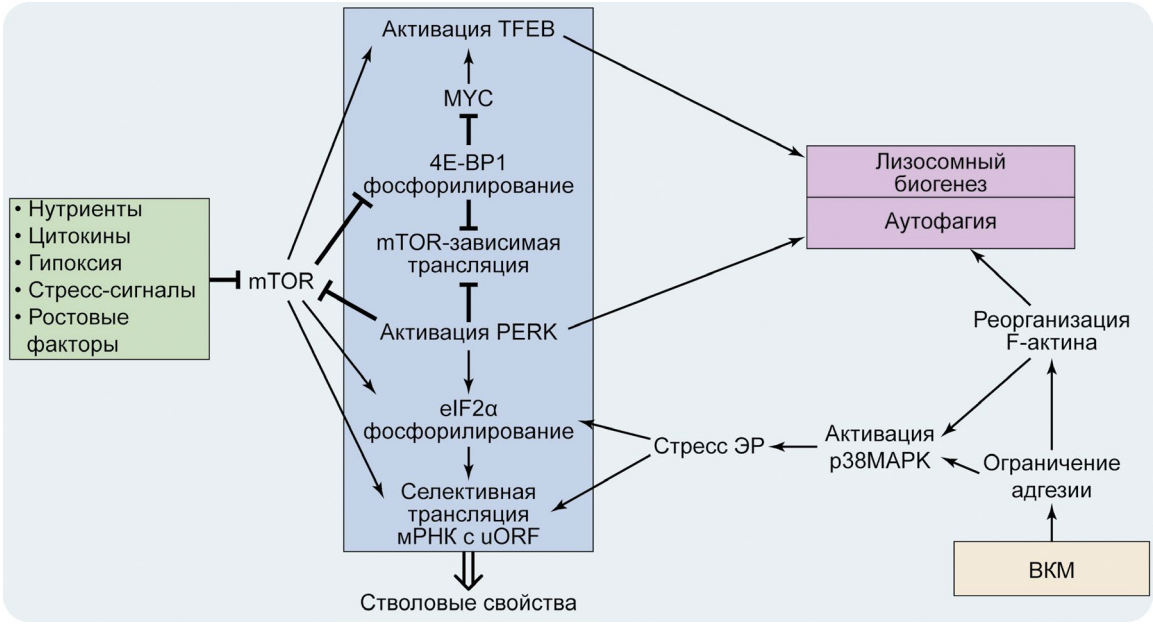


Рис. 2. Реконструкция иерархической организации шести молекулярных каскадов, детерминирующих переход к клеточному покою в раковых клетках. Ингибирование mTOR и снижение клеточной адгезии являются центральными узлами в цепи молекулярных событий, ведущих к клеточному покою. Ослабление адгезии инициирует внутриклеточные изменения, связанные с арестом клеточного цикла, реструктуризацией цитоскелета для формирования осевого каркаса и активацией аутофагии как компенсаторного механизма при снижении потребления глюкозы и нутриентов. Комплексы mTOR локализованы в различных субклеточных компартментах (лизосомах, ЭР, аппарате Гольджи) и связывают метаболические пути с внешними сигналами. Ингибирование mTORC1 происходит параллельно с блокадой клеточного цикла, останавливая синтез белка. Нарушение белкового синтеза служит одним из триггеров стресса ЭР, который дополнительно ограничивает активность mTORC1; таким образом, mTORC1 функционирует как выше, так и ниже сигналов ЭР-стресса по каскаду. Степень подавления mTOR выступает критическим фактором, определяющим переключение клетки на селективную трансляцию и инициацию масштабного аутофагического ответа. В условиях выраженного подавления активности mTORC1 снимается блок с транскрипционного фактора TFEB, что обеспечивает сопряжение процессов лизосомного биогенеза и выживания. Частично активная киназа mTOR препятствует этому переходу, соответственно, одновременное функционирование mTOR и аутофагии ведет к дисбалансу анаболических и катаболических процессов. В ответ на длительный стресс ЭР и ингибирование mTOR подавляется транскрипционный модуль MYC и активируется транскрипционный путь TFEB, что ведет к усилению биогенеза лизосом и активации аутофагии. Ключевые события, определяющие переход к альтернативной трансляции и активации аутофагии, происходят в ЭР: именно здесь «принимается решение» о запуске апоптоза или входе в состояние покоя в условиях стресса. Эффективный переход к селективной трансляции через uORFs способствует формированию фенотипа стволовости у покоящихся раковых клеток.

