

The diagram illustrates the metabolic pathways of nitrogen metabolism, organized by oxidation state from +5 to -3. Key pathways include:

- Disubstituted nitrate reduction:** Nitrate (oxidation state +5) is reduced to Nitrite (oxidation state +3) via the *narX* gene.
- Auxiliary nitrate reduction:** Nitrate (oxidation state +5) is reduced to Nitrite (oxidation state +3) via the *nirX* gene.
- Denitrification:** Nitrite (oxidation state +3) is reduced to Nitrous oxide (oxidation state +1) via the *nirX* gene, and then to Nitrogen (oxidation state 0) via the *nirX* gene.
- Nitrogen fixation:** Nitrogen (oxidation state 0) is fixed to Ammonia (oxidation state -3) via the *nifH* gene.
- Nitrification:** Ammonia (oxidation state -3) is oxidized to Nitrite (oxidation state +3) via the *nirX* gene, and then to Nitrate (oxidation state +5) via the *nirX* gene.
- Assimilation:** Ammonia (oxidation state -3) is assimilated into various amino acids (e.g., Glutamate, Glutamine, Aspartate, Asparagine, Alanine, Serine, Glycine, Proline, Arginine, Lysine, Histidine, Threonine, Valine, Isoleucine, Methionine, Cysteine, Tyrosine, Phenylalanine, Tryptophan, Nucleotides) via the *nirX* gene.

The diagram also shows the conversion of Nitrate (oxidation state +5) to Nitrite (oxidation state +3) via the *nirX* gene, and the conversion of Nitrite (oxidation state +3) to Nitrous oxide (oxidation state +1) via the *nirX* gene. The diagram also shows the conversion of Nitrous oxide (oxidation state +1) to Nitrogen (oxidation state 0) via the *nirX* gene.

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The diagram illustrates the metabolic pathways of nitrogen metabolism, starting from nitrogen fixation and leading to various products. The pathways are organized into several main sections:

- Nitrogen Fixation:** Nitrogen (N<sub>2</sub>) is fixed by nitrogenase (EC 1.1.1.1) to form ammonia (NH<sub>3</sub>). This process is coupled with the reduction of ferredoxin (Fd) and the oxidation of NADH to NAD<sup>+</sup>.
- Ammonia Assimilation:** Ammonia can be assimilated into glutamine (Gln) by glutamine synthetase (EC 6.3.1.2) or into glutamate (Glu) by glutamate synthase (EC 1.4.1.14). These reactions are coupled with the reduction of NADP<sup>+</sup> to NADPH.
- Nitrogen Metabolism:** Ammonia can be converted to nitrite (NO<sub>2</sub><sup>-</sup>) by nitrite reductase (EC 1.1.1.1) or to nitrate (NO<sub>3</sub><sup>-</sup>) by nitrate reductase (EC 1.1.1.1). These reactions are coupled with the reduction of NADH to NAD<sup>+</sup>.
- Nitrate Assimilation:** Nitrate can be assimilated into glutamine (Gln) by glutamine synthetase (EC 6.3.1.2) or into glutamate (Glu) by glutamate synthase (EC 1.4.1.14). These reactions are coupled with the reduction of NADP<sup>+</sup> to NADPH.
- Nucleic Acid Metabolism:** Glutamine (Gln) is a precursor for the synthesis of nucleic acids. It is converted to glutamate (Glu) by glutamate synthase (EC 1.4.1.14), which is then converted to L-glutamate (L-Glu) by L-glutamate dehydrogenase (EC 1.4.1.13). L-Glu is then converted to L-glutamine (L-Gln) by L-glutamine synthetase (EC 6.3.1.2).
- Other Pathways:** Glutamine (Gln) is also a precursor for the synthesis of urea, creatine, and other nitrogen-containing compounds. It is converted to urea by urea synthase (EC 2.9.1.1) or to creatine by creatine synthase (EC 2.3.1.1).

The diagram also shows the interconversion of various nitrogenous compounds, such as the conversion of glutamine (Gln) to glutamate (Glu) and the conversion of glutamate (Glu) to L-glutamate (L-Glu). The pathways are color-coded: green for nitrogen fixation and assimilation, blue for nitrogen metabolism, and red for nucleic acid metabolism.

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The diagram illustrates the metabolic pathways of nitrogen, organized by redox state on the x-axis (from +5 to -3). Key pathways include:

- Ammonification:** Conversion of organic nitrogen (amino acids, nucleic acids) to ammonia (NH<sub>3</sub>) and then to nitrite (NO<sub>2</sub><sup>-</sup>) and nitrate (NO<sub>3</sub><sup>-</sup>).
- Nitrification:** Conversion of ammonia to nitrite and then to nitrate.
- Denitrification:** Conversion of nitrate back to ammonia.
- Nitrogen fixation:** Conversion of atmospheric nitrogen (N<sub>2</sub>) to ammonia.
- Nitrogen assimilation:** Incorporation of nitrate, nitrite, and ammonia into amino acids and nucleic acids.
- Other carbon fixation pathways:** Such as the C<sub>3</sub> and C<sub>4</sub> pathways.
- Other carbon fixation pathways:** Such as the C<sub>3</sub> and C<sub>4</sub> pathways.

The diagram also shows the redox states of various nitrogen-containing compounds, such as nitrate (+5), nitrite (+3), ammonia (-3), and various amino acids and nucleic acids.

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The diagram illustrates the metabolic pathways of nitrogen metabolism, showing the conversion of various amino acids into central intermediates and then into products. The pathways are organized into several main categories:

- Other carbon fixation pathways:** Includes pathways for Glutamine, Glutamate, and Glutathione.
- Glutamine metabolism:** Shows the conversion of Glutamine to Glutamate and then to Glutathione.
- Glutamate metabolism:** Shows the conversion of Glutamate to Glutathione.
- Glutathione metabolism:** Shows the conversion of Glutathione to Glutathione.
- Other amino acid metabolism:** Includes pathways for Aspartate, Asparagine, Serine, Glycine, Alanine, and others.
- Central Intermediates:** Nucleotide, Nucleoside, and Nucleic acid.
- Products:** Glutamine, Glutamate, Glutathione, and others.

The diagram is a complex metabolic map showing the interconnections between various amino acids and their metabolic products. The pathways are color-coded and labeled with specific enzymes and cofactors. The central intermediates are Nucleotide, Nucleoside, and Nucleic acid. The products are Glutamine, Glutamate, and Glutathione. The diagram is a detailed representation of the nitrogen metabolism pathways in a cell.

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