Redox Signalling & Redox Systems in Health & Disease

Redox signalling achieved by reactive oxygen species (ROS) is a key aspect of signal transduction in various cellular processes such as cell death, differentiation, and inflammation.

However, the line separating redox signalling from oxidative stress is a thin one and redox homeostasis is reliant on the action of redox active systems. These systems are complex arrays of enzymes controlling ROS levels but also the oxidation-reduction cycle of critical protein residues (e.g. cysteines) that enable signal transduction.

Disruption of redox signalling has been implicated in the aetiology of several pathologies including cancer and neurodegenerative diseases. Moreover, redox enzymes have very reactive nucleophilic residues (cysteines and selenocysteines) and are, therefore, candidate targets for inhibition by electrophilic compounds, creating opportunities for therapeutic strategies. This Advanced Course will approach these aspects in detail which are of widespread interest for many PhD candidates in Pharmacy.

Specific Topics and Schedule

Monday, January 26th, 2026

TOPIC A - Oxidative stress and Antioxidants and Redox enzymes systems

• Lecture A1 — Oxidative stress and oxidative species (Vasco Branco);

• Lecture A2—ROS as signalling molecules in physiology

• Flipped classroom A: methods to evaluate ROS and oxidative stress

Tuesday, January 27th, 2026

TOPIC B - Reactive Oxygen Species in biology

• Lecture B1 — Redox active systems: thioredoxin and glutathione (Lucia Coppo; KI)

• Lecture B2 — Nitric oxide-dependent neurovascular coupling to support cognitive performance (JoãoLaranjinha; FFUC);

• Flipped Classroom B — Natural and custom-design inhibitors, emulators, and modulators of redox elements

Wednesday, January 28th, 2026

TOPIC C — Redox signalling and cancer

• Lecture Ci — Redox regulation in cancer cells (Ana Sofia Femandes; Univ. Lusófona)

• Lecture C2 — Redox systems and therapy resistance in glioblastoma (Cristina Carvalho)

• Flipped classroom C: MAPK cascades: major pathways of redox signal transduction.

Thursday, January 29th, 2026

TOPIC D — Oxidative stress and neurodegenerative diseases

• Lecture D1 — Redox-based regulation of adult neurogenesis: implications for CNS (Susana Sola);

• Lecture D2 — Oxidative modifications in neurodegenerative diseases (Andreia Carvalho)

• Flipped classroom D: Redox signaling in glia cells.

Friday, January 30th, 2026

Student's project presentation and discussion

Deadline for final proposal submission: February 13th, 2026.