Lu, S., Hedderich, J., Oettinghaus, C., Jonat, W., Mettler, L., 2001. Interaction of interleukin-6 on human granulosa cell steroid secretion. *J. Endocrinol.* 170, 471–478.

Sallinen, K., Veräjänkorva, E. and Pöllänen, P., 2000. Expression of antigens involved in the presentation of lipid antigens and induction of clonal anergy in the female reproductive tract. *Journal of reproductive immunology*, 46(2), pp.91-101.

Sauté, J.P.E., Healey, G.D., Borges, A.M., Sheldon, M., 2014. Ovarian steroids do not affect bovine endometrial cytokine or chemokine responses to Escherichia coli or LPS in vitro. *Reproduction* 148, 593–606.

Savan, R., Igawa, D. and Sakai, M., 2003. Cloning, characterization and expression analysis of interleukin-10 from the common carp, Cyprinus carpio L. *European Journal of Biochemistry*, 270(23), pp.4647-4654.

Schiel, X., Rose-John, S., Dufhues, G., Schooltink, H., Gross, V. and Heinrich, P.C., 1990. Microheterogeneity of human interleukin 6 synthesized by transfected NIH/3T3 cells: comparison with human monocytes, fibroblasts and endothelial cells. *European journal of immunology*, 20(4), pp.883-887.

Secombes, C.J., Wang, T. and Bird, S., 2011. The interleukins of fish. *Developmental & Comparative Immunology*, 35(12), pp.1336-1345.

Sehgal, P.B. and Sagar, A.D., 1980. Heterogeneity of poly (I). poly (C)-induced human fibroblast interferon mRNA species. *Nature*, 288(5786), pp.95-97.

Senthilkumaran, B., Yoshikuni, M. and Nagahama, Y., 2004. A shift in steroidogenesis occurring in ovarian follicles prior to oocyte maturation. *Molecular and cellular endocrinology*, 215(1-2), pp.11-18.

Seppola, M., Larsen, A.N., Steiro, K., Robertsen, B. and Jensen, I., 2008. Characterisation and expression analysis of the interleukin genes, IL-1 β , IL-8 and IL-10, in Atlantic cod (*Gadus morhua* L.). *Molecular immunology*, 45(4), pp.887-897.

Sepulcre, M.P., Sarropoulou, E., Kotoulas, G., Meseguer, J. and Mulero, V., 2007. *Vibrio anguillarum* evades the immune response of the bony fish sea bass (*Dicentrarchus labrax* L.)

through the inhibition of leukocyte respiratory burst and down-regulation of apoptotic caspases.

Molecular immunology, 44(15), pp.3751-3757.

Shao R, Nutu M, Karlsson-Lindahl L, Benrick A, Weijdegård B, Lager S, et al. Downregulation of cilia-localized Il-6R alpha by 17beta-estradiol in mouse and human fallopian tubes. *Am J Physiol Cell Physiol* 2009;297:51.

Shimasaki, S., Moore, R.K., Erickson, G.F. and Otsuka, F., 2003. The role of bone morphogenetic proteins in ovarian function. *REPRODUCTION-CAMBRIDGE-SUPPLEMENT-*, pp.323-337.

Shimizu, H., Mitomo, K., Watanabe, T., Okamoto, S. and Yamamoto, K., 1990. Involvement of a NF-kappa B-like transcription factor in the activation of the interleukin-6 gene by inflammatory lymphokines. *Molecular and cellular biology*.

Silva, A.W.B., Bezerra, F.T.G., Glanzner, W.G., Dos Santos, J.T., Dau, A.M.P., Rovani, M.T., Ilha, G.F., Costa, J.J.N., Cunha, E.V., Donato, M.A.M. and Peixoto, C.A., 2017. mRNA expression profile of the TNF- α system in LH-induced bovine preovulatory follicles and effects of TNF- α on gene expression, ultrastructure and expansion of cumulus-oocyte complexes cultured in vitro.

