CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)

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Project Number

S1422

Project Title

Cellular Characterization of Nickel-Induced C3H/10T1/2 Cl 8 Cell Transformation

Abstract

Objectives/Goals

Inhalation exposures to soluble and insoluble nickel compounds during sulfidic ore refining were previously correlated with excess respiratory and nasal cancer risks by others in epidemiological studies. No excess risks were detected among workers refining lateritic ores. My objective is to investigate the genotoxicity of nickel compounds found in the occupational setting to reduce the risk of lung cancer in refinery workers and also to understand the process of metal carcinogenesis.

Methods/Materials

A lateritic ore sample (95% Ni, 5% NiO) called Queensland Nickel Compact (QNIC), was evaluated to detect whether or not it can be taken up into C3H/10T1/2 Cl 8 (10T1/2) mouse embryo cells by phagocytosis, induce cytotoxicity, and morphological transformations and chromosome aberrations in 10T1/2 cells. QNIC was compared to various nickel compounds including carcinogens, NiO and Ni(3)S(2). QNIC was also compared to the known carcinogen, 3-methylcholanthrene (MCA), and the well-known chromosomal breaking agent, mitomycin C (MMC) in transformation and chromosome aberrations studies.

Results

QNIC was: phagocytosed less, less cytotoxic, and not less able to induce cell transformation (transformation slope = 0.06 not significantly different from zero) than black/green NiO or Ni(3)S(2) (slopes = 5-10 and 1-50, respectively). The genotoxicity of the lateritic sample was low and the LC(50) level of QNIC was determined to be between 10 to 20 ug/mL concentration.

Conclusions/Discussion

The cytotoxicity by the QNIC sample was dose-dependent in 10T1/2 cells. From 0-20 ug/mL concentration, the phagocytic uptake was dose-dependent. Frequencies of chromosomal aberrations were small in the range of 5-30 ug/mL (3-fold to 7-fold), but results did not show a dose-dependent pattern. Frequencies of transformed cells revealed no dose-dependence pattern in QNIC concentration and did not induce Type-III foci at any concentration. Therefore, information gathered from this study indicates QNIC to be either non-carcinogenic or at not readily carcinogenic.

Summary Statement

A nickel compound called QNIC was induced into C3H/10T1/2 Cl 8 mouse embryo cells to detect whether or not it can be phagocytosed, induce cytotoxicity, and morphological cell transformations and chromosome aberrations in 10T1/2 cells.

Help Received

Used lab equipment at University of Southern California under the supervision of Dr. Joseph Landolph; advised by Duane Nichols; trained by Patricia Loo and Ashiya Hamirani