



# Heritability of Bioenergetic Traits in Migratory Breast Cancer Cells



Santiago Lopez<sup>1</sup>, Jenna Mosier<sup>2</sup>, Addison White<sup>2</sup>, Cynthia Reinhart-King<sup>2</sup>  
Virginia Commonwealth University<sup>1</sup>, Vanderbilt University<sup>2</sup>

## INTRODUCTION

- Characteristics of the tumor microenvironment, like oxygen and glucose availability, contribute to the diversity of the cancer cells<sup>1</sup>
- Genetic diversity and external forces cause cells to undergo metabolic changes<sup>2</sup>
- Recent studies have shown that metabolic heterogeneity plays a role in the collective cancer cell migration<sup>3</sup>
- Hypothesis: We hypothesize that cells bioenergetics is heritable after cell division based on our knowledge of metabolic heterogeneity.**



Figure 1: Diagram description of metabolic heterogeneity

## MATERIALS AND METHODS

- Since ATP is the cells main source of energy, we use the ATP:ADP ratio to quantify cellular energy as it is directly proportional to cellular energy charge<sup>4</sup>
- We use the PercevalHR probe to measure the ATP:ADP as it exhibits a fluorescent signal that can be measured as a ratiometric value of ATP and ADP

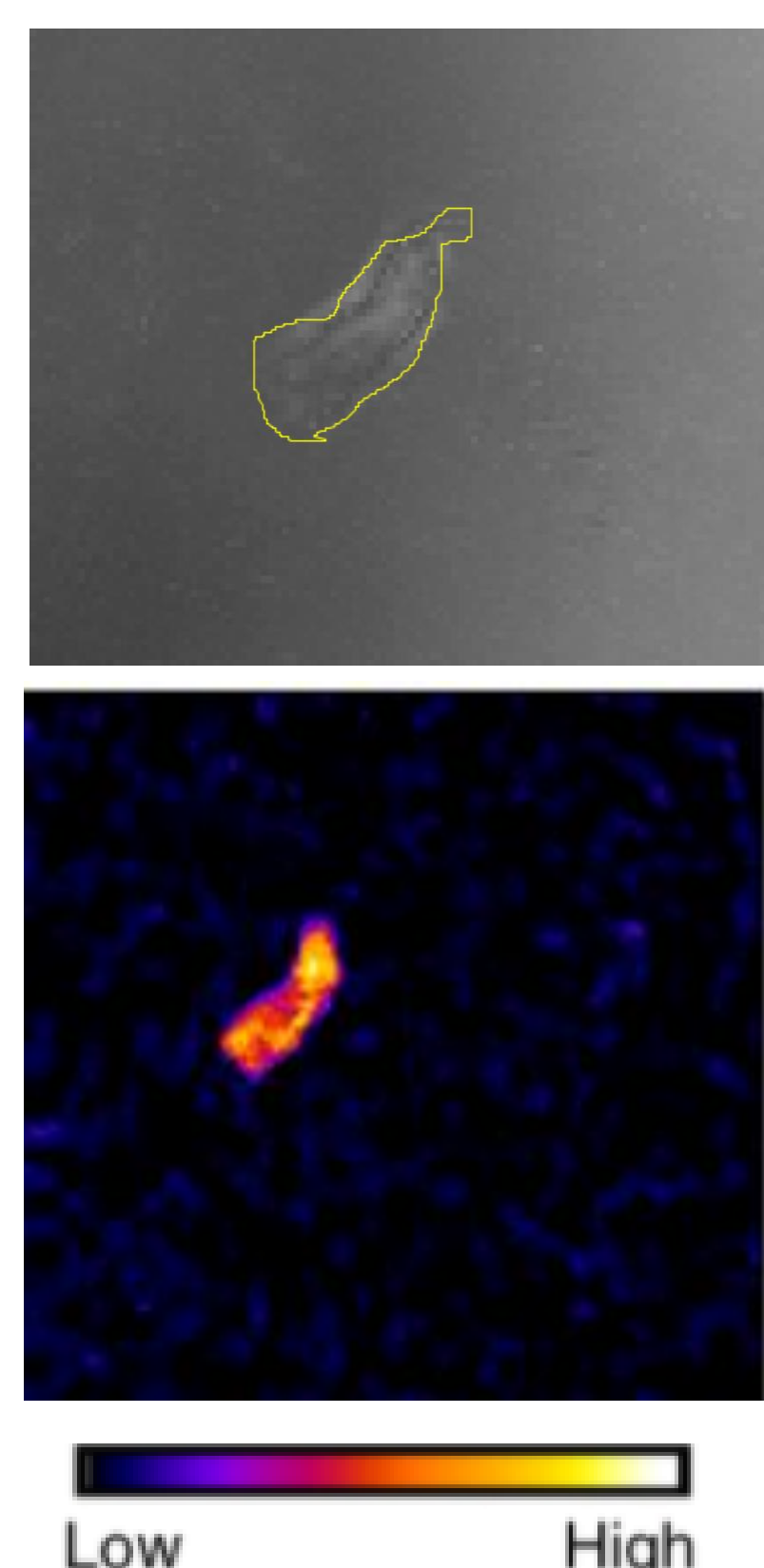


Figure 2: ImageJ images of the cell tracing and PercevalHR probe

- Fluorescent analysis was performed on ImageJ using a macro program
- The velocity and shape of cells were calculated by tracing the cells in ImageJ
- Used cell centroid displacement in the X and Y direction to determine speed and a numeric circulatory value for its shape

