Poster: Gene Regulation & Molecular Biology

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Abs # P14019: A role in sugar and redox handling for maize aldose reductase

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Our initial interest in aldose reductase (AR) rose from its possible role in sorbitol metabolism by maize kernels. AR is the only known enzyme in maize, other than sorbitol dehydrogenase, with capacity to synthesize or use the sorbitol so prominent in developing kernels (sorbitol + NADP glucose + NADPH). The reaction is reversible and could allow sorbitol use by embryos. However, ARs can catalyze diverse reactions and may have multiple roles in sugar- and redox-handling. Aldo-keto reductases (AKRs) are widely distributed in nature and play numerous roles in metabolism. In this study, we present eight putative AKRs in maize and characterize one of them, AKR4C13, due to its embryo specificity. Each of these eight genes show differential expression in maize tissues during development at mRNA and protein levels. Polyclonal antibodies raised against a recombinant maize AKR, reacted with several polypeptides that varied in amount among tissues. Results were consistent with different roles for the AR-like proteins. Data from western blots also agreed with predicted molecular weights of the AR family members as well as their expression patterns. The AKR4C13 was embryo-specific, with a MW of 35,659 Da and was temporally correlated with seed maturation and lipid biosynthesis in scutellum. The recombinant AKR4C13 enzyme could reduce DL-glyceraldehyde (standard) and oxidize sorbitol, but not reduce D-glucose. One possibility is that the maize sorbitol pathway, and AR in vivo, has similarities to roles in humans, where their primary effect is that of balancing sugar pools and redox levels under high-sugar conditions. Such a scenario could be especially valuable given the predicted gradients of sugars and reducing power within the maize kernel.