Undergraduate biology students often conflate gene expression with Punnett squares and traits.

Student Ideas About Gene Expression: Making Proteins vs. Punnett Squares
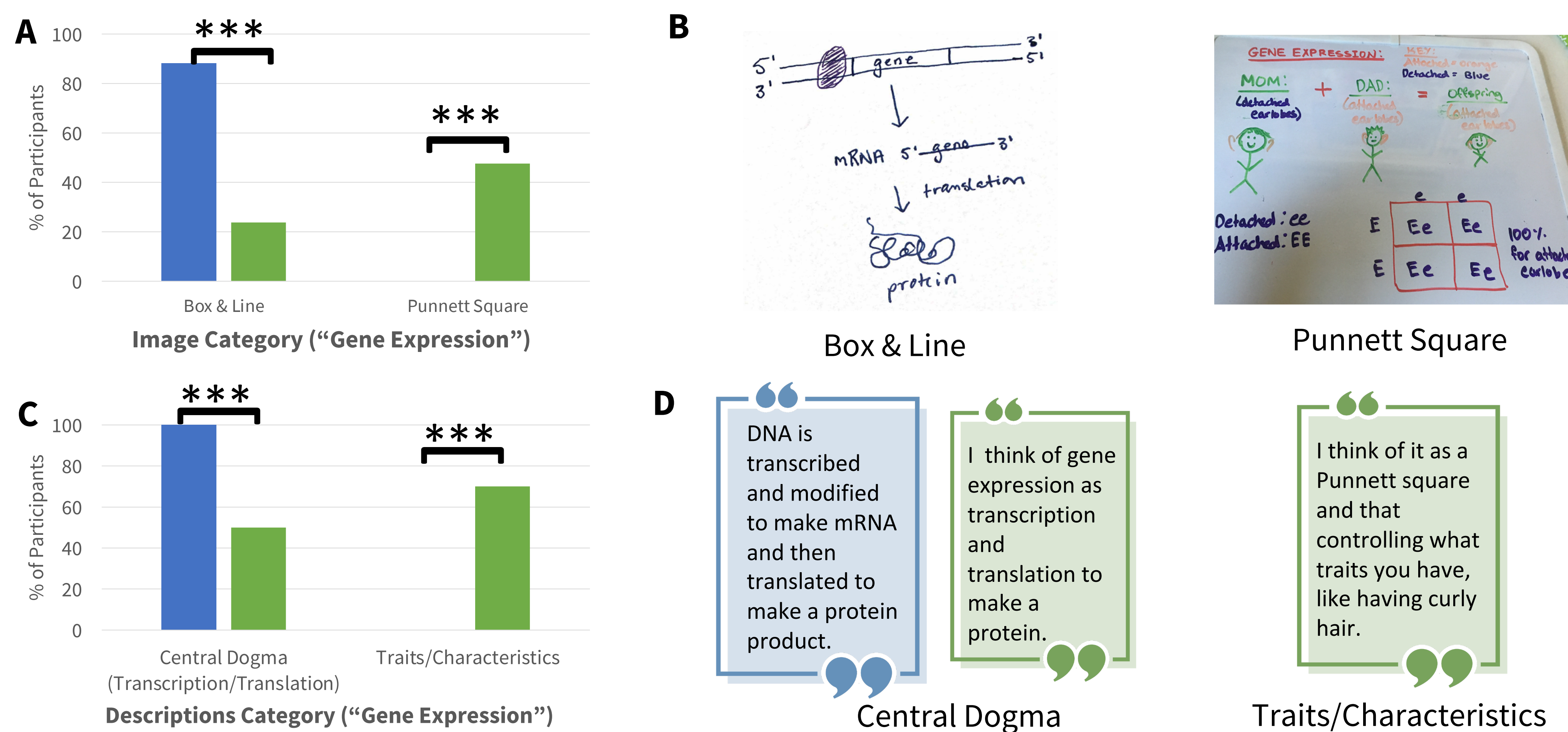
RESULTS

