

- tions. *Science*. V. 352. P. 242.
<https://doi.org/10.1126/science.aaf1328>
- Qian B.Z., Pollard J.W.* 2010. Macrophage diversity enhances tumor progression and metastasis. *Cell*. V. 141. P. 39.
<https://doi.org/10.1016/j.cell.2010.03.014>
- Ravishankar B., Shinde R., Liu H., Chaudhary K., Bradley J., Lemos H.P., Chandler P., Tanaka M., Munn D.H., Mellor A.L., McGaha T.L.* 2014. Marginal zone CD169⁺ macrophages coordinate apoptotic cell-driven cellular recruitment and tolerance. *PNAS*. V. 111. P. 4215.
<https://doi.org/10.1073/pnas.1320924111>
- Recalcati S., Locati M., Gammella E., Invernizzi P., Cairo G.* 2012. Iron levels in polarized macrophages: Regulation of immunity and autoimmunity. *Autoimmun. Rev.* V. 11. P. 883.
<https://doi.org/10.1016/j.autrev.2012.03.003>
- Robbins C.S., Chudnovskiy A., Rauch P.J., Figueiredo J.-L., Iwamoto Y., Gorbatov R., Etzrodt M., Weber G.F., Ueno T., van Rooijen N., Mulligan-Kehoe M.J., Libby P., Nahrendorf M., Pittet M.J., Weissleder R. et al.* 2012. Extramedullary hematopoiesis generates Ly-6C^{high} monocytes that infiltrate atherosclerotic lesions. *Circulation*. V. 125. P. 364.
<https://doi.org/10.1161/CIRCULATIONAHA.111.061986>
- Salcedo S.P., Noursadeghi M., Cohen J., Holden D.W.* 2001. Intracellular replication of *Salmonella typhimurium* strains in specific subsets of splenic macrophages *in vivo*. *Cell. Microbiol.* V. 3. P. 587.
<https://doi.org/10.1046/j.1462-5822.2001.00137.x>
- Sancho D., Joffre O.P., Keller A.M., Rogers N.C., Martinez D., Hernanz-Falcon P., Rosewell I., Reis e Sousa C.* 2009. Identification of a dendritic cell receptor that couples sensing of necrosis to immunity. *Nature*. V. 458. P. 899.
<https://doi.org/10.1038/nature07750>
- Schulz C., Perdiguer E.G., Chorro L., Szabo-Rogers H., Cagnard N., Kierdorf K., Prinz M., Wu B., Jacobsen S.E., Pollard J.W., Frampton J., Liu K.J., Geissmann F.* 2012. A lineage of myeloid cells independent of Myb and hematopoietic stem cells. *Science*. V. 336. P. 86.
<https://doi.org/10.1126/science.1219179>
- da Silva H.B., Fonseca R., dos Anjos Cassado A., de Salles E.M., de Menezes M.N., Langhorne J., Perez K.R., Cuccovia I.M., Ryffel B., Barreto V.M., Marinho F.C.-R., Boscardin S.-B., Alvarez J.-M., D'Imperio-Lima M.-R., Tadokoro C.-E.* 2015. *In vivo* approaches reveal a key role for DCs in CD4+ T cell activation and parasite clearance during the acute phase of experimental blood-stage malaria. *PLoS Pathog.* V. 11. P. 24.
<https://doi.org/10.1371/journal.ppat.1004598>
- Steiniger B., Barth P., Hellinger A.* 2001. The perifollicular and marginal zones of the human splenic white pulp. Do fibroblasts guide lymphocyte immigration? *Am. J. Pathol.*
- V. 159. P. 501.
[https://doi.org/10.1016/S0002-9440\(10\)61722-1](https://doi.org/10.1016/S0002-9440(10)61722-1)
- Steiniger B.S., Seiler A., Lampp K., Wilhelm V., Stachniss V.* 2014. B lymphocyte compartments in the human splenic red pulp: capillary sheaths and periarteriolar regions. *Histochemistry Cell Biol.* V. 141. P. 507.
<https://doi.org/10.1007/s00418-013-1172-z>
- Sun L.M., Chen H.J., Jeng L.B., Li T.C., Wu S.C., Kao C.H.* 2015. Splenectomy and increased subsequent cancer risk: A nationwide population-based cohort study. *Am. J. Surg.* V. 210. P. 243.