## RESULTS

### Parent and Daughter Cell Energy Comparison

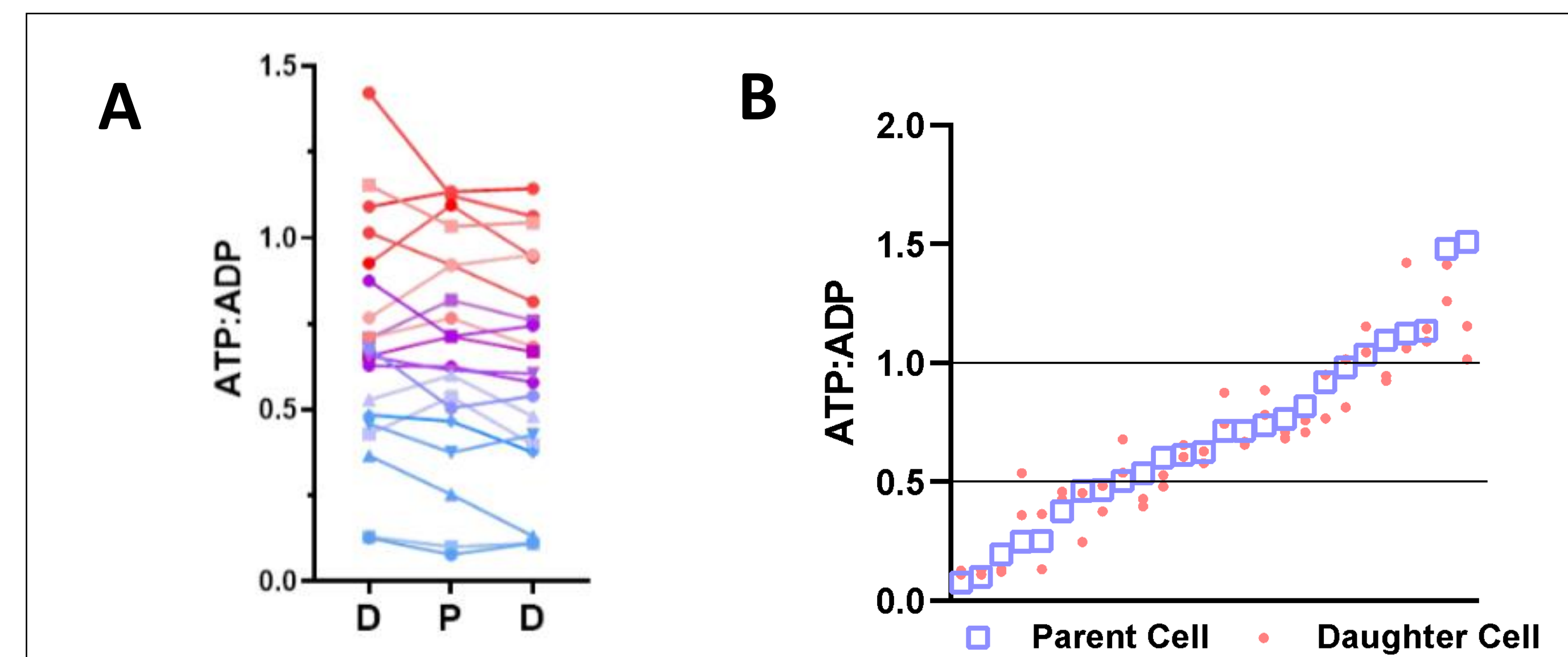


Figure 3(a,b): Difference between energy consumption of cells before and after cell division

- There is no significant difference between energy in parent and daughter cells (Fig. 3a 3b)

