Grass pollination and pollen

[We’ve got to come up with a catchy title]

**Introduction and Objectives** (and/or Hypotheses)

Introduction

Grasses, with ca. 12,000 species, are the 5th most diverse plant family and the most diverse wind-pollinated one; Cyperaceae (with ca. 5,000 species) is in the top 10.

Wind pollination is ecologically common, but only a relatively small % of seed plants, in terms of species, have evolved this mode of pollination.

However, insect visitation to grass inflorescences (and not just forest grasses) and those of a number of wind-pollinated plants have been documented. Ambophily vs. insect-assisted pollination.

Inflorescence/flower characteristics of wind-pollinated angiosperms. Grass spikelet structure, bracteate, reduced flowers, feathery stigmas, versatile anthers. Grass pollen development (peripheral pollen). Grass pollen (uniporate, annulus, operculum, supposedly smooth walls, microchannels as a potential synapomorphy). Note similarities of Cyperaceae (bracteate spikelets, reduced flowers, independent evolution of peripheral pollen).

Objectives (including hypotheses)

-to

Hypotheses (in no particular order, and we can add or subtract)

-peripheral pollen driven by biomechanical advantage for release, not pollen nutrition

-stigma exsertion is always the same (perpendicular to the larger faces of the spikelet)

-spikelet shape has no relation to pollen release/capture (i.e., dispersal requirements are entirely driving spikelet evolution)

-awns/hairs have no effect on pollen release/capture

-microchannels and operculum are synapomorphies for the Poaceae

**Significance**

[If we include this section, we have to be careful not to be redundant with the Broader Impacts. But this would give us a chance to highlight the novelty of the virtual wind tunnel.]

**Proposed Work**

Pollination and Spikelet Evolution

Sampling

Spikelet modeling

Virtual wind tunnel experiments [anything we might do with peripheral pollen should go here]

Pollen

Sampling (go for 24)

LM

SEM

TEM

**Preliminary Results**

Pollination and Spikelet Evolution

Method for spikelet modeling has been developed (cite APPS paper)

Preliminary tests of virtual wind tunnel

Pollen

Discuss what is known regarding the distribution of the microchannels

Include anything relevant about experience with processing pollen

**Timetable**

[brief summary of what will be accomplished in each year]

**Broader Impacts**

Educational: Grass spikelet models that are digitally dissectible.

Human Resources: Training of two Ph.D. students, one of whom is female and a first generation college and graduate school student; training of at least two undergraduates during the project.

Methods: Development of 3D methods and analyses

Other fields: potential impact on paleoecology/paleoclimatology

[work in BPMI?; Carver students?; SACNAS?]

**Results from Prior NSF Support** (Poaceae Plastome and Dimensions/NASA)

**Details/Budget**

3-year project, with a start date as soon as possible in 2019 (but might have to be mid-semester in the spring or not until the start of summer semester)

12 months of RA support per year, plus benefits and tuition

Hourly for undergrads, plus benefits

Supplies for anatomical work for both components of the project

LM imaging, measurements, etc.

SEM training and beam time

TEM samples

Travel to meetings

Greenhouse supplies/costs

Publication costs

[likely no request for computer or software, but what about server time?]