Institute of Biotechnology of the Czech Academy of Sciences

MitoDFX – Revolutionizing Cancer Treatment with Targeted Iron Chelation

CHALENGE

One of the major limitations of conventional anti-cancer drugs lies in their non-selective action against proliferating cells. This indiscriminate targeting often leads to higher drug doses and unwelcome side effects. While certain iron chelators have exhibited anti-cancer properties, they have not been tailored to specifically target cancer cells. Additionally, their systemic distribution and membrane-penetration abilities often fall short of ideal standards. Consequently, despite their promising results against cancer cells *in vitro*, these compounds can significantly disrupt systemic iron metabolism when administered *in vivo*. Overcoming these challenges has been a pivotal endeavor, one we have successfully addressed by precisely targeting the iron chelator, deferasirox, to the mitochondria.

INNOVATION

MitoDFX: A Targeted Breakthrough

MitoDFX is our groundbreaking chemical entity meticulously engineered to address the unique challenges of cancer treatment. MitoDFX takes aim at highly polarized cancer cell mitochondria, where it orchestrates a dual attack on cancer cells' iron metabolism. This dual-action approach selectively eradicates cancer cells while preserving the essential role of iron in cellular processes.

How MitoDFX Works: The Dual Nature of Iron

MitoDFX adeptly harnesses the "dual nature of iron." It binds to iron, disrupting iron-dependent cellular processes within cancer cells. Simultaneously, it induces iron-driven oxidative damage, overwhelming cancer cells' antioxidant defenses and leading to their demise through cell death.

Proven Efficacy: POC Studies

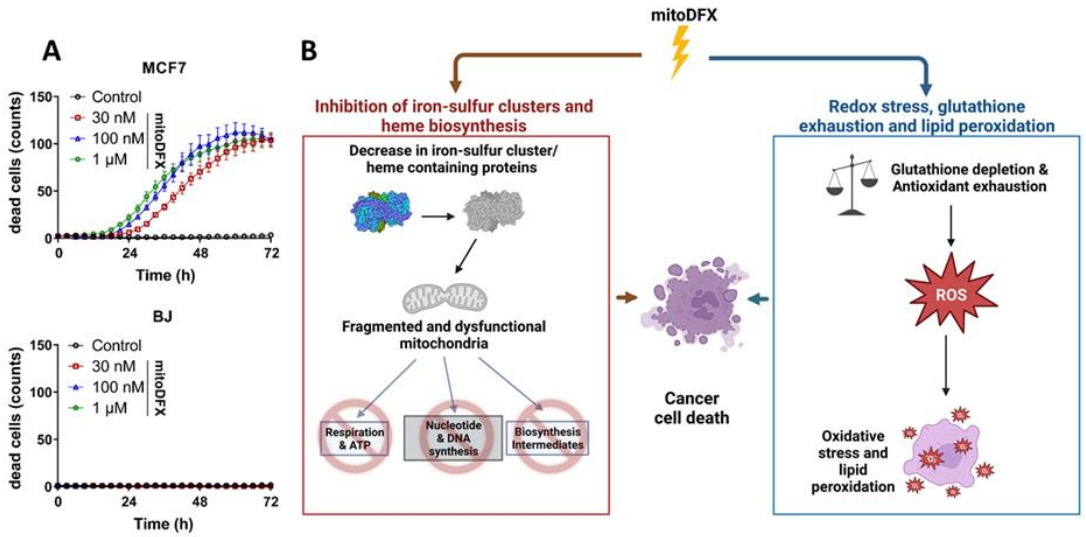
Our proof-of-concept (POC) studies have demonstrated the effectiveness of our mitochondria-targeting approach against melanoma, breast cancer (including triple-negative breast cancer) both *in vitro* and *in vivo*, and pancreatic cancer *in vitro*. MitoDFX's unique ability to suppress cell migration holds promise in preventing metastatic spread—a formidable challenge in cancer treatment.

Resistance Unlikely: Iron's Vital Role

Cancer cells are unlikely to develop resistance to mitoDFX due to the fundamental importance of iron in numerous cellular processes, ensuring the sustainability of this treatment strategy.

Safety and Administration: A Winning Formula

MitoDFX has shown excellent tolerability in experimental animal studies and can be administered orally. Importantly, it leaves systemic iron metabolism and erythropoiesis unaffected, minimizing adverse effects.



A: Specific induction of cell death by mitoDFX in malignant cancer cells (MCF7) is effective at 30 nM while there is no effect on non-malignant cells (BJ) up to 1 µM. B: Mode of action of mitoDFX involves (I) deprivation of iron and (II) oxidative damage coupled with depletion of glutathione.

COMMERCIAL OPPORTUNITIES

High-Potential Indications
MitoDFX presents valuable commercial prospects in cancer treatment, notably in challenging areas like melanoma and pancreatic cancer, where significant unmet needs persist.

Radiopharmaceutical Potential
Beyond conventional treatments, mitoDFX's chelating properties suggest a role as a pharmacophore for radioactive radioligands. This versatility positions mitoDFX in theranostics—a combination of radioimaging diagnostics and radiotherapy.

DEVELOPMENT STATUS

POC studies on lead compound ready.
Aiming to enter pre-clinical studies.

SEEKING PARTNERSHIP

Seeking a partnership for pre-clinical studies and early clinical studies.

Ownership
JOINT INVENTION
Institute of Biotechnology of the Czech Academy of Sciences
Smart Brain s.r.o. (Czech Republic)

IP rights
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Granted patents: EP3983420, JP7246524
Patent pending: US, China

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