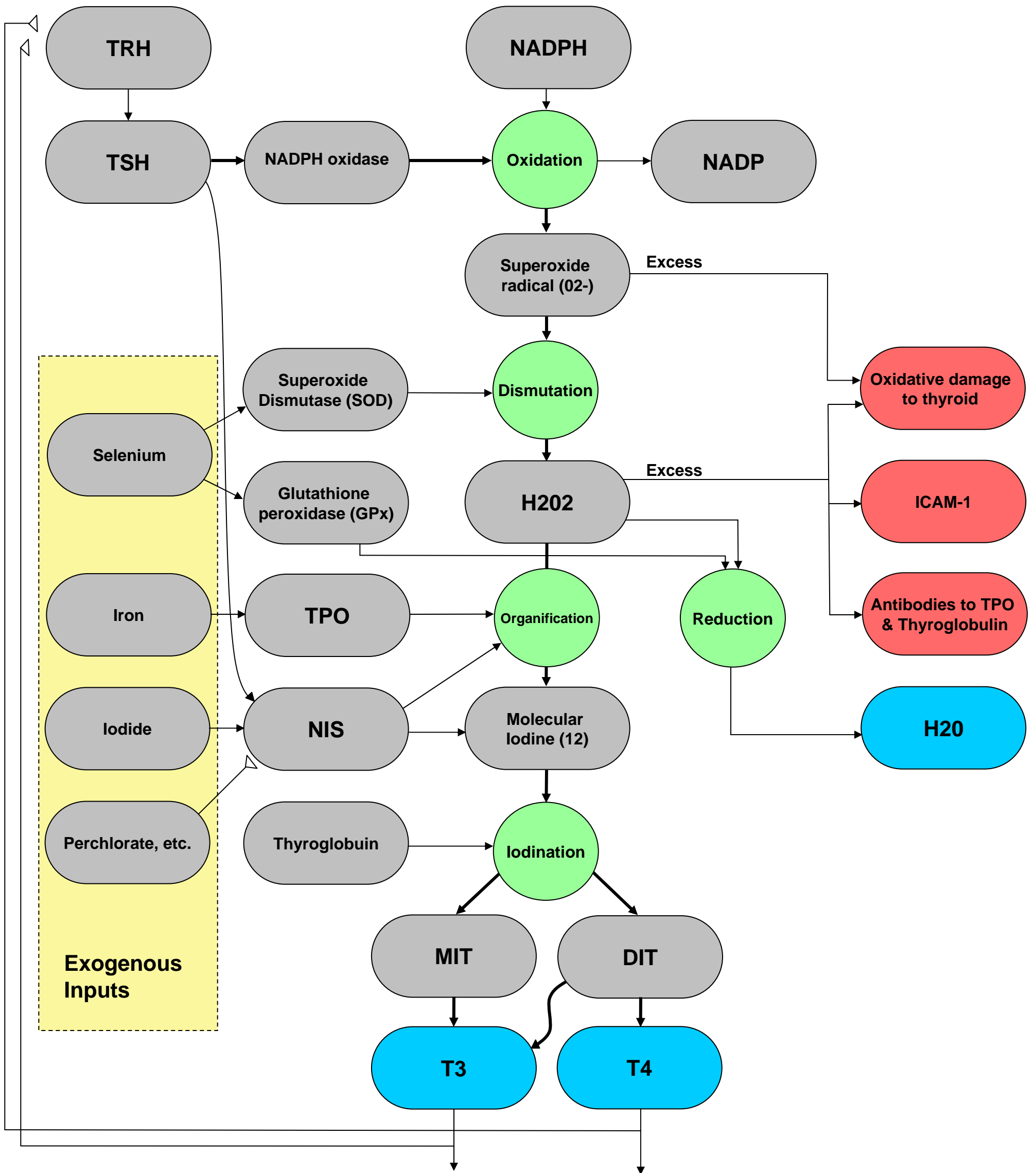


Thyroid Hormone Production



Normal process: Thyroid hormone levels drop. TSH binds to receptors on the follicular cells, stimulates NIS activity and also ensures H₂O₂ will be available as a substrate by inducing NADPH oxidase, which oxidizes NADPH to NADP, liberating superoxide radicals (O₂⁻), which are then converted to the less potent free radical, H₂O₂, by SOD, a selenium-dependent enzyme. NIS transports Iodide (I⁻) into the follicular cell where it is catalyzed by heme-dependent TPO using H₂O₂ to form I₂, which then binds to tyrosine residues in thyroglobulin to form MIT and DIT. DIT+ DIT then produce T₄; DIT + MIT produce T₃. H₂O₂ that is not used up in this process is neutralized by selenium-dependent glutathione peroxidase. **Iodine deficiency / Selenium deficiency / Iron deficiency:** Low iodine stores result in low levels of thyroid hormones, which activates TSH. H₂O₂ is produced, but no iodide arrives. If selenium is also insufficient, O₂⁻, a more potent ROS than H₂O₂, is formed and is not converted to H₂O₂. If iron is deficient, TPO will not be available to catalyze iodide, so H₂O₂ will remain to cause damage to the follicular cell. **Iodine repletion:** the Wolff-Chaikoff effect will prevent excessive organification of iodide; however, during the formation of thyroid hormones, some ROS will be generated in excess of those used to produce I₂, and will cause damage if not reduced by glutathione peroxidase.