Figure 1. Experts and novices differ in their understanding of "gene expression" as demonstrated by drawings and explanations in semi-structured interviews. A) Types of representations drawn (Novices n = 21, Experts n = 17); B) Example drawings; C) Types of descriptions used (Novices n = 20, Experts n = 17); D) Example quotes for each category. ***=p < 0.001
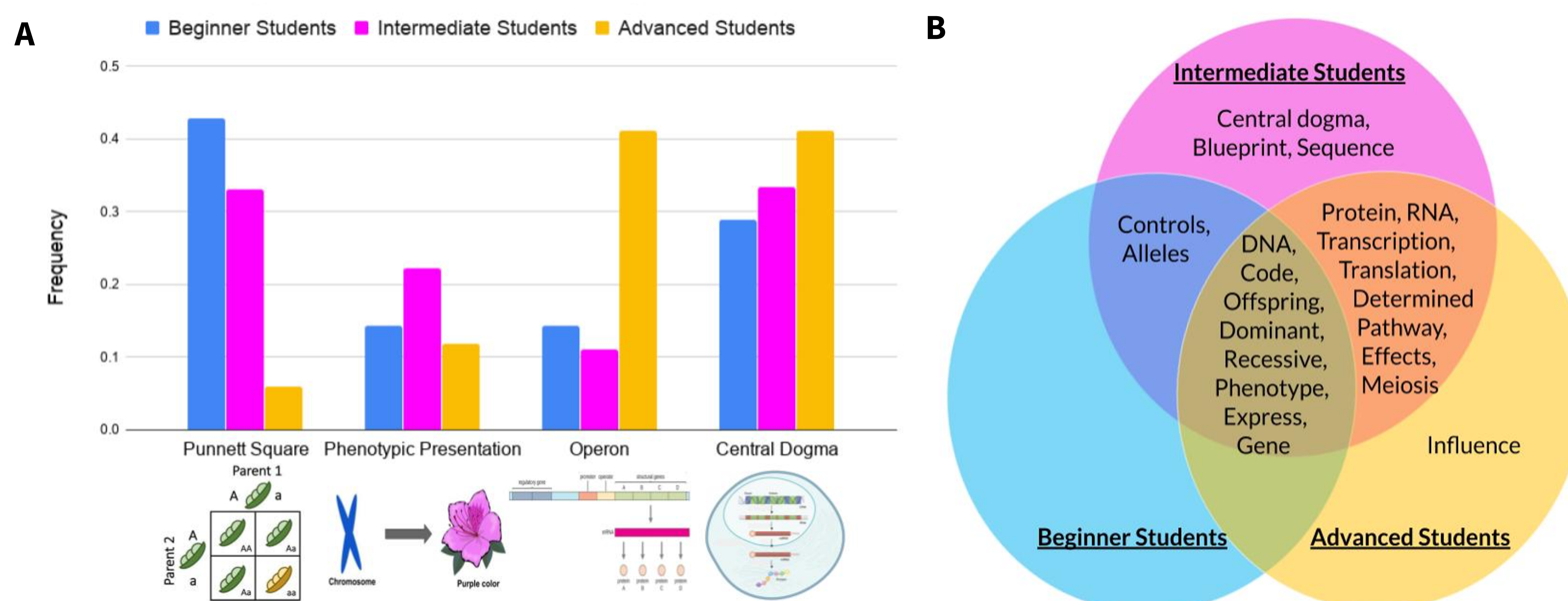

Figure 2. Student conceptual understanding of "gene expression" progresses over time as demonstrated by survey results. A) Students were given a choice of four images and asked to choose which best matched their mental picture of "gene expression." (Beginning Students n=14, Intermediate Students n=18, Advanced Students n=17); B) Students were asked to describe "gene expression" in their own words.

INTRODUCTION

Molecular biology makes use of visualizations to represent concepts that cannot be observed. Student-generated drawings can give insight into their mental models of molecular processes and can reveal previously unknown areas of confusion.

METHODS

Interviews were conducted with undergraduates (n=22) and biology faculty members (n=17), who were asked to draw and explain gene expression. Then, biology undergraduates (n=51) were surveyed to confirm initial findings that confusion about gene expression is a widespread issue among learners.

DISCUSSION

Undergraduate biology students commonly described gene expression using Punnett square drawings and representations of traits instead of describing the processes of transcription and translation. Beginner students tended to be more deterministic in their models, while advanced students showed more sophisticated molecular reasoning.

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