

**Women represent about 30% of scientific researchers worldwide, with substantial variation by region and discipline. Gender imbalance affects the practice of science and may hinder its success, particularly in the context of large cooperative research teams. In this study, we focus on the next generation of professional scientists: undergraduate researchers in the newly emerging field of synthetic biology.**

We present a detailed study of women's participation in a specific scientific community, with emphasis on the potential causes of gender inequality and the impact of gender balance on research team performance. First, to document the representation of women among young synthetic biologists and thereby raise awareness of gender issues in a specific scientific community. Second, to understand the relationship between gender balance and research team success. By correlating team gender composition with performance metrics, we seek novel quantitative insights into the impact of gender on the practice of science.

## THE iGEM COMPETITION

The annual iGEM (international Genetically Engineered Machines) competition brings together thousands of young synthetic biology researchers working in teams to design and execute innovative projects. Projects are thoroughly documented on publically available team websites and lab notebooks. High-performing teams are awarded prizes in multiple categories.

### WE INVESTIGATED GENDER DYNAMICS IN iGEM AND IN SYNTHETIC BIOLOGY RESEARCH COMMUNITY AT LARGE IN A QUANTITATIVE MANNER

**BY SCREENING AND ANALYZING**

**50** Synthetic Biology Laboratories  
**ALL** SB Conferences  
**731** Team Screened

**TO MAKE 1 Database**

All info available on wiki  
2013.igem.org/Team:Paris\_Bettencourt/

Several datasets were manually curated from publically available sources and statistically analysed. The iGEM-related data included male and female team member counts and awarded prizes for 850 teams over 7 years of competition. Similar data was collected from self-identified synthetic biology research labs, relevant conference speakers and publication authors.

## WOMEN ARE UNDER REPRESENTED IN iGEM AND SYNTHETIC BIOLOGY

Synthetic biology is interesting because it is new and comes from a multitude of disciplines. Therefore it does not carry historical biases. Only 33 % of researchers in synthetic biology are women, this number drops down to 18 % for heads of labs. This is representative of other fields of science. We observed a robust gender imbalance in the iGEM competition, with women representing 37% of team members. Average team gender ratios showed no significant differences by region (Europe, North America, Asia) and no significant change over 7 years.