Theriogenology, 90, pp.1-10.

Sirotnik, A.V., 2011. Cytokines: signalling molecules controlling ovarian functions. *Int J Biochem Cell Bio.* 43, 857–861.

Smolikova, K., Mlynarcikova, A., Scesukovva, S., 2012. Role of interleukins in the regulation of ovarian fucntions. *Endocr. Regul.* 46, 237–253.

Son, E.W., Mo, S.J., Rhee, D.K. and Pyo, S., 2004. Vitamin C blocks TNF- α -induced NF- κ B activation and ICAM-1 expression in human neuroblastoma cells. *Archives of pharmacal research*, 27, pp.1073-1079.

Spangelo, B.L., Judd, A.M., Isakson, P.C. and Macleod, R.M., 1989. Interleukin-6 stimulates anterior pituitary hormone release in vitro. *Endocrinology*, 125(1), pp.575-577.

- Spangleo, B.L., Macleod, R.M. and Isakson, P.C., 1990. Production of interleukin-6 by anterior pituitary cells in vitro. *Endocrinology*, 126(1), pp.582-586.
- Spangle, B.L., Judd, A.M., Macleod, R.M., Goodman, D.W. and Isakson, P.C., 1990. Endotoxin-induced release of interleukin-6 from rat medial basal hypothalami. *Endocrinology*, 127(4), pp.1779-1785.
- Spangelo, B.L., Judd, A.M., Call, G.B., Zumwalt, J. and Gorospe, W.C., 1995. Role of the cytokines in the hypothalamic-pituitary-adrenal and gonadal axes. *Neuroimmunomodulation*, 2(5), pp.299-312.
- Stacey, N.E., Pandey, S., 1975. Effects of indomethacin and prostaglandins on ovulation of gold fish. *Prostaglandins* 9, 597–607.
- Stassi, A.F., Baravalle, M.E., Belotti, E.M., Rey, F., Gareis, N.C., Díaz, P.U., Rodríguez, F.M., Leiva, C.J., Ortega, H.H., Salvetti, N.R., 2017. Altered expression of cytokines IL-1 α , IL-6, IL-8 and TNF- α in bovine follicular persistence. *Theriogenology* 97, 104–112.
- Stephanou, A. and Handwerger, S., 1994. Interleukin-6 stimulates placental lactogen expression by human trophoblast cells. *Endocrinology*, 135(2), pp.719-723.
- Stewart, C.L., Kaspar, P., Brunet, L.J., Bhatt, H., Gadi, I., Köntgen, F. and Abbondanzo, S.J., 1992. Blastocyst implantation depends on maternal expression of leukaemia inhibitory factor. *Nature*, 359(6390), pp.76-79.
- Sunarto, A., Liongue, C., McColl, K.A., Adams, M.M., Bulach, D., Crane, M.S.J., Schat, K.A., Slobedman, B., Barnes, A.C., Ward, A.C. and Walker, P.J., 2012. Koi herpesvirus encodes and expresses a functional interleukin-10. *Journal of virology*, 86(21), pp.11512-11520.
- Suzuki, K., Kawauchi, H. and Nagahama, Y., 1988. Isolation and characterization of two distinct gonadotropins from chum salmon pituitary glands. *General and Comparative Endocrinology*, 71(2), pp.292-301.