СПИСОК ЛИТЕРАТУРЫ

1. *Adam A. P., George A., Schewe D., Bragado P., Iglesias B. V., Ranganathan A. C., Kourtidis A., Conklin D. S., Aguirre-Ghiso J.A.* 2009. Computational identification of a p38SAPK regulated transcription factor network required for tumor cell quiescence. Cancer Res. V. 69. P. 5664. https://doi.org/10.1158/0008-5472.CAN-08-3820
2. *Adhikari D., Zheng W., Shen Y., Gorre N., Hämäläinen T., Cooney A. J., Huhtaniemi I., Lan Z-J., Liu K.* 2010. Tsc/mTORC1 signaling in oocytes governs the quiescence and activation of primordial follicles. Hum Mol Genet. V. 19. P. 397. https://doi.org/10.1093/hmg/ddp483
3. *Aguilera M. O., Berón W., Colombo M. I.* 2012. The actin cytoskeleton participates in the early events of autophagosome formation upon starvation induced autophagy. Autophagy. V. 8. V. 1590. https://doi.org/10.4161/auto.21459
4. *Aguirre-Ghiso J.A., Liu D., Mignatti A., Kovalski K., Ossowski L.* 2001. Urokinase Receptor and Fibronectin Regulate the ERKMAPK to p38MAPK Activity Ratios That Determine Carcinoma Cell Proliferation or Dormancy in Vivo. Mol Biol Cell. V.12. P. 863.