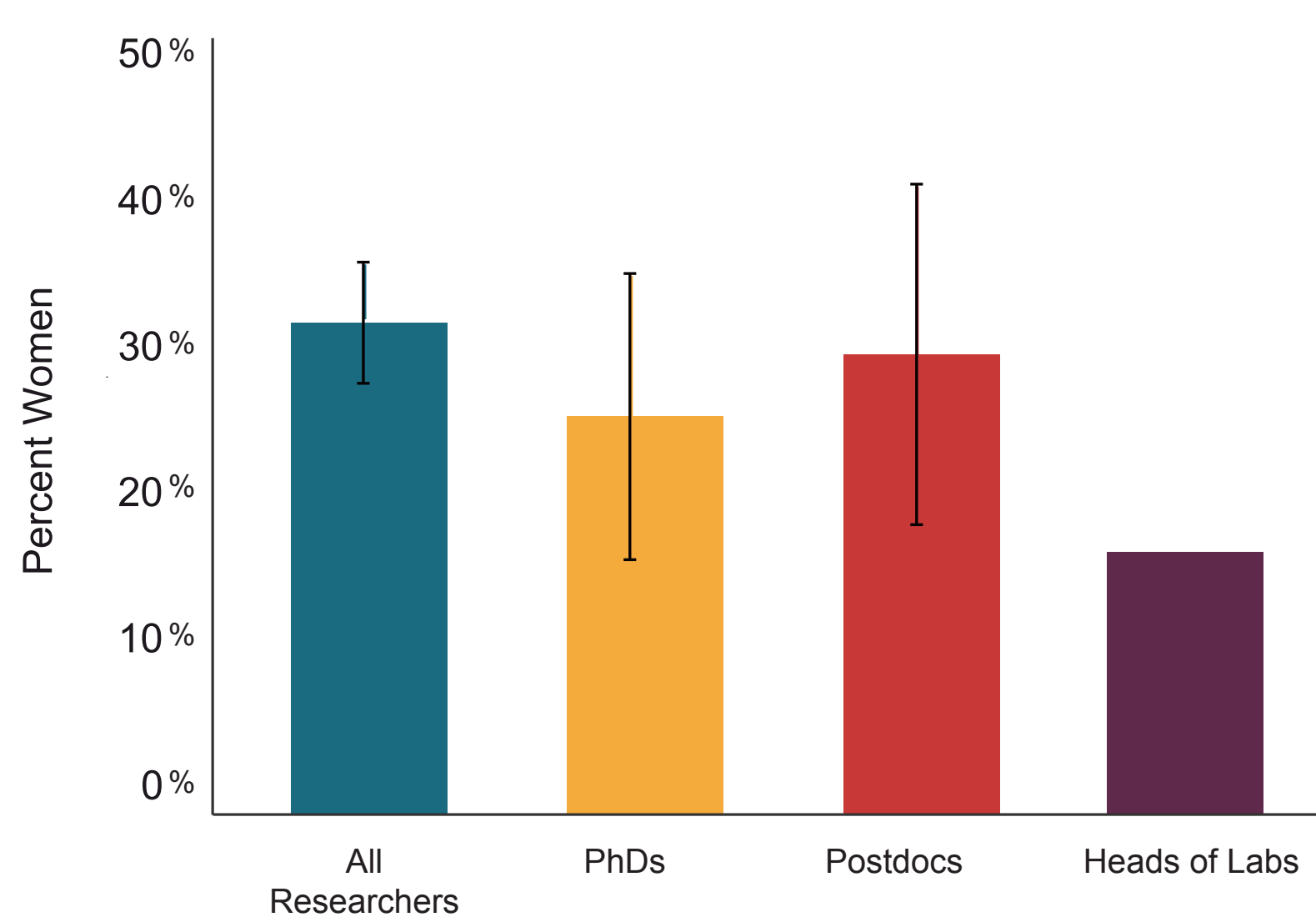


Figure 1 : Sex ratio in synthetic biology labs. The percentage of women by role in 50 synthetic biology labs. Error bars represent SD. The sex ratio of each lab is determined independently and then the mean of the labs was determined.

