Introduction outline:

Layout the major questions. Then address the answers. Finally, construct the logical flow of necessary statements. Each sentance should be defendable and contain well defined or cited jargon.

1 these are the questions I want to address

- What field am I in?
- Thesis statement: develop a criterion for AL/diffusion transition in active random media
- Historically speaking, how did we get here?
- When does AL versus diffusion occur?
- What currently exist for criteria?
- How are those criteria modeled numerically?
- How do I plan on accomplishing the result desired in the thesis statement?

2 this is how I will address the questions

Note: you are an expert, stick to the topic you are an expert on.

- What field am I in?
  - Mesoscopic transport: ignore atomic-specific considerations, but small enough system that quantum effects are present (not bulk properties). [cite]
  - light waves
  - study of transition from diffusion to Anderson Localization [specifically not defining these yet.]
  - both are defined in passive media [cite], but we extend applicability to active media [ties to thesis statement]
- Thesis statement: develop a criterion for AL/diffusion transition in active random media
  - How? Develop numerical simulations [cite PWA "necessity of numerical sim"]
- Historically speaking, how did we get here?
  - self-interference applies to any wave, including photonic
  - $g = T = \sum_{ab} |t_{ab}|^2$ [cite]
  - define diffusion [cite], AL [cite] [sets up clash of applicability]
- When does AL versus diffusion occur?
  - ballistic, diffusive, and localized regimes
  - single parameter scaling says (any?) parameter is valid [cite]
  - passive, active systems, and why active is exception to single parameter scaling
  - (transition: need a way to characterize when an experiment is in a given regime)
- What currently exist for passive criteria?
  - single parameter scaling makes all passive criteria equivalent [cite]
  - D(z) [cite]
  - universal conductance fluctuations [cite Genack]

- correlation functions [cite]
  - Ioffe-Regel
  - Thouless
- How are those criteria modeled numerically?
  - transfer matrix method, renormalization
- How do I plan on accomplishing the result desired in the thesis statement?
  - 1D alternating dielectric material numerical model
  - quasi-1D active randomly-placed scatterers numerical model
  - regimes plot

3 detailed logic flow

- What field am I in?
  - Mesoscopic transport is defined [**?**] as the length scale on which atom and molecular considerations are ignored, but small enough system that quantum effects such as phase coherence are present (i.e., bulk properties of material are not present).
  - Of interest in this dissertation, propagation of light waves the self-interference thereof in media with randomly-placed scatterers. The mesocopic scale is important because the coherence length, over which phase is is not altered, is longer than system length L.
  - At this scale, we study of transition from diffusion to Anderson Localization
  - define diffusion [cite], AL [cite] [sets up clash of applicability]
  - Both AL and diffusion are defined in passive media [cite], but we extend applicability to active media [ties to thesis statement]
- The purpose here is to develop a criterion for AL/diffusion transition in active random media [Thesis statement]
  - To do this, numerical simulations are developed. [[**?**] "one has to resort to the indignity of numerical simulations to settle even the simplest questions about it."]
- Historically speaking, how did we get here?
  - Although AL was initial developed in the context of self-interference of de Broglie waves, the concept applies to any wave, including light waves.
  - The relation between unitless conductance and transmission is $g = T = \sum_{ab} |t_{ab}|^2$ [**?**] (transition?)
- When does AL versus diffusion occur?
  - ballistic (ℓ_{scat}), diffusive (ℓ_{tmfp}), and localized (ξ) regimes
  - single parameter scaling says (any?) parameter is valid [**?**]
  - passive, active systems, and why active is exception to single parameter scaling
  - (transition: need a way to characterize when an experiment is in a given regime)
- What currently exist for passive criteria?
  - single parameter scaling makes all passive criteria equivalent [**?**]
  - D(z) [**?**]
  - universal conductance fluctuations [**?**]

  - correlation functions [cite]
  - Ioffe-Regel [?]
  - Thouless [?]

- How are those criteria modeled numerically?
  - transfer matrix method, renormalization

- How do I plan on accomplishing the result desired in the thesis statement?
  - 1D alternating dielectric material numerical model
  - quasi-1D active randomly-placed scatterers numerical model
  - regimes plot