### Energy Variation Between High and Low ATP:ADP Cells

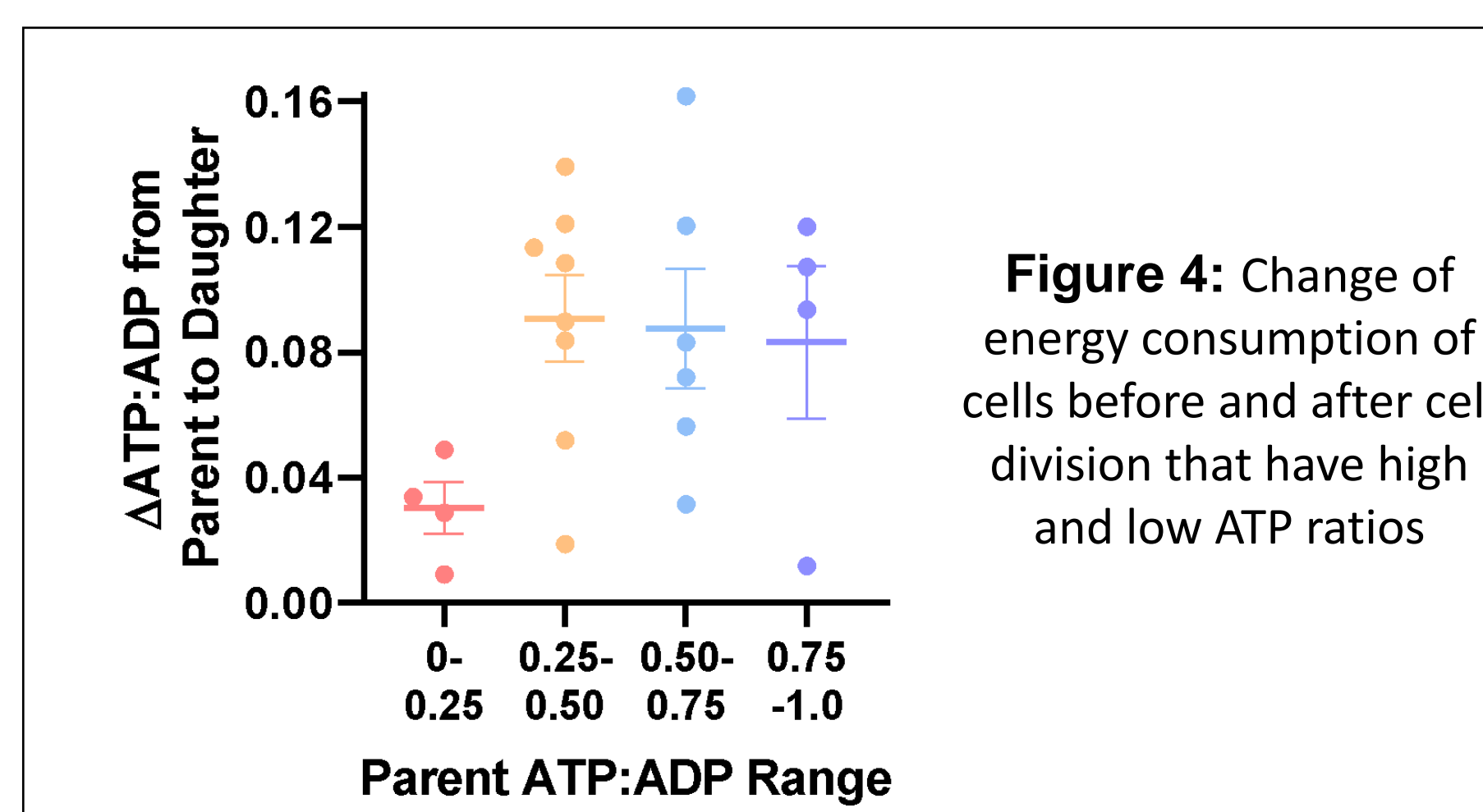


Figure 4: Change of energy consumption of cells before and after cell division that have high and low ATP ratios

- As energy levels increase, the energy