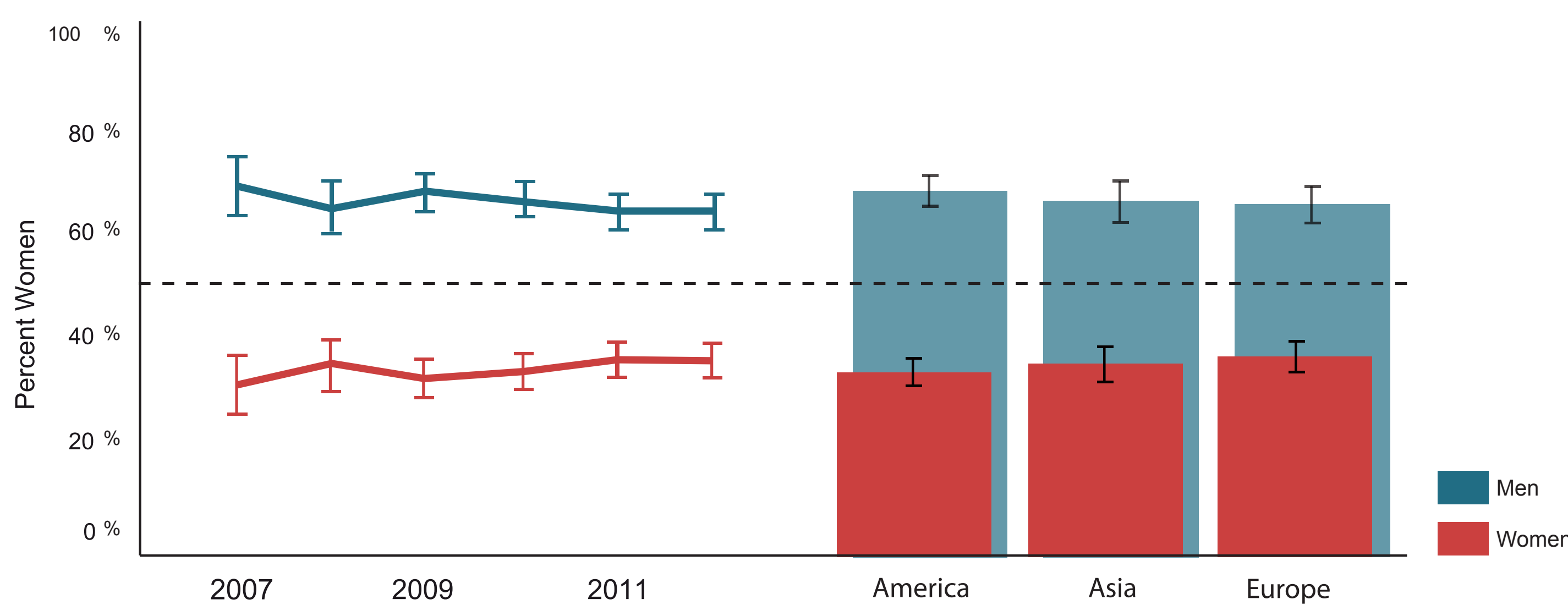


Figure 2 : Sex ratio of iGEM teams through the years and across continents. The proportion of team members of each gender over time and between regions in the collegiate iGEM competition. Bars represent the 95% Confidence interval.

