Plan Overview

A Data Management Plan created using HKUL DMPTool

Title: Elucidating the Roles of Vanadium and Chromium in Alleviating Cellular Senescence

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Template: HKU Template

Project abstract:

Aging is considered as one of the largest risk factors that lead to the human diseases and the aging population is anticipated to double in the next two decades. The increased prevalence of aging related diseases, such as neurodegeneration and diabetes, constitute the major social burdens that urgently requires appropriate interventions. Cellular senescence, a state of permanent cell cycle arrest, contributes to organismal aging. Senescent cells accumulate due to variety of inducers such as DNA damage, oxidative stress, mitochondrial dysfunction and secretion of senescence-associated secretory phenotypes. As the aging population continues to grow, targeting senescent cells is emerged as a promising strategy to delay cell senescence and reduce the burdens of age-related pathologies.

In this study, we investigated the potential of two classes of metal-based compounds—vanadium and chromium complexes—previously implicated in anti-diabetic therapy, to mitigate cellular senescence. Using different senescence models e.g., Lamin AG609G/G609G progeroid mouse embryonic fibroblasts (MEFs), ionizing radiation-exposed wild-type MEFs, and H2O2 exposed wild-type MEFs, we demonstrate that vanadium and chromium complexes effectively alleviate senescence-associated phenotypes. Mechanistically, we find that vanadium acts primarily by reducing ER stress and restoring protein homeostasis via direct interaction with the ER chaperone protein disulfide isomerase (PDI), while selected chromium complexes downregulate the p53–p21 pathway and enhance cell proliferation following oxidative stress. The specific aims are as follows:

1) To determine the role of VO-OHpic in modulating ER stress during cellular senescence.

2) To investigate the functional interaction between VO-OHpic and PDI in delaying senescence.

3) To identify and characterize chromium complexes that suppress the p53–p21 senescence axis.

These work provides proof-of-concept that targeted modulation of ER chaperone networks and mitochondrial signaling pathways can be harnessed to delay the onset of cellular senescence, offering a new strategy for lifespan extension and healthy aging by Metallo-drugs.

Start date: 01-01-2024

End date: 08-31-2027

Last modified: 04-29-2025

Copyright information:

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Data Collection

What data will you collect or create?

in vitro data: cell proliferation before and after the treatment with compounds of interests, SA-beta-gal assay to examine the number of senescent cells, unfolded protein assay, western blot to detect the regulation of biomarkers, protein expression, metal ion determination.

How will the data be collected or created?

The cell proliferation data will be collected using microplate reader, SA-beta-gal and unfolded protein amount will be collected using microscope, the western blot data will be resolved under iBright 750 system. The protein expression will be resolved using SDS-PAGE, and the metal ion determination data will be collected using ICP-MS

Documentation and Metadata

What documentation and metadata will accompany the data?

The protocol and results are recorded in the lab notebook. The raw data and processed are stored in my personal computer. I will also back up all my documents, raw data, processed data in 2 mobile hard drives simultaneously.

Ethics and Legal Compliance

How will you manage any ethical issues?

There are no ethical issues involved in my research project.

How will you manage copyright and Intellectual Property Rights (IP/IPR) issues?

The intellectual Property Rights of this project will be protected by The University of Hong Kong. The copyright will be owned and reserved by Prof. SUN Hongzhe, the principal invigilator of our lab.

Storage and Backup

How will the data be stored and backed up during the research? i. e. until stored in the final location (e.g. on your password protected laptop)?

All the data are stored in my personal computer and hard drives with password protected.

The procedure and raw data are recorded in the lab notebook, which is stored in the lab.

How will you manage access and security?

The lab notebook is locked in the bookcase and only permitted person can enter our lab.

The computer and hard drive are password protected.

Selection and Preservation

Which data are of long-term value and should be retained, shared, and/or preserved?

All data obtained should be retained and preserved and are of long-term value. Those data are shared when they are used for academic journal publishing and conference display via posters.

What is the long-term preservation plan for the dataset?

All data are processed into the documents as work report and shared with my supervisor.

Data Sharing

How will you share the data?

I'll only share the data with my supervisor and collaborators during the meeting. The data will be accessible to the public once the paper is published in an academic journal.

Are any restrictions on data sharing? If yes, Why?

Yes, because the intellectual property belongs to my supervisor, the lab and the university. They are not allowed to the shared to others without the permission of my supervisor until they are published.

Responsibilities and Resources

Who will be responsible for data management?

My supervisor, research collaborators and me are in charge of the data management including collection, storage, backup, and sharing.

What resources will you require to deliver your plan?

All public facilities provided by the department of chemistry or other institutes granted by the university, such as ICP-MS, LC-MS, NMR etc. Relevant equipments, reagents, lab spaces and basic lab facilities are also needed from our lab, such as high-speed centrifuge, incubator, fume hood, cell room etc.
