# Polymer Chain Simulation Experiment

## Abstract

This report summarizes the outcomes of a simulation experiment conducted to analyze the properties of randomly oriented polymer chains in 3D space. Specifically, the focus was on calculating the mean squared end-to-end distance of the chains and exploring the scaling behaviors as the number of segments increases.

## Introduction

Polymer chains can exhibit complex behaviors depending on their molecular structure and the nature of their constituent segments. Understanding the spatial configuration of these polymers through computational simulations helps in predicting their physical properties and usefulness in various applications. This experiment seeks to provide insights into the behavior of polymer chains through a computational exploration.

## Methods

We simulated 2000 polymer chains with a fixed segment length but varying total lengths consisting of 10, 50, 100, 200, and 400 segments. Each segment's orientation was determined randomly in 3D space, ensuring a uniform distribution of angles. The simulation calculates the end-to-end distance vector and the mean squared end-to-end distance for each set of polymer chains.

## Results

The distributions and behaviors of the polymer chains were visualized through multiple plots, highlighting the variances and patterns as the number of segments increased. Key figures include the plots of the polymer chains ("Fig. 1-5") and the plot of mean squared end-to-end distance against the number of segments ("Fig. 6"). The observed scaling exponent was found to be approximately 1.0051124288768594, indicating a nearly linear relationship between the number of segments and the mean squared end-to-end distance.