## WOMEN DO NOT SUPERVISE AS MUCH AS MEN

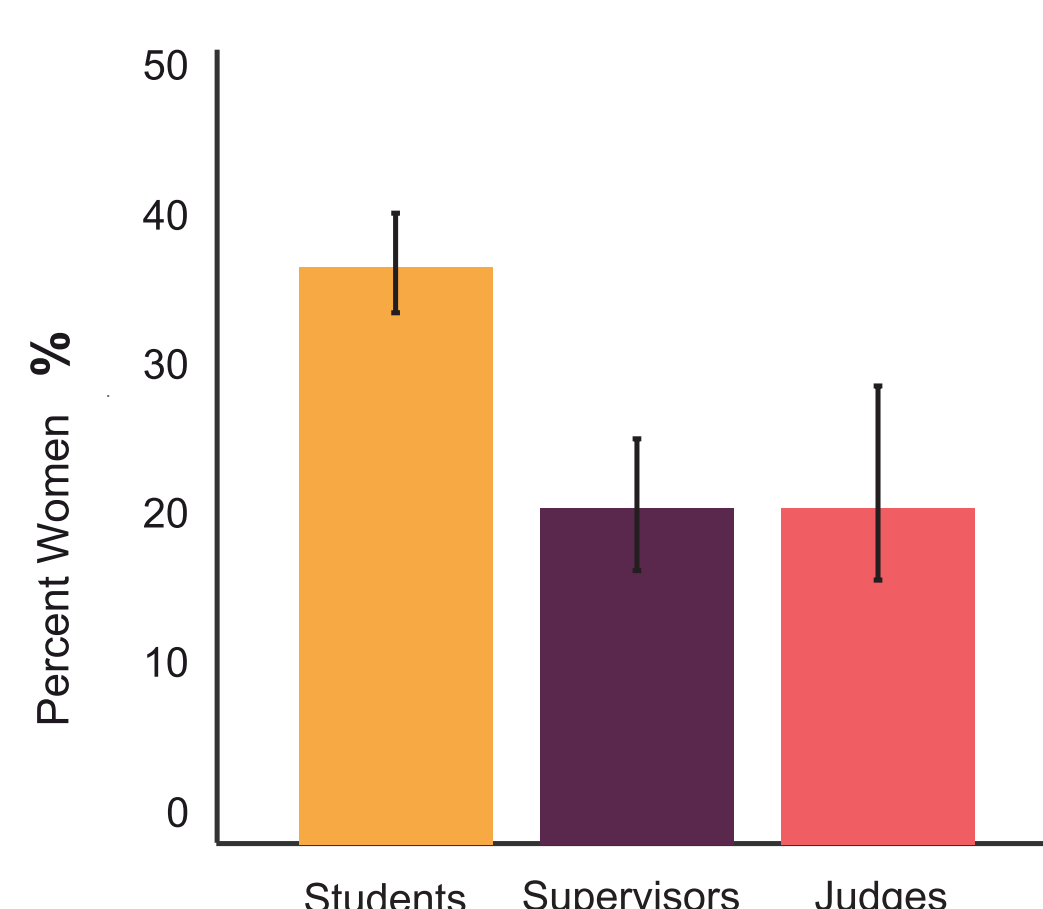


Figure 3 : Sex ratios in iGEM according to categories of people participating. The gender balance of students, Supervisors and Judges in iGEM collegiate competitions. Supervisors is taken as the combination of advisors and instructors due to variations on how individual teams differentiate between them. Bars are 95% confidence intervals.

From team members to instructors, the sex ratio is divided by two. When Comparing those numbers to sex ratios of PhD students and post docs in labs, those numbers are still 10 points lower. Women constitute a pool of talent that is not mobilized. They participate but do not supervise teams.

