ABSTRACT
The speed of chemical reactions is largely dependent on temperature. In cell biology, researchers are often most interested in maintaining the sample above freezing but below roughly 15 degrees C. Often researchers rehydrate their samples or put them on ice prior to processing and rely on the thermal inertia of the sample and vessel to maintain temperature, since not all processes are housed in a refrigerated environment.

Experimental studies are often set up as a matrix of sample titrations across a well plate. In some cases, the effect of temperature variation across the plate is a significant disturbance in the data set. This is particularly problematic when the samples are at a lower temperature than ambient. The most common format for such testing is ANSI/SLAS 1-2004 96 well plates. Another common format is the micro-centrifuge tube which allows larger volumes (usually up to 2ml) to be utilized in an array of samples, useful for automated sample processing.

INTRODUCTION
This poster describes passive cooling solutions for two popular vessel formats, 96 well plate, and micro-centrifuge tubes. For applications requiring the sample to be chilled on ice prior to processing and maintained below 15 degree C, the goal was to minimize sample-to-sample temperature variation across the plate (or array of micro-centrifuge tubes) throughout processing. Additionally, it was determined that the samples need to be maintained below 15 degree C for a minimum of 22 minutes, with a goal of extending this to 45 minutes.

MATERIALS AND METHODS
Common vessel formats; Polypropylene 96 std. round bottom well plate (left), and polystyrene 1.5 & 2ml micro-centrifuge tubes (right).

A FLX 5800 infrared camera was used to view temperature gradients across the plate (or array of micro-centrifuge tubes). Very thin (36 gage) K-type thermocouples were placed in center and corner wells to monitor sample temperature extremes.

RESULTS - 96 STD. U WELL PLATE

RESULTS - MICROCENTRIFUGE TUBES

CONCLUSIONS
The infrared imaging largely agrees with the thermocouple data, except there was significant distortion from the fish-eye lens on the IR camera, so only temperatures in the center of the field of view were true. The IR images show that the heat transfer from the acetal tray in direct contact below the cooling block is reasonably low (temperature of the acetal tray is within a couple degrees C of ambient).

The 96-well plate alone (without cooling block) did not meet the 22 minute minimum.

The temperature variation from center well to corner well was also larger for the plate alone (about 3 degree C).

The phase-change 96-well and micro-centrifuge tube holder provide the best processing time (over 100 min) and had the smallest sample-to-sample temperature variation (< 1 degree C). The flatter, more horizontal portion of the temperature profile is likely due to the shape of the micro-centrifuge holder passed the minimum processing time.

Future study could measure different plate materials and/or bottom configurations, or possibly devise a universal solution.

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