- Suzuki, K., Nagahama, Y. and Kawauchi, H., 1988. Steroidogenic activities of two distinct salmon gonadotropins. *General and Comparative Endocrinology*, 71(3), pp.452-458.
- Suzuki, K., Kawauchi, H. and Nagahama, Y., 1988. Isolation and characterization of subunits from two distinct salmon gonadotropins. *General and Comparative Endocrinology*, 71(2), pp.302-306.
- Swain, S.L., McKinstry, K.K. and Strutt, T.M., 2012. Expanding roles for CD4+ T cells in immunity to viruses. *Nature Reviews Immunology*, 12(2), pp.136-148.
- Szukiewicz, D., Pyzlak, M., Klimkiewicz, J., Szewczyk, G. and Maslinska, D., 2007. Mast cell-derived interleukin-8 may be involved in the ovarian mechanisms of follicle growth and ovulation. *Inflammation Research*, 56, pp.S35-S36.
- Taga, T. and Kishimoto, T., 1997. Gp130 and the interleukin-6 family of cytokines. *Annual review of immunology*, 15(1), pp.797-819.
- Takahashi, T., Hagiwara, A., Ogiwara, K., 2018. Prostaglandins in teleost ovulation: a review of the roles with a view to comparison with prostaglandins in mammalian ovulation. *Mol. Cell. Endocrinol.* 461, 236–247.
- Tamura, T., Nakanishi, T.O.H.R.U., Kimura, Y.U.S.U.K.E., Hattori, T.A.K.A.K.O., Sasaki, K., Norimatsu, H.I.R.O.M.I.C.H.I., Takahashi, K. and Takigawa, M.A.S.A.H.A.R.U., 1996. Nitric oxide mediates interleukin-1-induced matrix degradation and basic fibroblast growth factor release in cultured rabbit articular chondrocytes: a possible mechanism of pathological neovascularization in arthritis. *Endocrinology*, 137(9), pp.3729-3737.
- Tamura, K., Kawaguchi, T., Hara, T., Takatoshi, S., Tohei, A., Miyajima, A., Seishi, T. and Kogo, H., 2000. Interleukin-6 decreases estrogen production and messenger ribonucleic acid expression encoding aromatase during in vitro cytodifferentiation of rat granulosa cell. *Molecular and Cellular Endocrinology*, 170(1-2), pp.103-111.

- Tamura, K., Kawaguchi, T. and Kogo, H., 2001. Interleukin-6 inhibits the expression of luteinizing hormone receptor mRNA during the maturation of cultured rat granulosa cells. *Journal of endocrinology*, 170(1), pp.121-127.
- Tanaka, M., Telecky, T.M., Fukada, S., Adachi, S., Chen, S. and Nagahama, Y., 1992. Cloning and sequence analysis of the cDNA encoding P-450 aromatase (P450arom) from a rainbow trout (*Oncorhynchus mykiss*) ovary; relationship between the amount of P450arom mRNA and the production of oestradiol-17 β in the ovary. *Journal of molecular endocrinology*, 8(1), pp.53-61.
- Tang, H., Liu, Y., Li, J., Li, G., Chen, Y., Yin, Y., Guo, Y., Cheng, C.H., Liu, X., Lin, H., 2017. LH signaling induced ptgs2a expression is required for ovulation in zebrafish. *Mol. Cell. Endocrinol.* 447, 125–133.
- Tao, M., Kodama, H., Kagabu, S., Fukuda, J., Murata, M., Shimizu, Y., Hirano, H. and Tanaka, T., 1997. Possible contribution of follicular interleukin-1beta to nitric oxide generation in human pre-ovulatory follicles. *Human reproduction (Oxford, England)*, 12(10), pp.2220-2225.
- Telleria, C.M., Zhong, L., Deb, S., Srivastava, R.K., Park, K.S., Sugino, N., Park-Sarge, O.K. and Gibori, G., 1998. Differential expression of the estrogen receptors α and β in the rat corpus luteum of pregnancy: regulation by prolactin and placental lactogens. *Endocrinology*, 139(5), pp.2432-2442.
- Terranova, P.F., 1997. Potential roles of tumor necrosis factor-alpha in follicular development, ovulation, and the life span of the corpus luteum. *Domest. Anim. Endocrinol.* 14, 1–15.
- Thaxton, J.E. and Sharma, S., 2010. Interleukin-10: a multi-faceted agent of pregnancy. *American Journal of Reproductive Immunology*, 63(6), pp.482-491.
- Tingen, C.M., Kiesewetter, S.E., Jozefik, J., Thomas, C., Tagler, D., Shea, L. and Woodruff, T.K., 2011. A macrophage and theca cell-enriched stromal cell population influences growth and survival of immature murine follicles in vitro. *Reproduction (Cambridge, England)*, 141(6), p.809.