## MOTIVATIONS FOR PARTICIPATING IN iGEM

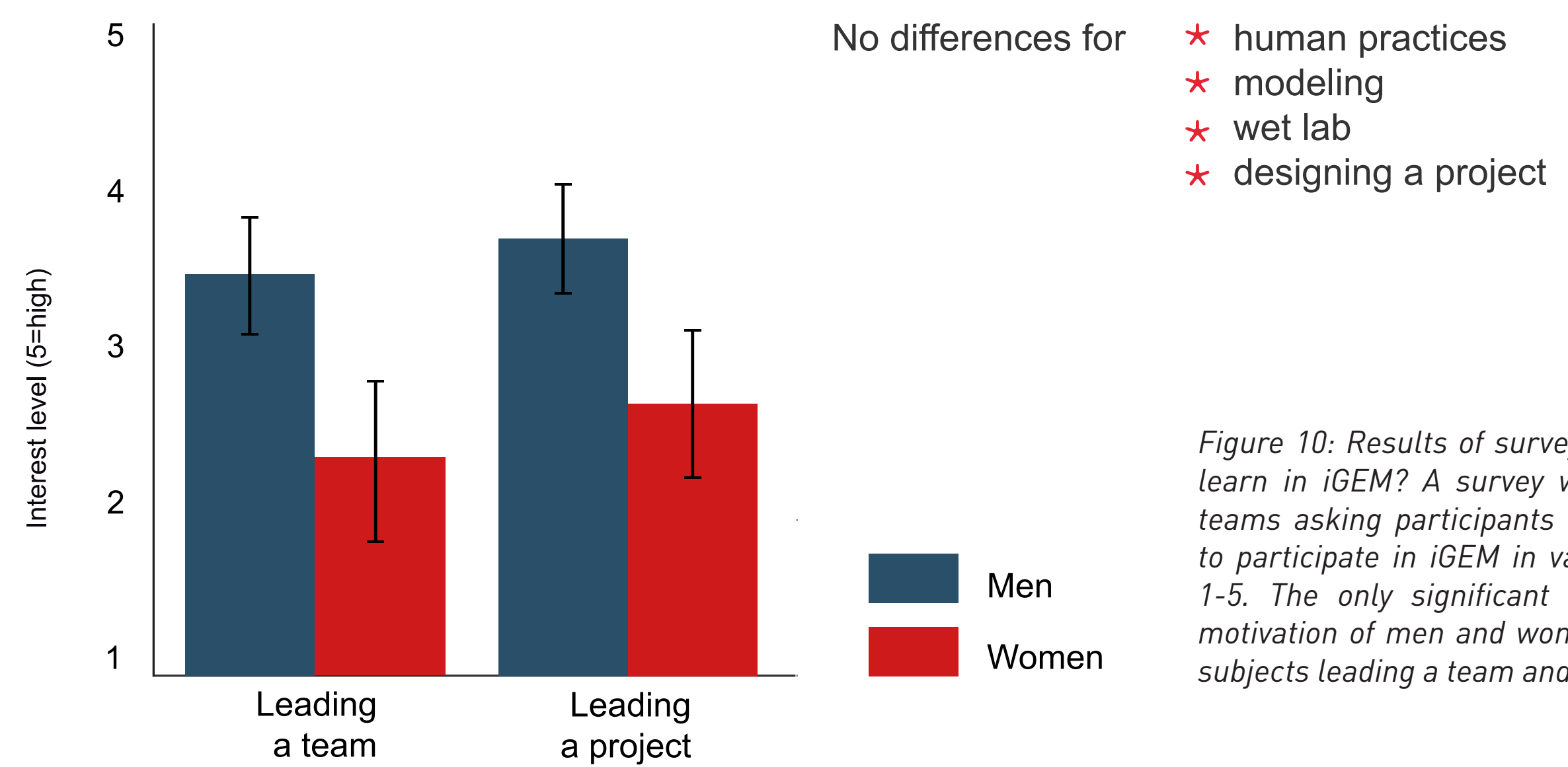


Figure 10: Results of survey : what did you hope to learn in iGEM? A survey was distributed to iGEM teams asking participants to rank their motivation to participate in iGEM in various subjects between 1-5. The only significant difference between the motivation of men and women in iGEM were in the subjects leading a team and leading a project.

Through the answers to a questionnaire, we showed that motivations for men and women to participate in iGEM are the same except for two things : leading a project and leading a team. Those results could be an explanation for the lack of women advisors in iGEM.