5. *Avivar-Valderas A., Bobrovnikova-Marjon E., Diehl J. A., Bardeesy N., Debnath J., Aguirre-Ghiso J.* 2013. Regulation of autophagy during ECM detachment is linked to a selective inhibition of mTORC1 by PERK. Oncogene. V. 32. P. 4932. https://doi.org/10.1038/onc.2012.512
6. *Avivar-Valderas A., Salas E., Bobrovnikova-Marjon E., Diehl J. A., Nagi C., Debnath J., Aguirre-Ghiso J.A.* 2011. PERK Integrates Autophagy and Oxidative Stress Responses to Promote Survival during Extracellular Matrix Detachment. Mol Cell Biol. V. 31. P. 3616. https://doi.org/10.1128/MCB.05164-11
7. *Barkan D., Green J. E., Chambers A. F.* 2010. Extracellular matrix: a gatekeeper in the transition from dormancy to metastatic growth. Eur J Cancer. V. 46. P. 1181. https://doi.org/10.1016/j.ejca.2010.02.027
8. *Barkan D., Kleinman H., Simmons J. L., Asmussen H., Kamaraju A. K., Hoenorhoff M. J., Liu Z., Costes S. V., Cho E. H., Lockett S., Khanna C., Chambers A. F., Green J. E.* 2008. Inhibition of Metastatic Outgrowth from Single Dormant Tumor Cells by Targeting the Cytoskeleton. Cancer Res. V. 68. P. 6241. https://doi.org/10.1158/0008-5472.CAN-07-6849
9. *Bartkowiak K., Kwiatkowski M., Buck F., Gorges T. M., Nilse L., Assmann V., Andreas A., Müller V., Wikman H., Riethdorf S., Schlüter H., Pantel K.* 2015. Disseminated Tumor Cells Persist in the Bone Marrow of Breast Cancer Patients through Sustained Activation of the Unfolded Protein Response. Cancer Research. V. 75. P. 5367. https://doi.org/10.1158/0008-5472.CAN-14-3728
10. *Blanco S., Bandiera R., Popis M., Hussain S., Lombard P., Aleksic J., Sajini A., Tanna H., Cortés-Garrido R., Gkatza N., Dietmann S., Frye M.* 2016. Stem cell function and stress response are controlled by protein synthesis. Nature. V. 534. P. 335. https://doi.org/10.1038/nature18282
11. *Blanco S., Kurowski A., Nichols J., Watt F. M., Benitah S. A., Frye M.* 2011. The RNA-methyltransferase Misu (NSun2) poises epidermal stem cells to differentiate. PLoS Genet. V. 7. Article ID: e1002403. https://doi.org/10.1371/journal.pgen.1002403
12. *Borgen E., Rypdal M. C., Sosa M. S., Renolen A., Schlichting E., Lønning P. E., Synnestvedt M., Aguirre-Ghiso J.A., Naume B.* 2018. NR2F1 stratifies dormant disseminated tumor cells in breast cancer patients. Breast Cancer Res. V. 20. P. 120. https://doi.org/10.1186/s13058-018-1049-0
13. *Bulut-Karslioglu A., Biechele S., Jin H., Macrae T. A., Hejna M., Gertsenstein M., Song J. S., Ramalho-Santos M.* 2016. Inhibition of mTOR induces a paused pluripotent state. Nature. V. 540. P. 119. https://doi.org/10.1038/nature20578
14. *Caetano M. S., Vieira-de-Abreu A., Teixeira L. K., Werneck M. B.F., Barcinski M. A., Viola J. P. B.* 2002. NFATC2 transcription factor regulates cell cycle progression during lymphocyte activation: evidence of its involvement in the control of cyclin gene expression. FASEB J. V. 16. P. 1940. https://doi.org/10.1096/fj.02-0282fje.
15. *Cai C., Hu X., Dai P., Zhang T., Jiang M., Wang L., Hua W., Fan Y., Han X—X., Gao Z.* 2021. c-Myc regulates neural stem cell quiescence and activation by coordinating the cell cycle and mitochondrial remodeling. Sig Transduct Target Ther. V. 6. P. 1. https://doi.org/10.1038/s41392-021-00664-7
16. *Calvo S. E., Pagliarini D. J., Mootha V. K.* 2009. Upstream open reading frames cause widespread reduction of protein expression and are polymorphic among humans. Proc Natl Acad Sci U S A. V. 106. P. 7507. https://doi.org/10.1073/pnas.0810916106
17. *Castilho R. M., Squarize C. H., Chodosh L. A., Williams B. O., Gutkind J. S.* 2009. mTOR mediates Wnt-induced epidermal stem cell exhaustion and aging. Cell Stem Cell. V. 5. P. 279. https://doi.org/10.1016/j.stem.2009.06.017
18. *Chen C., Liu Y., Liu R., Ikenoue T., Guan K-L., Liu Y., Zheng P.* 2008. TSC-mTOR maintains quiescence and function of hematopoietic stem cells by repressing mitochondrial biogenesis and reactive oxygen species. J Exp Med. V. 205. P. 2397. https://doi.org/10.1084/jem.20081297
19. *Cole A. J., Iyengar M., Panesso-Gómez S., O'Hayer P., Chan D., Delgoffe G. M., Aird K. M., Yoon E., Bai S., Buckanovich R. J.* 2020. NFATC4 promotes quiescence and chemotherapy resistance in ovarian cancer. JCI Insight. V 5. https://doi.org/10.1172/jci.insight.131486
20. *Cui Z., Napolitano G., de Araujo M. E.G., Esposito A., Monfregola J., Huber L. A., Ballabio A., Hurley J. H.* 2023. Structure of the lysosomal mTORC1–TFEB–Rag–Ragulator megacomplex. Nature. V. 614. P. 572. https://doi.org/10.1038/s41586-022-05652-7