Tsigos, C., Papanicolaou, D.A., Kyrou, I., Raptis, S.A. and Chrousos, G.P., 1999. Dose-dependent effects of recombinant human interleukin-6 on the pituitary-testicular axis. *Journal of interferon & cytokine research*, 19(11), pp.1271-1276.

Tsushima, T., 1995. Interaction between endocrine and immune system. *J. Toxicol. Sci.* 20, 474–476.

Uemura, Y., Liu, T.Y., Narita, Y., Suzuki, M. and Matsushita, S., 2008. 17 β -Estradiol (E2) plus tumor necrosis factor- α induces a distorted maturation of human monocyte-derived dendritic cells and promotes their capacity to initiate T-helper 2 responses. *Human immunology*, 69(3), pp.149-157.

Van Beurden, S.J., Forlenza, M., Westphal, A.H., Wiegertjes, G.F., Haenen, O.L. and Engelsma, M.Y., 2011. The alloherpesviral counterparts of interleukin 10 in European eel and common carp. *Fish & Shellfish Immunology*, 31(6), pp.1211-1217.

Van Damme, J., Opdenakker, G., Simpson, R.J., Rubira, M.R., Cayphas, S., Vink, A., Billiau, A. and Van Snick, J., 1987. Identification of the human 26-kD protein, interferon beta 2 (IFN-beta 2), as a B cell hybridoma/plasmacytoma growth factor induced by interleukin 1 and tumor necrosis factor. *The Journal of experimental medicine*, 165(3), pp.914-919.

Van der Hoek, K.H., Woodhouse, C.M., Brännström, M. and Norman, R.J., 1998. Effects of Interleukin (IL)-6 on Luteinizing Hormone-and IL-1 β -Induced Ovulation and Steroidogenesis in the Rat Ovary. *Biology of reproduction*, 58(5), pp.1266-1271.

Van Eijk, M.J.T., Mandelbaum, J., Salat-Baroux, J., Belaisch-Allart, J., Plachot, M., Junca, A.M. and Mummery, C.L., 1996. Expression of leukaemia inhibitory factor receptor subunits LIFR β and gp130 in human oocytes and preimplantation embryos. *Mol Hum Reprod*, 2(5), pp.355-360.

van Gool, J., van Vugt, H., Helle, M. and Aarden, L.A., 1990. The relation among stress, adrenalin, interleukin 6 and acute phase proteins in the rat. *Clinical immunology and immunopathology*, 57(2), pp.200-210.

Varela, M., Dios, S., Novoa, B., Figueras, A., 2012. Characterisation, expression and ontogeny of interleukin-6 and its receptors in zebrafish (*Danio rerio*). *Dev. Comp. Immunol.* 37, 97–106.

Vernon-Roberts, B., 1969. The effects of steroid hormones on macrophage activity. *International review of cytology*, 25, pp.131-159.

Vinatier, D., Dufour, P., Tordjeman-Rizzi, N., Prolongeau, J.F., Depret-Moser, S. and Monnier, J.C., 1995. Immunological aspects of ovarian function: role of the cytokines. *European Journal of Obstetrics & Gynecology and Reproductive Biology*, 63(2), pp.155-168.

Vosshenrich, C.A. and Di Santo, J.P., 2002. Interleukin signaling. *Current Biology*, 12(22), pp.R760-R763.

Wallace, A.R., 1895. THE METHOD OF ORGANIC EVOLUTION. *Fortnightly*, 57(338), pp.211-224.

Walters, K.A., Allan, C.M., Handelsman, D.J., 2008. Androgen actions and the ovary. *Biol. Reprod.* 78 (3), 380–389.

Wang, T. and Secombes, C.J., 2013. The cytokine networks of adaptive immunity in fish. *Fish & shellfish immunology*, 35(6), pp.1703-1718.

