Meeting for Sex in Iowa

Evolution of Sex & Recombination: In Theory & In Practice, University of Iowa

A diverse group of ~130 researchers from around the world convened at the University of Iowa in Iowa City on 31 May to 3 June 2009 for the first symposium of the Roy J. Carver Center of Comparative Genomics: Evolution of Sex & Recombination: In Theory & In Practice. The idea for the meeting originated 3 years earlier from a group of Department of Biology faculty at The University of Iowa, who felt that there was a need to bring together scientists taking both empirical and theoretical approaches to a wide range of problems in the evolution of sexual reproduction and recombination. This meeting represented an opportunity for a synthesis on these important issues and to attempt answers to the still-unsolved question of “Why sex?”

What became known as the “Sex & Rec” meeting was originally planned for 16–19 June 2008. Unfortunately, those dates coincided with an event that became the greatest natural disaster in the history of Iowa City: the Great Flood of 2008. Iowa City and sister-city Coralville were inundated with record-breaking floodwaters, resulting in more than $7 billion damage to the region, including ~$250 million in damage to the University of Iowa. Those of us in the Biology Department were largely spared but many on campus and in the community were not. Following the flood, the meeting organizing committee—bolstered by strong email encouragement from scheduled attendees—unanimously decided to hold the symposium the following year. The new dates were selected to immediately precede the annual meeting of the Society for Molecular Biology and Evolution, already planned to be hosted in Iowa City on 3–8 June 2009.

To our relief, the 2009 Sex & Rec meeting took place as scheduled. The meeting featured 46 plenary talks: 2 evening keynote lectures, 5 anchor talks and 39 short talks representing a combination of invited speakers and speakers selected from contributed abstracts. Two evening sessions featured 46 poster presentations. The kickoff keynote address from Graham Bell (McGill University) entitled “Sexual dynamics in complex communities” provided an introduction to the problems facing research on the evolution of sex and recombination and emphasized the need to synthesize both real-world data and tractable theoretical approaches. Over the next 2 exciting days, talks were organized into 5 topical sessions: Advantages of Sex (anchored by Curt Lively [Indiana University]), Recombination Rates and Selection (anchored by Alex Kondrashov [University of Michigan]), Mating Types and Sex Chromosomes (anchored by Joe Heitman [Duke University]), and Sexual Oddities (anchored by Matthew Meselson [Harvard University]). At the close of the second day of talks, and immediately following the conference banquet, Michael Lynch (Indiana University) provided a keynote entitled “The causes and consequences of meiosis suppression in Daphnia.” The next morning featured a half-day of talks on the remaining 2 topics: Sexual Conflict and Sexual Selection (anchored by Adam Chippendale [Queens University]). See the Sex & Rec website (http://ccg.biology.uiowa.edu/sexrec) for more details on the meeting, including information on the organizers, attendees, and presentations.

All attendees of the Sex & Rec meeting were invited to contribute to this special issue of the Journal of Heredity, which has been generously sponsored by the American Genetic Association. The 17 papers comprising this issue represent those manuscripts that passed external peer review and our subsequent editorial revision and commentary. We are indebted to all the authors for their submissions, and to the reviewers for their comments and critiques, especially given that this process was very time-limited. We thank the National Evolutionary Synthesis Center (NESCent) for providing us (in December 2009) with a pleasant venue and printing resources necessary for the completion of tasks required for the final editorial review of the issue. We especially thank the Journal of Heredity Managing Editor, Anjanette Baker and Editor-In-Chief, Scott Baker, for their assistance and patience with all the details needed to make this project a success.

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Solution(s) to Sex Problems?

A core motivation for the meeting was to bring together the people involved in solving the so-called “queen of problems” in evolutionary biology, the maintenance of sexual reproduction in nature. We also hoped to stimulate interaction among those studying related areas, not the least because the maintenance of sex cannot be fully understood in the absence of its biological trappings or without in-depth understanding of its genetic outcomes.

In fact, the questions of why sexual reproduction, outcrossing, and recombination are so common, why mating systems are so variable, and why males and females look and behave so differently have been central in evolutionary biology since
Darwin’s time. In particular, understanding the predominance of sex in nature has received a great deal of attention since the 1970s, when George Williams and John Maynard Smith pointed out that sex is so costly that its persistence requires profound and rapidly generated individual-level advantages. This realization has continued to inspire many biologists to attempt to identify potential benefits of sex and to characterize their presence in nature.

Many meeting participants presented data or theory that provided important steps toward a better understanding of the advantages of sexual reproduction and relatively high levels of recombination. Highlights included convincing empirical evidence for direct benefits of genetic recombination, such as effective mutational clearance and escape from biological enemies. Equally prominent were the many talks and posters demonstrating that lineage-specific characteristics (e.g., desiccation resistance in rotifers) and ecological conditions experienced by natural populations (e.g., high frequency of virulent coevolving parasitism) are also key determinants of the outcome of mating system evolution. One clear message from this latter set of presentations is that complete understanding of the success of sex requires more than an in-depth evaluation of the consequences of recombination and must take organismal biology and ecology into account.

Another meeting highlight—and positive development in light of the data that are critical to truly understand sex—was organismal diversity. Talks and posters featured systems from across the tree of life, ranging from wasps, strawberries, and stickleback fish to algae, yeast, bacteria, and life in silico. Several presentations also included a philosophical or historical angle, which helped both to illuminate and to clarify the complexity of the sex problem. Diversity of methodological approaches was notable, with meeting participants using analytical and simulation models, model and nonmodel systems, field and laboratory studies, and descriptive and experimental methodologies; all aimed at generating novel insights into the costs and benefits of sex and recombination.

Identification of areas where progress is still needed was also an important outcome of the Sex & Rec meeting. For example, it was apparent that identifying potential advantages of sexual reproduction and disadvantages associated with asexuality do not translate directly into a solution for the “paradox” of sex. Empirical data from natural systems are needed to directly study sex and ultimately, to resolve the “queen of problems” in evolutionary biology. It was apparent that such data continue to remain all too rare. We hope that the meeting generated new inspiration and resolve to continue and expand research efforts in this area.

One of the most surprising elements of the meeting was the extent to which an historical (and we believe, artificial) divide between “ecology” and “genetics” still exists when it comes to the study of sex. In fact, arguments conceptually identical to debates that took place at meetings and in the literature 20 years ago are still ongoing. This stalemate is disappointing in light of much conceptual and some empirical progress in terms of developing and utilizing pluralistic and integrative approaches, and a growing—though not universally held—appreciation for the reality that the complexity of sex means that its success may also often have a complex underpinning.

This special issue of the Journal of Heredity highlights some of the key issues in the evolution of sex and recombination. The papers include empirical and theoretical studies (some with both), a variety of model genetic and nonmodel systems, genetic and genomic approaches, historical commentaries, and enough “weird sex” to keep any biologist’s attention. We hope that you, the reader, will enjoy the issue as much as we have enjoyed putting it together!

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