21. *Deng Z., Lei X., Zhang X., Zhang H., Liu S., Chen Q., Hu H., Wang X., Ning L., Cao Y., Zhao T., Zhou J., Chen T., Duan E.* 2015. mTOR signaling promotes stem cell activation via counterbalancing BMP-mediated suppression during hair regeneration. J Mol Cell Biol. V. 7. P. 62. https://doi.org/10.1093/jmcb/mjv005
22. *Dhimolea E., de Matos Simoes R., Kansara D., Al'Khafaji A., Bouyssou J., Weng X., Sharma S., Raja J., Awate P., Shirasaki R., Tang H., Glassner B.J., Liu Z., Gao D., Bryan J., Bender S., Roth J., Scheffer M., Jeselsohn R., Gray N.S., Georgakoudi I., Vazquez F., Tsherniak A., Chen Y., Welm A., Duy C., Melnick A., Bartholdy B., Brown M., Culhane A.C., Mitsiades C.S.* 2021. An Embryonic Diapause-like Adaptation with Suppressed Myc Activity Enables Tumor Treatment Persistence. Cancer Cell. V. 39. P. 240. https://doi.org/10.1016/j.ccell.2020.12.002
23. *Friend K., Brooks H.A., Propson N.E., Thomson J.A., Kimble J.* 2015. Embryonic Stem Cell Growth Factors Regulate eIF2α Phosphorylation. PLOS ONE. Article ID: 10: e0139076. https://doi.org/10.1371/journal.pone.0139076
24. *Fujimaki K., Li R., Chen H., Della Croce K., Zhang H.H., Xing J., Bai F., Yao G.* 2019. Graded regulation of cellular quiescence depth between proliferation and senescence by a lysosomal dimmer switch. Proc Natl Acad Sci USA. Article ID: 116:22624. https://doi.org/10.1073/pnas.1915905116
25. *Fung C., Lock R., Gao S., Salas E., Debnath J.* 2008. Induction of autophagy during extracellular matrix detachment promotes cell survival. Mol Biol Cell. V. 19. P. 797. https://doi.org/10.1091/mbc.e07-10-1092
26. *Gan B., DePinho R.A.* 2009. mTORC1 signaling governs hematopoietic stem cell quiescence. Cell Cycle. V. 8. P. 1003.
27. *García-Prat L., Kaufmann K.B., Schneiter F., Voisin V., Murison A., Chen J., Chan-Seng-Yue M., Gan O.I., McLeod J.L., Smith S.A., Shoong M.C., Parris D., Pan K., Zeng A.G.X., Krivdova G., Gupta K., Takayanagi S-I., Wagenblast E., Wang W., Lupien M., Schroeder T., Xie S.Z., Dick J.E.* 2021. TFEB-mediated endolysosomal activity controls human hematopoietic stem cell fate. Cell Stem Cell. V. 28. P. 1838. https://doi.org/10.1016/j.stem.2021.07.003
28. *Gerisch B., Tharyan R.G., Mak J., Denzel S.I., Popkes-van Oepen T., Henn N., Antebi A.* 2020. HLH-30/TFEB Is a Master Regulator of Reproductive Quiescence. Dev Cell. V. 53. P. 316. https://doi.org/10.1016/j.devcel.2020.03.014
29. *Harwood F.C., Klein Geltink R.I., O'Hara B.P., Cardone M., Janke L., Finkelstein D., Entin I., Paul L., Houghton P.J., Grosveld G.C.* 2018. ETV7 is an essential component of a rapamycin-insensitive mTOR complex in cancer. Sci Adv. V. 4. Article ID: eaar3938. https://doi.org/10.1126/sciadv.aar3938
30. *Henriet P., Zhong Z.D., Brooks P.C., Weinberg K.I., DeClerck Y.A.* 2000. Contact with fibrillar collagen inhibits melanoma cell proliferation by up-regulating p27KIP1. Proc Natl Acad Sci U S A. V. 97. P. 10026. https://doi.org/10.1073/pnas.170290997
31. *Herz D.B., Aitken K., Bagli D.J.* 2003. Collagen directly stimulates bladder smooth muscle cell growth in vitro: regulation by extracellular regulated mitogen activated protein kinase. J Urol. V. 170. P. 2072. https://doi.org/10.1097/01.ju.0000091810.33953.13
32. *Ho T.T., Warr M.R., Adelman E.R., Lansinger O.M., Flach J., Verovskaya E.V., Figueroa M.E., Passegué E.* 2017. Autophagy maintains the metabolism and function of young and old stem cells. Nature. V. 543. P. 205.
33. *Horsley V., Aliprantis A.O., Polak L., Glimcher L.H., Fuchs E.* 2008. NFATc1 balances quiescence and proliferation of skin stem cells. Cell. V. 132. P. 299. https://doi.org/10.1016/j.cell.2007.11.047
34. *Hui L., Bakiri L., Mairhorfer A., Schweifer N., Haslinger C., Kenner L., Komnenovic V., Scheuch H., Beug H., Wagner E.F.* 2007. p38alpha suppresses normal and cancer cell proliferation by antagonizing the JNK-c-Jun pathway. Nat Genet. V. 39. P. 741. https://doi.org/10.1038/ng2033
35. *Hussein A.M., Wang Y., Mathieu J., Margaretha L., Song C., Jones D.C., Cavanaugh C., Miklas J.W., Mahen E., Showalter M.R., Ruzzo W.L., Fiehn O., Ware C.B., Blau C.A., Ruohola-Baker H.* 2020. Metabolic Control over mTOR-Dependent Diapause-like State. Dev Cell. V. 52. Article ID: 236—250.e7. https://doi.org/10.1016/j.devcel.2019.12.018
36. *Imamura H., Takaishi K., Nakano K., Kodama A., Oishi H., Shiozaki H., Monden M., Sasaki T., Takai Y.* 1998. Rho and Rab Small G Proteins Coordinately Reorganize Stress Fibers and Focal Adhesions in MDCK Cells. MBoC. V. 9. P. 2561. https://doi.org/10.1091/mbc.9.9.2561