## GENDER BALANCE AND SUCCESS IN iGEM

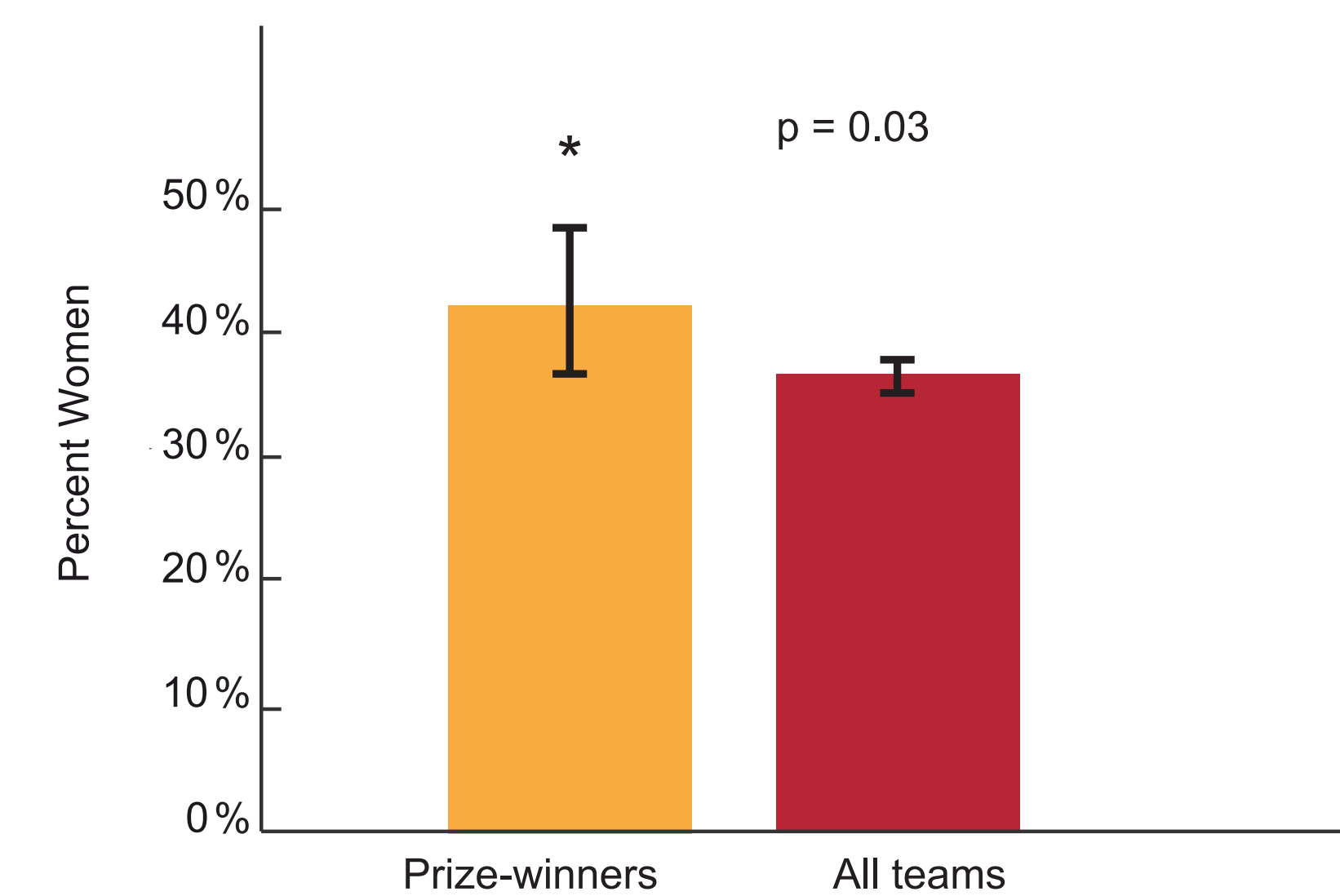
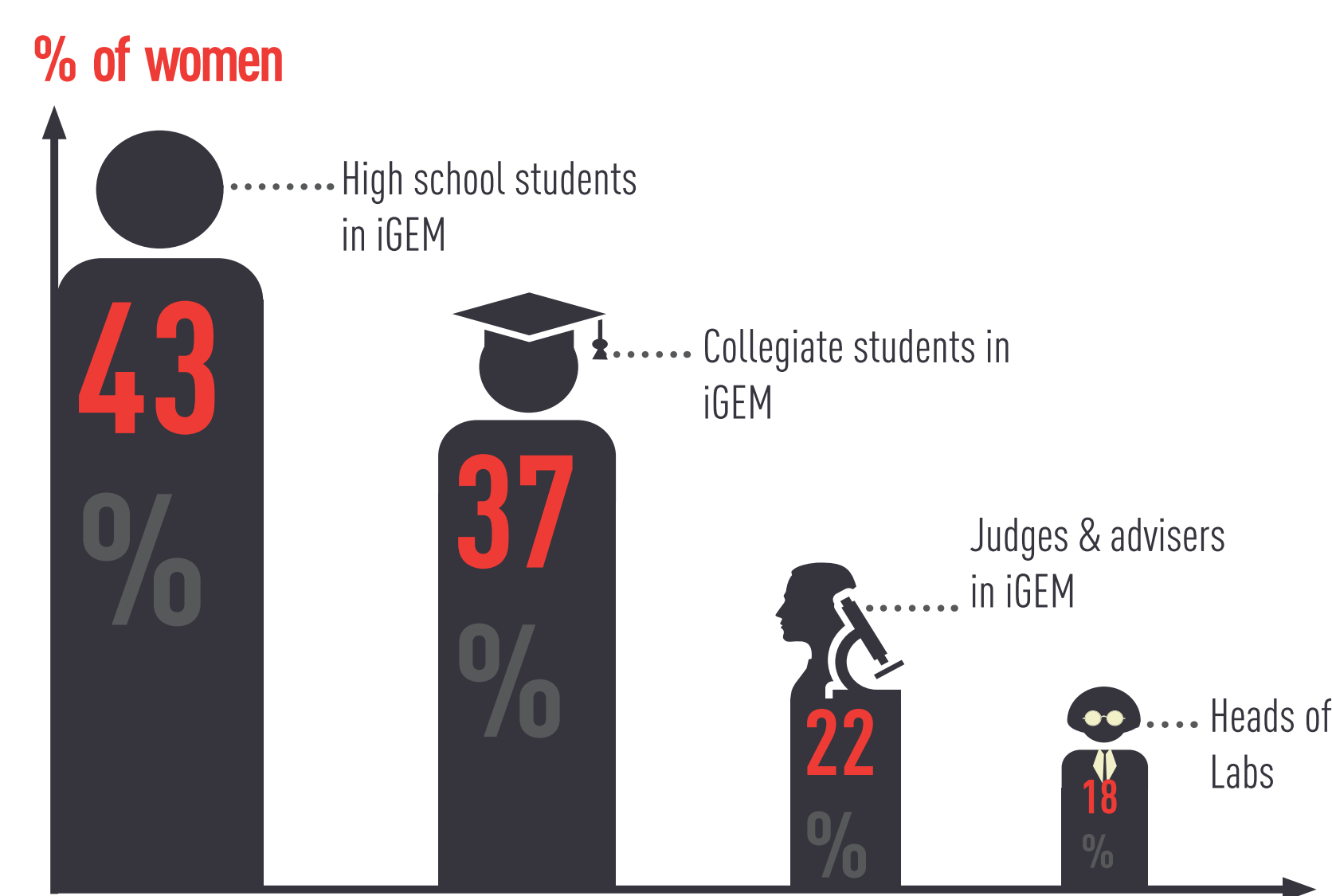