Wang, L.J., Brännström, M., Robertson, S.A., Norman, R.J., 1992. Tumor necrosis factor α in the human ovary: presence in follicular fluid and effects on cell proliferation and prostaglandin production. *Fertil. Steril.* 58, 934–940.

Wang, T., Yuan, W., Liu, Y., Zhang, Y., Wang, Z., Zhou, X., Ning, G., Zhang, L., Yao, L., Feng, S. and Kong, X., 2015. The role of the JAK-STAT pathway in neural stem cells, neural progenitor cells and reactive astrocytes after spinal cord injury. *Biomedical Reports*, 3(2), pp.141-146.

Wei, L., Jiao, P., Song, Y., Cao, L., Yuan, R., Gong, L., Cui, J., Zhang, S., Qi, W., Yang, S., Liao, M., 2013. Host immune responses of ducks infected with H5N1 highly pathogenic avian influenza viruses of different pathogenicities. *Vet. Microbiol.* 166, 386–393.

- Weissenbach, J., Chernajovsky, Y., Zeevi, M., Shulman, L., Soreq, H., Nir, U., Wallach, D., Perricaudet, M., Tiollais, P. and Revel, M., 1980. Two interferon mRNAs in human fibroblasts: in vitro translation and Escherichia coli cloning studies. *Proceedings of the National Academy of Sciences*, 77(12), pp.7152-7156.
- Wheelock, E.F., 1965. Interferon-like virus-inhibitor induced in human leukocytes by phytohemagglutinin. *Science*, 149(3681), pp.310-311.
- Wissing, M.L., Kristensen, S.G., Andersen, C.Y., Mikkelsen, A.L., Høst, T., Borup, R., Grøndahl, M.L., 2014. Identification of new ovulation-related genes in humans by comparing the transcriptome of granulosa cells before and after ovulation triggering in the same controlled ovarian stimulation cycle. *Hum. Reprod.* 29, 997–1010.
- Wolf, J., Rose-John, S. and Garbers, C., 2014. Interleukin-6 and its receptors: a highly regulated and dynamic system. *Cytokine*, 70(1), pp.11-20.
- Wong, C.K., Ho, C.Y., Ko, F.W.S., Chan, C.H.S., Ho, A.S.S., Hui, D.S.C. and Lam, C.W.K., 2001. Proinflammatory cytokines (IL-17, IL-6, IL-18 and IL-12) and Th cytokines (IFN- γ , IL-4, IL-10 and IL-13) in patients with allergic asthma. *Clinical & Experimental Immunology*, 125(2), pp.177-183.
- Xu, F., Stouffer, R.L., Muller, J., Hennebold, J.D., Wright, J.W., Bahar, A., Leder, G., Peters, M., Thorne, M., Sims, M., Wintermantel, T., Lindenthal, B., 2010. Dynamics of the transcriptome in the primate ovulatory follicle. *Mol. Hum. Reprod.* 17, 152–165.
- Yang, L., Blumbergs, P.C., Jones, N.R., Manavis, J., Sarvestani, G.T. and Ghabriel, M.N., 2004. Early expression and cellular localization of proinflammatory cytokines interleukin-1 β , interleukin-6, and tumor necrosis factor- α in human traumatic spinal cord injury. *Spine*, 29(9), pp.966-971.

Yasuda, K., Fukuoka, M., Taii, S., Takakura, K. and Mori, T., 1990. Inhibitory effects of interleukin-1 on follicle-stimulating hormone induction of aromatase activity, progesterone secretion, and functional luteinizing hormone receptors in cultures of porcine granulosa cells. *Biology of reproduction*, 43(6), pp.905-912.

Yasukawa, K., Hirano, T., Watanabe, Y., Muratani, K., Matsuda, T., Nakai, S. and Kishimoto, T., 1987. Structure and expression of human B cell stimulatory factor-2 (BSF-2/IL-6) gene. *The EMBO journal*, 6(10), pp.2939-2945.