37. *Ingolia N. T., Lareau L. F., Weissman J. S.* 2011. Ribosome Profiling of Mouse Embryonic Stem Cells Reveals the Complexity of Mammalian Proteomes. Cell. V. 147. P. 789. https://doi.org/10.1016/j.cell.2011.10.002

38. *Jingyuan L., Yu L., Hong J., Tao W., Kan L., Xiaomei L., Guiqing L., Yujie L.* 2023. Matrix stiffness induces an invasive-dormant subpopulation via cGAS-STING axis in oral cancer. Translational Oncology. V. 33. P. 101681. https://doi.org/10.1016/j.tranon.2023.101681

39. *Juntilla M. M., Patil V. D., Calamito M., Joshi R. P., Birnbaum M. J., Koretzky G. A.* 2010. AKT1 and AKT2 maintain hematopoietic stem cell function by regulating reactive oxygen species. Blood. V. 115. P. 4030. https://doi.org/10.1182/blood-2009-09-241000

40. *Kellenberger A. J., Tauchi M.* 2013. Mammalian target of rapamycin complex 1 (mTORC1) may modulate the timing of anagen entry in mouse hair follicles. Exp Dermatol. V. 22. P. 77. https://doi.org/10.1111/exd.12062

41. *Khalil B. D., Sanchez R., Rahman T., Rodriguez-Tirado C., Moritsch S., Martinez A. R., Miles B., Farias E., Mezei M., Nobre A. R., Singh D., Kale N., Sproll K. C., Sosa M. S., Aguirre-Ghiso J.A.* 2021. An NR2F1-specific agonist suppresses metastasis by inducing cancer cell dormancy. J Exp Med. V. 219. Article ID: e20210836. https://doi.org/10.1084/jem.20210836

42. *Kim J. K., Jung Y., Wang J., Joseph J., Mishra A., Hill E. E., Krebsbach P. H., Pienta K. J., Shiozawa Y., Taichman R. S.* 2013. TBK1 regulates prostate cancer dormancy through mTOR inhibition. Neoplasia. V. 15. P. 1064. https://doi.org/10.1593/neo.13402

43. *Kleffel S., Schatton T.* 2013. Tumor dormancy and cancer stem cells: two sides of the same coin? Adv Exp Med Biol. V. 734. P. 145. https://doi.org/10.1007/978-1-4614-1445-2_8