variation between parent and daughter cells increases (Fig. 4)

### 2D Collagen Cell Bioenergetics Traits

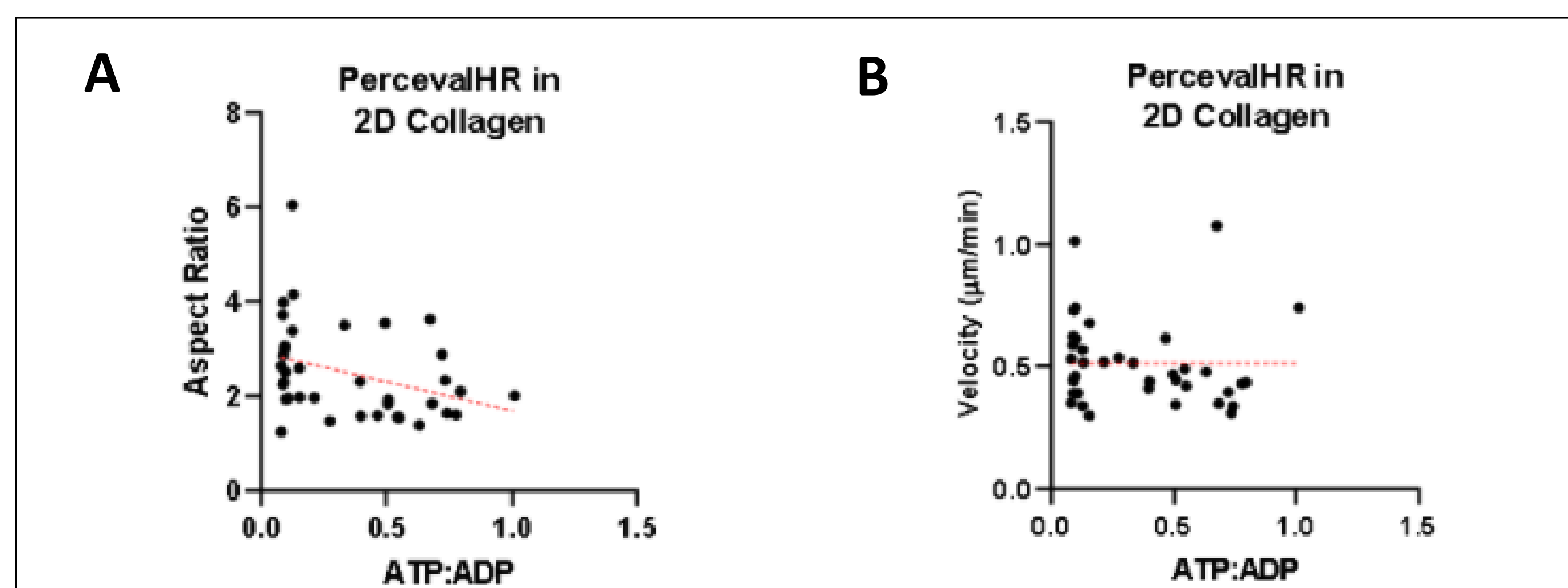


Figure 5(a,b) Relationship between energy consumption and shape(a) and velocity (b) of cells in 2D collagen