Yoshino, O., Osuga, Y., Koga, K., Hirota, Y., Yano, T., Tsutsumi, O., Fujimoto, A., Kugu, K., Momoeda, M., Fujiwara, T. and Taketani, Y., 2003. Upregulation of interleukin-8 by hypoxia in human ovaries. *American Journal of Reproductive Immunology*, 50(4), pp.286-290.

Zhang, D.C., Shao, Y.Q., Huang, Y.Q. and Jiang, S.G., 2005. Cloning, characterization and expression analysis of interleukin-10 from the zebrafish (*Danio rerio*). *BMB Reports*, 38(5), pp.571-576.

Zhu, Y., Liu, D., Shaner, Z.C., Chen, S., Hong, W., Stellwag, E.J., 2015. Nuclear progestin receptor (pgr) knockouts in zebrafish demonstrate role for pgr in ovulation but not in rapid nongenomic steroid mediated meiosis resumption. *Front. Endocrinol.* 6, 1–10.

Zolti, M., Meirom, R., Shemesh, M., Wollach, D., Mashiach, S., Shore, L., Rafael, Z.B., 1990. Granulosa cells as a source and target organ for tumor necrosis factor alpha. *FEBS Lett.* 26, 1253–1255.

Zou, J., Secombes, C.J., 2016. The function of fish cytokines. *Biology* 5, 1–35.

List of Published papers:

1. Chatterjee, A., Guchhait, R., Maity, S., Mukherjee, D., & Pramanick, K. (2020). Functions of interleukin-6 in ovulation of female climbing perch, *Anabas testudineus*. *Animal Reproduction Science*, 219, 106528. <https://doi.org/10.1016/j.anireprosci.2020.106528>
2. Chatterjee, A., Maity, S., Banerjee, S., Dutta, S., Adhikari, M., Guchhait, R., Biswas, C., De, S., & Pramanick, K. (2022). Toxicological impacts of nanopolystyrene on zebrafish oocyte with insight into the mechanism of action: An expression-based analysis. *Science of The Total Environment*, 830, 154796. <https://doi.org/10.1016/j.scitotenv.2022.154796>
3. Guchhait, R., Chatterjee, A., Mukherjee, D., & Pramanick, K. (2018). Seasonal ovarian development in relation to the gonadotropins, steroids, aromatase and steroidogenic factor 1 (SF-1) in the banded gourami, *Trichogaster fasciata*. *General and Comparative Endocrinology*, 268, 40-49. <https://doi.org/10.1016/j.ygcen.2018.07.014>
4. Guchhait, R., Chatterjee, A., Gupta, S., Debnath, M., Mukherjee, D., & Pramanick, K. (2018). Molecular mechanism of mercury-induced reproductive impairments in banded gourami, *Trichogaster fasciata*. *General and Comparative Endocrinology*, 255, 40-48. <https://doi.org/10.1016/j.ygeen.2017.10.004>
5. Maity, S., Chatterjee, A., Guchhait, R., De, S., & Pramanick, K. (2020). Cytogenotoxic potential of a hazardous material, polystyrene microparticles on *Allium cepa* L. *Journal of Hazardous Materials*, 385, 121560. <https://doi.org/10.1016/j.jhazmat.2019.121560>
6. Banerjee, S., Maity, S., Guchhait, R., Chatterjee, A., Biswas, C., Adhikari, M., & Pramanick, K. (2021). Toxic effects of cyanotoxins in teleost fish: A comprehensive review. *Aquatic Toxicology*, 240, 105971. <https://doi.org/10.1016/j.aquatox.2021.105971>
7. Maity, ., Biswas, C., Banerjee, S. *et al.* Interaction of plastic particles with heavy metals and the resulting toxicological impacts: a review. *Environ Sci Pollut Res* 28, 60291–60307 (2021). <https://doi.org/10.1007/s11356-021-16448-z>