44. *Kobayashi T., Piao W., Takamura T., Kori H., Miyachi H., Kitano S., Iwamoto Y., Yamada M., Imayoshi I., Shioda S., Ballabio A., Kageyama R.* 2019. Enhanced lysosomal degradation maintains the quiescent state of neural stem cells. Nat Commun. V. 10. P. 5446. https://doi.org/10.1038/s41467-019-13203-4

45. *Koyama H., Raines E. W., Bornfeldt K. E., Roberts J. M., Ross R.* 1996. Fibrillar collagen inhibits arterial smooth muscle proliferation through regulation of Cdk2 inhibitors. Cell. V. 87. P. 1069. https://doi.org/10.1016/s0092-8674(00)81801-2

46. *Kwon J. S., Everetts N. J., Wang X., Wang W., Della Croce K., Xing J., Yao G.* 2017. Controlling Depth of Cellular Quiescence by an Rb-E2F Network Switch. Cell Rep. V. 20. P. 3223. https://doi.org/10.1016/j.celrep.2017.09.007

47. *Leeman D. S., Hebestreit K., Ruetz T., Webb A. E., McKay A., Pollina E. A., Dulken B. W., Zhao X., Yeo R. W., Ho T. T., Mahmoudi S., Devarajan K., Passegué E., Rando T. A., Frydman J., Brunet A.* 2018. Lysosome activation clears aggregates and enhances quiescent neural stem cell activation during aging. Science. V. 359. P. 1277. https://doi.org/10.1126/science.aag3048

48. *Liang R., Arif T., Kalmykova S., Kasianov A., Lin M., Menon V., Qiu J., Bernitz J. M., Moore K., Lin F., Benson D. L., Tzavaras N., Mahajan M., Papatsenko D., Ghaffari S.* 2020. Restraining Lysosomal Activity Preserves Hematopoietic Stem Cell Quiescence and Potency. Cell Stem Cell. V. 26. P. 359. https://doi.org/10.1016/j.stem.2020.01.013

49. *Liu Y., Lv J., Liang X., Yin X., Zhang L., Chen D., Jin X., Fiskesund R., Tang K., Ma J., Zhang H., Dong W., Mo S., Zhang T., Cheng F., Zhou Y., Xie J., Wang N., Huang B.* 2018. Fibrin Stiffness Mediates Dormancy of Tumor-Repopulating Cells via a Cdc42-Driven Tet2 Epigenetic Program. Cancer Research. V. 78. P. 3926. https://doi.org/10.1158/0008-5472.CAN-17-3719

50. *Malladi S., Macalinao D. G., Jin X., He L., Basnet H., Zou Y., de Stanchina E., Massagué J.* 2016. Metastatic Latency and Immune Evasion through Autocrine Inhibition of WNT. Cell. V. 165. P. 45. https://doi.org/10.1016/j.cell.2016.02.025

51. *Marqués-Torrejón M.Á., Williams C. A. C., Southgate B., Alfazema N., Clements M. P., Garcia-Diaz C., Blin C., Arranz-Emparan N., Fraser J., Gammoh N., Parrinello S., Pollard S. M.* 2021. LRIG1 is a gatekeeper to exit from quiescence in adult neural stem cells. Nat Commun. V. 12. P. 2594. https://doi.org/10.1038/s41467-021-22813-w

52. *Marthandan S., Priebe S., Hemmerich P., Klement K., Diekmann S.* 2014. Long-Term Quiescent Fibroblast Cells Transit into Senescence. PLoS One. V. 9. Article ID: e115597. https://doi.org/10.1371/journal.pone.0115597

53. *Matte B. F., Kumar A., Placone J. K., Zanella V. G., Martins M. D., Engler A. J., Lamers M. L.* 2019. Matrix stiffness mechanically conditions EMT and migratory behavior of oral squamous cell carcinoma. Journal of Cell Science. V. 132. Article ID: jcs224360.
https://doi.org/10.1242/jcs.224360