- There is no relationship between energy and velocity (Fig. 5a) but a slight negative trend with shape (Fig. 5b) meaning that cells tend to show a rounder form as ATP:ADP increases

## RESULTS

### 3D Collagen Cell Bioenergetics Traits

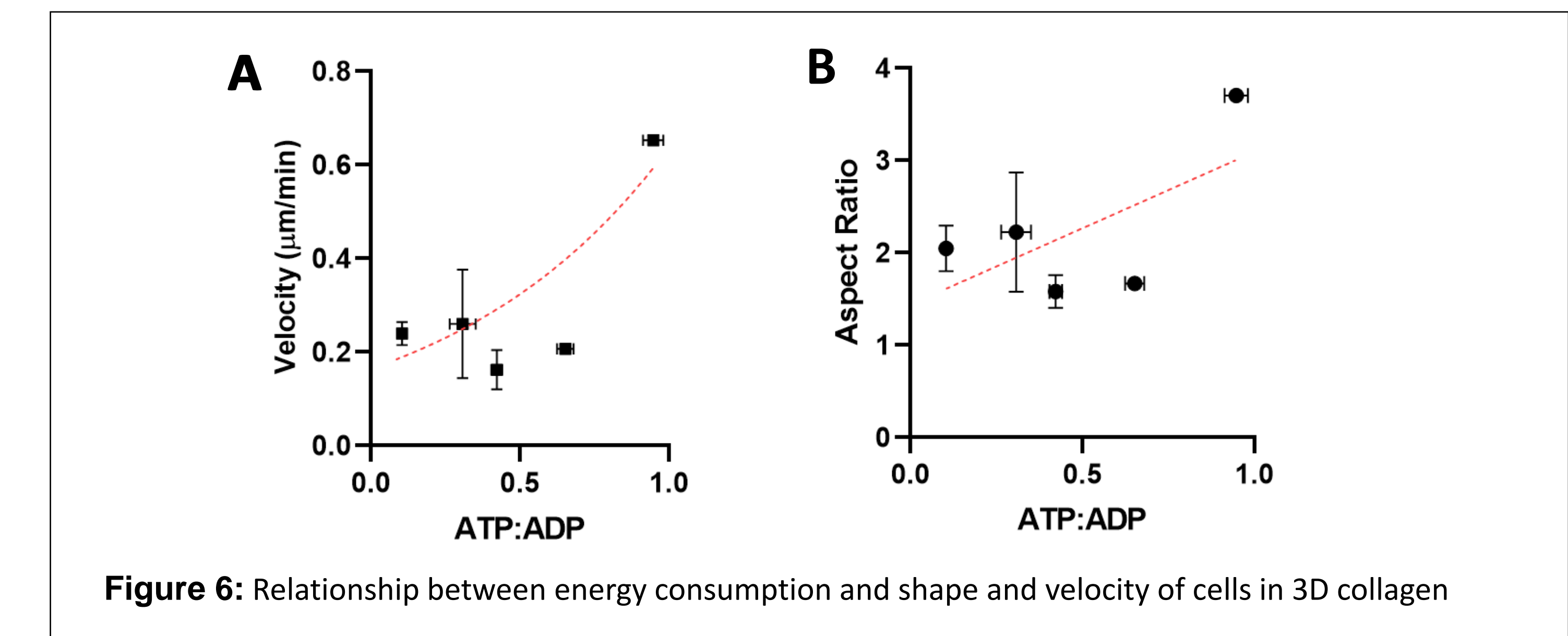


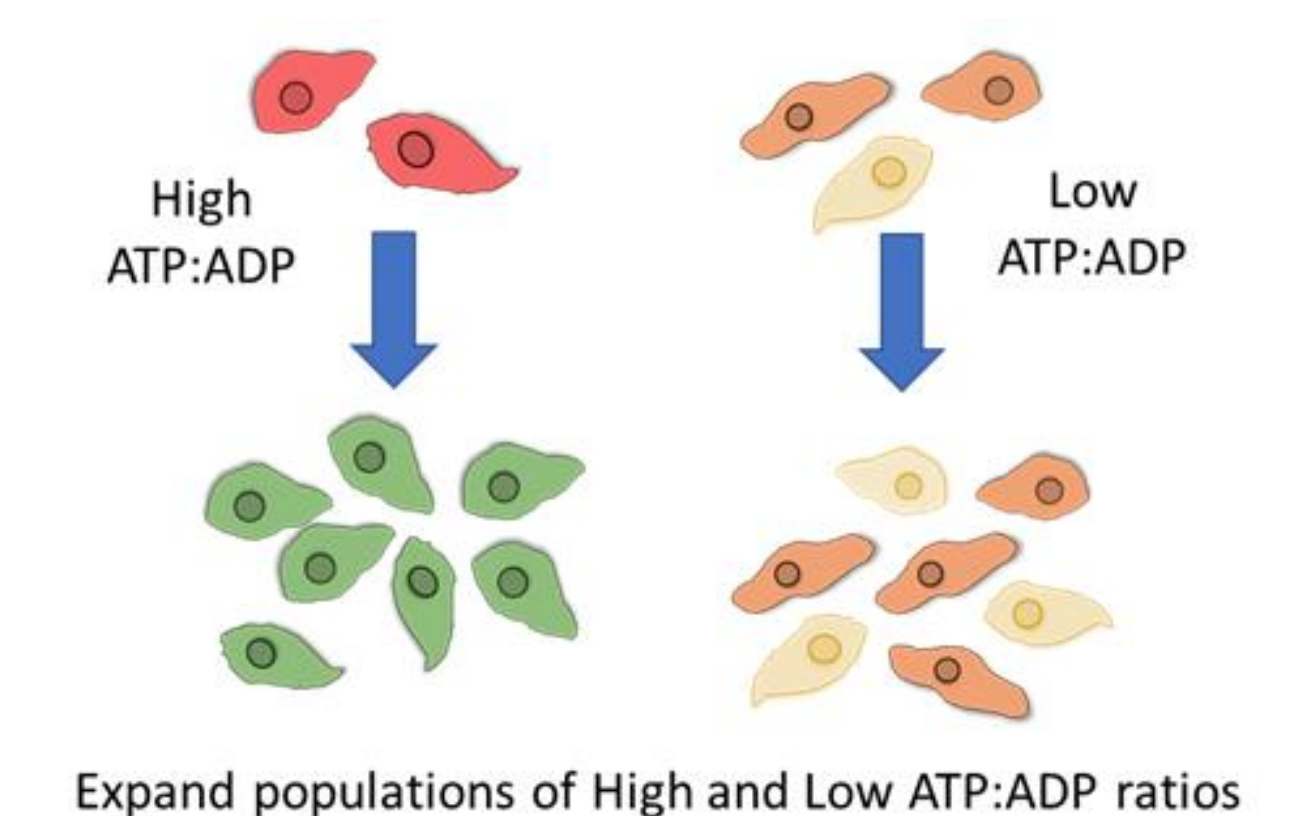
Figure 6: Relationship between energy consumption and shape and velocity of cells in 3D collagen

- There is both a positive relationship in both velocity (Fig 6a) and shape (Fig 6b) as energy consumption increases

## CONCLUSIONS

- Bioenergetic heterogeneity is a heritable trait during cell division**

- Findings provide a foundation to determine the feasibility of sorting cells based on ATP:ADP ratios



- Results also provide a better understanding of the bioenergetics at play in tumor migration and may point to targeted metabolic therapies for metastasis.

## REFERENCES and ACKNOWLEDGMENTS

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