<https://doi.org/10.1016/j.amjsurg.2015.01.017>
- Swirski F.K., Nahrendorf M., Etzrodt M., Wildgruber M., Cortez-Retamozo V., Panizzi P., Figueiredo J.-L., Kohler R.H., Chudnovskiy A., Waterman P., Aikawa I. E., Mempel T.R., Libby P., Weissleder R., Pittet M.J.* 2009. Identification of splenic reservoir monocytes and their deployment to inflammatory sites. *Science*. V. 325. V. 612.
<https://doi.org/10.1126/science.1175202>
- Tian Y., Miao B., Charles E.J., Wu D., Kron I.L., French B.A., Yang Z.* 2018. Stimulation of the beta2 adrenergic receptor at reperfusion limits myocardial reperfusion injury via an interleukin-10-dependent antiinflammatory pathway in the spleen. *Circ. J.* V. 82. P. 2829.
<https://doi.org/10.1253/circj.CJ-18-006>
- Wang, M., Subramanian M., Abramowicz S., Murphy A.J., Gonen A., Witztum J., Welch C., Tabas I., Westerterp M., Tall A.R.* 2014. Interleukin-3/granulocyte macrophage colony-stimulating factor receptor promotes stem cell expansion, monocytosis, and atherosoma macrophage burden in mice with hematopoietic ApoE deficiency. *Arterioscler. Thromb. Vasc. Biol.* V. 34. P. 976.
<https://doi.org/10.1161/ATVBAHA.113.303097>
- Wu C., Ning H., Liu M., Lin J., Luo S., Zhu W., Xu J., Wu W.-C., Liang J., Shao C.-K., Ren J., Wei B., Cui J., Chen M.-S., Zheng L.* 2018. Spleen mediates a distinct hematopoietic progenitor response supporting tumor-promoting myelopoiesis. *J. Clin. Invest.* V. 128. P. 3425.
<https://doi.org/10.1172/JCI97973>
- Yamada S., Morine Y., Imura S., Ikemoto T., Arakawa Y., Iwashashi S., Saito Y., Yoshikawa M., Teraoku H., Shimada M.* 2016. Liver regeneration after splenectomy in patients with liver cirrhosis. *Hepatol. Res.* V. 46. P. 443.
<https://doi.org/10.1111/hepr.12573>
- Yona S., Kim K.W., Wolf Y., Mildner A., Varol D., Breker M., Strauss-Ayali D., Viukov S., Guilliams M., Misharin A., Hume D.A., Perlman H., Malissen B., Zelzer E., Jung S.* 2013. Fate mapping reveals origins and dynamics of monocytes and tissue macrophages under homeostasis. *Immunity*. V. 38. P. 1073.
<https://doi.org/10.1016/j.jimmuni.2012.12.001>

Spleen Macrophages: Features of Population Composition and Function

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The heterogeneous population of spleen macrophages perform many important functions. However, most of the research in this field has been done on experimental models and much remains have been understood not fully. The

review summarizes data about characteristics of human and animal macrophages in various functional areas of the spleen. The role of spleen macrophages in the utilization of senescent erythrocytes, iron metabolism, immunogenesis, immunosuppression and elimination of apoptotic cells, phagocytosis of hematogenically spreading pathogens and the role of tuftsin in this process, the role of the spleen as a reservoir of monocytes involved in inflammation and regeneration are discussed. An attempt was made to find data on the possible role of spleen macrophages in the phenomenon of the rarity spleen metastases during cancer progression.

Keywords: macrophages, spleen, splenectomy, repair, carcinomas