54. *Nguyen J. T., Haidar F. S., Fox A. L., Ray C., Mendonça D. B., Kim J. K., Krebsbach P.* H. 2019. mEAK-7 Forms an Alternative mTOR Complex with DNA-PKcs in Human Cancer. iScience. V. 17. P. 190.
https://doi.org/10.1016/j.isci.2019.06.029

55. *Nieto-González J.L., Gómez-Sánchez L., Mavillard F., Linares-Clemente P., Rivero M. C., Valenzuela-Villatoro M., Muñoz-Bravo J.L., Pardal R., Fernández-Chacón R.* 2019. Loss of postnatal quiescence of neural stem cells through mTOR activation upon genetic removal of cysteine string protein-α. Proc Natl Acad Sci U S A. V. 116. P. 8000.
https://doi.org/10.1073/pnas.1817183116

56. *Pommier A., Anaparthy N., Memos N., Kelley Z. L., Gouronnec A., Yan R., Auffray C., Albrengues J., Egeblad M., Iacobuzio-Donahue C.A., Lyons S. K., Fearon D. T.* 2018. Unresolved endoplasmic reticulum stress engenders immune-resistant, latent pancreatic cancer metastases. Science. V. 360. Article ID: eaao4908.
https://doi.org/10.1126/science.aao4908

57. *Pradhan S., Slater J. H.* 2019. Tunable hydrogels for controlling phenotypic cancer cell states to model breast cancer dormancy and reactivation. Biomaterials. V. 215. P. 119177.
https://doi.org/10.1016/j.biomaterials.2019.04.022

58. *Preciado J. A., Aksan A.* 2022. Method to Isolate Dormant Cancer Cells from Heterogeneous Populations. In: Rasooly A, Baker H, Ossandon MR (eds) Biomedical Engineering Technologies: Volume 2. Springer US, New York, NY, pp 19—29

59. *Ranganathan A. C., Ojha S., Kourtidis A., Conklin D. S., Aguirre-Ghiso J.A.* (2008) Dual function of pancreatic endoplasmic reticulum kinase in tumor cell growth arrest and survival. Cancer Res 68:3260—3268.
https://doi.org/10.1158/0008-5472.CAN-07-6215

60. *Rehman S. K., Haynes J., Collignon E., Brown K. R., Wang Y., Nixon A. M.L., Bruce J. P., Wintersinger J. A., Singh Mer A., Lo E. B.L., Leung C., Lima-Fernandes E., Pedley N. M., Soares F., McGibbon S., He H. H., Pollet A., Pugh T. J., Haibe-Kains B., Morris Q., Ramalho-Santos M., Goyal S., Moffat J., O'Brien C.A.* (2021) Colorectal Cancer Cells Enter a Diapause-like DTP State to Survive Chemotherapy. Cell 184:226—242.e21.
https://doi.org/10.1016/j.cell.2020.11.018

61. *Romine J., Gao X., Xu X—M., So K. F., Chen J.* (2015) The proliferation of amplifying neural progenitor cells is impaired in the aging brain and restored by the mTOR pathway activation. Neurobiol Aging 36:1716—1726.
https://doi.org/10.1016/j.neurobiolaging.2015.01.003

62. *Sampath.P., Pritchard D. K., Pabon L., Reinecke H., Schwartz S. M., Morris D. R., Murry C. E.* (2008) A hierarchical network controls protein translation during murine embryonic stem cell self-renewal and differentiation. Cell Stem Cell 2:448—460.
https://doi.org/10.1016/j.stem.2008.03.013

63. *Sendoel A., Dunn J. G., Rodriguez E. H., Naik S., Gomez N. C., Hurwitz B., Levorse J., Dill B. D., Schramek D., Molina H., Weissman J. S., Fuchs E.* (2017) Translation from unconventional 5' start sites drives tumour initiation. Nature 541:494—499.
https://doi.org/10.1038/nature21036

64. *Settembre C., Di Malta C., Polito V. A., Arencibia M. G., Vetrini F., Erdin S., Erdin S. U., Huynh T., Medina D., Colella P., Sardiello M., Rubinsztein D. C., Ballabio A.* (2011) TFEB Links Autophagy to Lysosomal Biogenesis. Science 332:1429—1433.
https://doi.org/10.1126/science.1204592

