COLUMN
Tracked changes

Writing together bridges disciplines, says **Eli Lazarus**.

Not long ago, I co-wrote a grant with a small army of of collaborators. As our deadline approached, we were circulating several e-mails a day among 24 people at 8 different institutions around the United Kingdom. Each 'reply-all' message laboured under the size of the latest attachment. Time stamps reflected ever-blearier hours. Our ambition for a major interdisciplinary consortium was at stake.

Our project called for researchers from the natural sciences (in hydrology, soil, ecology, sediment transport, water chemistry and gas exchange) to join colleagues from the social sciences (in economics, politics, policy and governance) to study changes in environmental resources at a national scale. We would collaborate to examine managed landscapes holistically, as integrated systems of natural processes and human activities. We would be a supergroup united by data sets, computer models, statistical analyses and case studies.

As iterations of the proposal rolled through our inboxes, it occurred to me that for all our use of future tense and conditional clauses, the promise of what we would do if funded, this — the collaborative act of writing the proposal — was really where our interdisciplinary work was happening. The requirement of writing a joint proposal was forcing us to transcend the shorthand of our respective disciplines.

The proof was in the rainbow of accumulated tracked changes and marginalia. "We're going to drive this model with results from that one, right?" someone asked in electric green. Yes. Terms familiar to one contributor were foreign to another. Clauses such as "construct a platform for linked subroutines capable of accounting for fluxes through the selected grid space" disappeared. "Deliberately abstracted" became "simplified", and "dynamically integrated comprehensive framework" became "system".

Co-authors haggled over content. Does a group of integrated models comprise a single model? Are we simulating or predicting or forecasting? Should we emphasize the elements that make the work applied, or the unresolved dynamics that make it exploratory? Each description, each choice of evidence, each reference was weighed. Debates about what stayed in a draft and what did not were essential to our internal process of deciding what we actually wanted to do. They propelled simpler, clearer writing — to everyone's benefit. By the time our submission was ready, what had started as a sprawling pitch had transformed into a compelling plan. The steps, however technically complicated, felt like items that we could tick off of a to-do list.

This grant proposal marks my fourteenth formal interdisciplinary undertaking. Each one has been an education. You hear the language of another discipline: its phrases and idioms; its favourite verbs and adjectives. You learn how colleagues from other backgrounds construct and solve problems. You gain a sense of the ideas that interest them, and an appreciation of why. You hear the language of your own discipline as if it were someone else's. You revisit your own preferences for puzzles and questions.

> *"Writing together makes projects real. It requires negotiations between disciplines."*

You strike your foregone conclusions, hang up your implicit assumptions and begin to build — and rebuild — explanations and arguments from scratch.

Every day, I read posts from institutions around the world soliciting ways of cultivating interdisciplinary initiatives. But I have found that strategic discussions about interdisciplinary research rarely come down to the practicalities of the research process.

Interdisciplinary research is too often described in terms of lofty abstraction, a collaborative effort that sounds more magical than methodical. Writing together makes projects real. It requires negotiations between disciplines and individuals (see Careers Column page 427). The exercise closes conceptual distances that conversations leave wide open.

The next time I am invited to an interdisciplinary workshop to galvanize links between researchers from disparate specialities, I might ask the organizers how much collaborative writing is on the agenda. If the event is mine to organize, I'll scrap hours of showcase presentations. Attendees will write. I'll offer a handful of relevant prompts: calls for research proposals from a funding agency, advertisements for an interdisciplinary conference, the announcement of a journal's special issue. Participants will establish ground rules for a safe creative space — and we will enjoy the alchemy of what emerges. ∎

Eli Lazarus *is a lecturer at Cardiff University, UK.*

TRADE TALK
Science strategist

Gautham Venugopalan, an analyst at the consulting firm Gryphon Scientific in Takoma Park, Maryland, describes switching from a post as a bioengineer who writes scientific papers to one as a consultant who assesses the literature to inform policy decisions.

How did you learn of jobs outside academia?
I never intended to go into an academic career. As a graduate student researching cancer biophysics, one of the reasons I chose my lab at the University of California, Berkeley, was because people there had gone on to do a variety of things: management consulting, freelance journalism, starting a company. Also, my adviser had an interest beyond the lab: he had done a White House fellowship. He would come back and say, "These are the scientific issues, and here are these societal components, political components and budget components".

I started a non-profit with some friends and then did a policy fellowship at the US Department of State. At a networking event, I met someone from Gryphon and ended up interviewing for a job there.

What do you do now?
Gryphon is a small research and consulting firm with 50 or 60 people. We use scientific analysis to advise people on national security and global health issues.

How do you apply your training?
One thing you hear a lot when you leave academia is, "Don't you wish you could use your scientific training more?" And right now I do use it. There is still a lot of uncertainty, but instead of spending five years finding out a piece of that, you spend five months generating a report, which is a different challenge but uses a lot of the same skills.

You use evidence to justify your conclusions, and sometimes you use scientific principles to test your assumptions or to provide a range of estimates. You need to know how publishing works and how evidence works if you want to make evidence-based policy. ∎

INTERVIEW BY MONYA BAKER
This interview has been edited for length and clarity. See go.nature.com/ifbowr for more.