Archaeoproteomics

The generation of an idea

Archaeoproteomics

- The study of protein residues from archaeological artifacts
  - Stone tools for butchery
  - Pottery for cooking and storage
  - We focus on cooking pottery

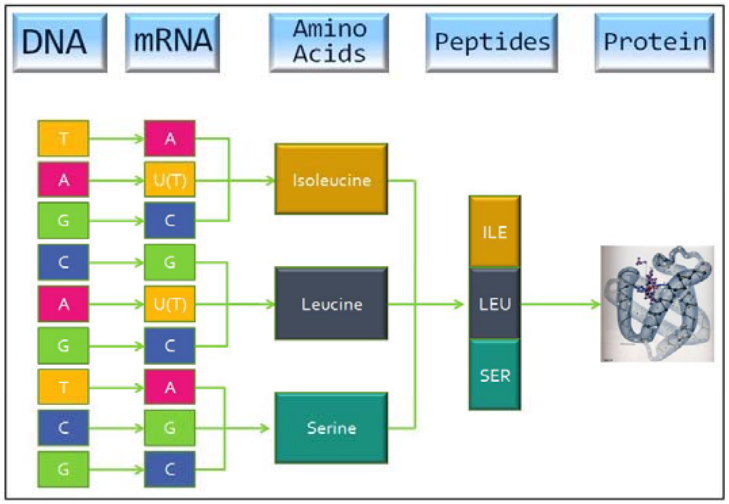

Figure by Andrew Barker

Problems

- Few studies of protein, pottery interactions
  - Proteins bind tightly to clay during cooking
  - How to extract them is problematic

- Very few studies on preservation of protein residues that bind to clay during cooking

Clay – protein interactions

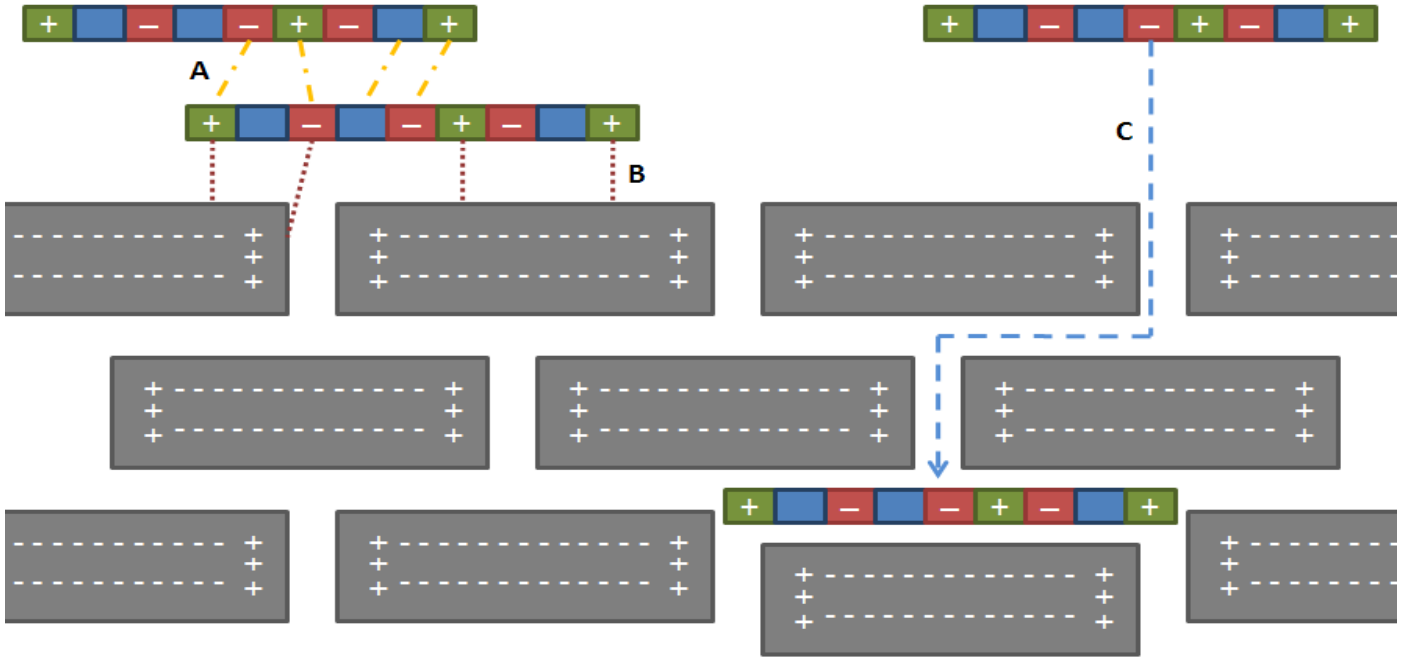

Figure by Andrew Barker

Advantages of proteins

- Fats (lipids) offer only coarse scale information
- Proteins, if extracted, can provide species & tissues cooked in pots
- Thus, it is beneficial to learn how to reliably extract protein residues from pottery
- The reward is precise information on pottery function and past diet.

The research plan

- We came to know this gap in knowledge in 2006

- We submitted grant proposals to do cooking experiments of known amounts of protein in pottery
  - Then we proposed to extract the residues
  - This would allow us to determine % recovery

Obstacles

- Reviewers complained…
  - That we were too simplistic
  - That we were not making huge archaeological claims
- We fired back…
  - How can we make claims with no acceptable methodology
  - Method development prevents “stabs in the dark”

Our team

- 2 archaeologists
- Environmental chemical biologist
- Protein biochemist
- Plant biochemist

- We combined our approaches to get the necessary support to do the experiments

Results

- We have optimized physical parameters and solvents for successful extraction
- We are now identifying proteins successfully with more confidence than other labs
- We are moving forward to work with archaeological pottery
  - We have not wasted real artifacts to do this…

Lessons

- To know gaps, you must know the literature
- Success requires the right team members
- Research is timely

Other Lessons

- To be successful you must be persistent
  - Our first grant submission was trashed by reviewers
  - Our first publication submission also trashed by a territorial reviewer

Other Lessons

- Careful research is uncommon
- Not everyone wants you to succeed
- Most importantly, your question matters more than the answer

Other Lessons

- Do more with less, and do it right
  - Changing the entire world should <u>not</u> be your agenda
  - Learning research skills <u>should be</u>
  - An important study is one that is <u>well done & finished</u>
  - Your professors <u>have</u> these skills, you are <u>gaining</u> them

Endpoints and deadlines

- Write a mission statement for each chapter
  - If an idea comes along that is not in your mission, save it for later
  - This allows you to see endpoints
- Schedule your proposal defense and other milestones ASAP

Defend your ideas

- A proposal defense is just that, a defense
- Be prepared to defend your ideas
- Also be prepared to accept productive ideas on structure, communication, etc.