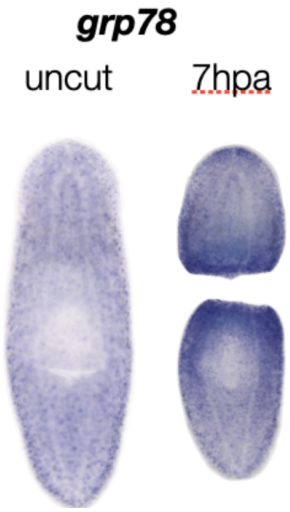
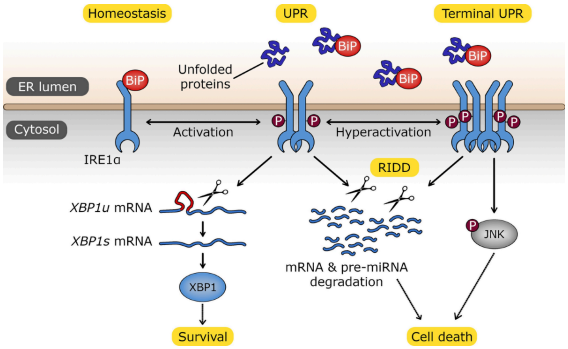
What is the role of unfolded protein response (UPR) genes in planarian regeneration?
UPR genes help regulate the energy of the cell when planarians are undergoing the process of regeneration. Regulating cell energy can help promote regeneration, especially if the planarians have little access to food.

- Grp78 (SMED30025067)



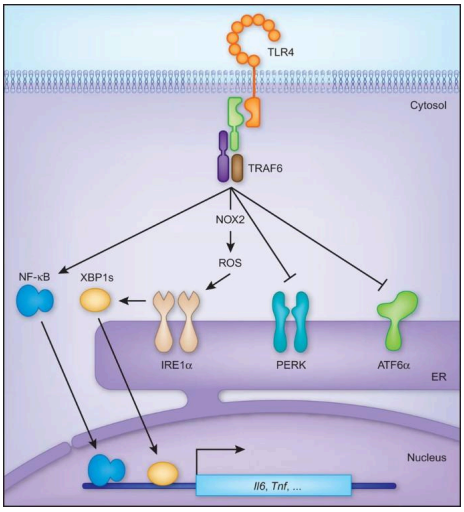
Grp78, or endoplasmic reticulum chaperone BiP, is mainly found in NB10: parapharyngeal, NB11: neural (nu-neoblasts), and NB12: gut precursor 1. It's also mainly found in sub-lethal irradiated cell populations SL4: gut precursor 4, SL5: gut precursor 3, SL6: neoblast, and SL9: parapharyngeal 1. A few of the tissues this gene is expressed in include the epidermis, pharynx, nervous system, and gut. Grp78 is important for protein folding, ER control, and the overall survival of eukaryotic cells. For planarians, this gene aids in tissue regeneration by binding newly synthesized proteins. Gething, M.-J. (1999). Role and regulation of the ER chaperone BiP. *Seminars in Cell & Developmental Biology*, *10*(5), 465–472. https://doi.org/10.1006/scdb.1999.0318
Paton, A. W., Beddoe, T., Thorpe, C. M., Whisstock, J. C., Wilce, M. C. J., Rossjohn, J., Talbot, U. M., & Paton, J. C. (2006). AB5 subtilase cytotoxin inactivates the endoplasmic reticulum chaperone BiP. *Nature*, *443*(7111), 548+. https://link.gale.com/apps/doc/A185447130/AONE?u=anon~fe9cb7ce&sid=googleScholar&xid=96e1fcac.
How would a mutation of this gene affect planarian tissue regeneration?

- IRE1 (SMED30015878)



IRE1, or serine/threonine-protein kinase/endoribonuclease IRE1, is found in NB5: gut progenitor and NB10: parapharyngeal. It's also found in sub-lethal irradiated cell population SL9: parapharyngeal 1. The gene is located in the ER and nucleus. IRE1 is a transmembrane protein that assists with UPR by mediating mRNA splicing. It also acts as a sensor for the ER to help with ER stress and function.
Wakasa, Y., Hayashi, S., Ozawa, K., & Takaiwa, F. (2012). Multiple roles of the ER stress sensor IRE1 demonstrated by gene targeting in rice. *Scientific Reports*, *2*(1). https://doi.org/10.1038/srep00944
IRE1 bifunctional endoribonuclease/protein kinase IRE1 [Saccharomyces cerevisiae S288C] - Gene - NCBI. (2025). Nih.gov. https://www.ncbi.nlm.nih.gov/gene/856478
Does alternative mRNA splicing play a role with this gene/protein?

- Xbp-1 (SMED30006119)



Xbp-1, or X-box binding protein 1, is mainly found in NB8: pharynx progenitor 2, NB10: parapharyngeal, and NB11: neural (nu-neoblasts). It's also mainly found in sub-lethal irradiated cell populations SL3: epidermis, SL6: neoblast, and SL9: parapharyngeal 1. A few of the tissues this gene is expressed in include the epidermis, muscle, gut, intestinal phagocyte, and central nervous system. Xbp-1

is a transcription factor that can be spliced to regulate UPR genes. IRE1 helps convert unspliced Xbp-1 to its mature form. Xbp-1 can fold enzymes and degrade proteins to help decrease ER stress as well.

Park, S.-M., Kang, T.-I., & So, J.-S. (2021). Roles of XBP1s in Transcriptional Regulation of Target Genes. *Biomedicines*, *9*(7), 791. https://doi.org/10.3390/biomedicines9070791

Liu, Y., Adachi, M., Zhao, S., Hareyama, M., Koong, A. C., Luo, D., Rando, T. A., Imai, K., & Shinomura, Y. (2009). Preventing oxidative stress: a new role for XBP1. *Cell Death & Differentiation*, *16*(6), 847–857. https://doi.org/10.1038/cdd.2009.14

How would an IRE1 malfunction/mutation affect this gene?