

# Study On the Mechanism of Impact Load on Immune Cells

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## Abstract

## Introduction

High G-value impact can result in serious health damage and even death directly. On frequent traffic accidents, the occupants suffer more than 100G impact in a few milliseconds; In extreme sport such as downhill, this value will exceed 200G or even reach to 500G. Suffering such a high G impact, important human tissues and organs will be severely damaged, the nervous system and the immune system will be under sustained damage and even death directly. Therefore, by establishing a variety of models basing on animals and dummies, many international medical and mechanical trauma research institutions extensively studied the damage mechanism and analysis the physical mechanism with Finite Element models.[1]

## Methods

To preliminary explore the high G-value load effects on immune cell function and its molecular mechanism, here, we chose immune cells of the mouse macrophages(RAW264.7) used in the study, Using split Hopkinson pressure bar to analog a physical environment of high G-value impact. After the experiments, we detected the immune function of macrophages (including phagocytosis and killing function of NO secretion, etc.) and we establish models by FEM to analysis the whole impact process. Fit the split Hopkinson pressure bar experiment and ABAQUS simulation, combined with biological experimental data analysis.

## Initial Findings

To analysis the experiment data and simulate in ABAQUS, the cells suffered about 600~700G impact. Under such a high G-value physical environment, the high G impact damage effect on murine macrophage were remarkable gradually, and the phagocytosis function and killing function of NO secretion got impaired obviously after 48 hours and this phenomenon didn't get any notable changes for 7days. Though they didn't have an immediately decrease after the impact.

## Discussion

The experimental data shows that the high G-value shock may cause a sustained damage to the immune system of the organism. This damage to the immune cells is becoming more obviously with the passage of the immune cells. Whether the impact caused a genetic level damage, we need a further experiment to explore the mechanism of its sustained damage.

## References

[1] B. Hopkinson, et al. "A Method of Measuring the Pressure Produced in the Detonation of High Explosives or by the Impact of Bullets," Philos. Trans. R. Soc. (London) A, 213, pp.437-456, 1914.