65. *Shiu Y-T., Li S, Marganski W. A., Usami S., Schwartz M. A., Wang Y-L., Dembo M., Chien S.* 2004. Rho Mediates the Shear-Enhancement of Endothelial Cell Migration and Traction Force Generation. Biophysical Journal. V. 86. P. 2558.
https://doi.org/10.1016/S0006-3495(04)74311-8

66. *Signer R. A.J., Magee J. A., Salic A., Morrison S. J.* 2014. Haematopoietic stem cells require a highly regulated protein synthesis rate. Nature. V. 509. P. 49.
https://doi.org/10.1038/nature13035

67. *Sosa M. S., Parikh F., Maia A. G., Estrada Y., Bosch A., Bragado P., Ekpin E., George A., Zheng Y., Lam H-M., Morrissey C., Chung C-Y., Farias E. F., Bernstein E., Aguirre-Ghiso J.A.* 2015. NR2F1 controls tumour cell dormancy via SOX9- and RARβ-driven quiescence programmes. Nat Commun. V. 6. P. 6170.
https://doi.org/10.1038/ncomms7170

68. *Talukdar S., Bhoopathi P., Emdad L., Das S., Sarkar D., Fisher P.B.* 2019. Dormancy and cancer stem cells: An enigma for cancer therapeutic targeting. Adv Cancer Res. V. 141. P. 43. https://doi.org/10.1016/bs.acr.2018.12.002

69. *Tao J., Choudhury M.I., Maity D., Kim T., Sun S.X., Fan C.-M.* 2023. Mechanical compression creates a quiescent muscle stem cell niche. Commun Biol. V. 6. P. 1. https://doi.org/10.1038/s42003-023-04411-2

70. *Vera-Ramirez L., Vodnala S.K., Nini R., Hunter K.W., Green J.E.* 2018. Autophagy promotes the survival of dormant breast cancer cells and metastatic tumour recurrence. Nat Commun. V. 9. P. 1944. https://doi.org/10.1038/s41467-018-04070-6

71. *Verma D., Ye N., Meng F., Sachs F., Rahimzadeh J., Hua S.Z.* 2012. Interplay between Cytoskeletal Stresses and Cell Adaptation under Chronic Flow. PLoS One. V. 7. Article ID: e44167. https://doi.org/10.1371/journal.pone.0044167

72. *Yang L., Wang L., Geiger H., Cancelas J.A., Mo J., Zheng Y.* 2007. Rho GTPase Cdc42 coordinates hematopoietic stem cell quiescence and niche interaction in the bone marrow. Proc Natl Acad Sci USA. V. 104. P. 5091. https://doi.org/10.1073/pnas.0610819104

73. *Zangrossi M., Romani P., Chakravarty P., Ratcliffe C.D.H., Hooper S., Dori M., Forcato M., Bicciato S., Dupont S., Sahai E., Montagner M.* 2021. EphB6 Regulates TFEB-Lysosomal Pathway and Survival of Disseminated Indolent Breast Cancer Cells. Cancers (Basel). V. 13. P. 1079. https://doi.org/10.3390/cancers13051079

74. *Zhang J., Grindley J.C., Yin T., Jayasinghe S., He X.C., Ross J.T., Haug J.S., Rupp D., Porter-Westpfahl K.S., Wiedemann L.M., Wu H., Li L.* 2006. PTEN maintains haematopoietic stem cells and acts in lineage choice and leukaemia prevention. Nature. V. 441. P. 518. https://doi.org/10.1038/nature04747

75. *Zismanov V., Chichkov V., Colangelo V., Jamet S., Wang S., Syme A., Koromilas A.E., Crist C.* 2016. Phosphorylation of eIF2α Is a Translational Control Mechanism Regulating Muscle Stem Cell Quiescence and Self-Renewal. Cell Stem Cell. V. 18. P. 79. https://doi.org/10.1016/j.stem.2015.09.020