Figure 9: Gender balance and success in iGEM. The proportion of women in teams that have won prizes in iGEM compared to the proportion in teams over all. There is a significantly higher proportion of women in teams that win prizes (p=0.034).

In iGEM, prize winners teams are more gender balanced than participating teams.

## RESEARCH ACTION IN iGEM

Despite being a newly formed scientific discipline, we demonstrated that synthetic biology suffers from the historical underrepresentation of women in science. By raising awareness in the iGEM community and in cooperation with the iGEM organizers, iGEM is becoming a test case for the effect of active policy.



Considering all the results that were presented above, here is a list of recommendations that were made to the iGEM foundation to pursue an active policy to improve mixity in iGEM.

- \* RAISE THE NUMBER OF WOMEN JUDGES
- \* PROMOTE LARGE TEAMS
- \* WRITE UP A SMALL PARAGRAPH TO TEAM HEADS TO INSIST ON THE IMPORTANCE OF MOTIVATING YOUNG WOMEN TO BE ADVISERS.
- \* GIVING BONUS POINT WHEN THE TEAM HAVE WOMEN ADVISERS
- \* ADD IN iGEM REQUIREMENTS FOR GENDER REFLECTION.
- \* COMMUNICATE BETTER AND REACH OUT TO A NEW PUBLIC

The results of this study were publically presented to the community of study at two iGEM competitions in Europe and the United States but also in two international conferences in Heidelberg and Turkey. In cooperation with the iGEM foundation, a highlighted gender page was added to the competition's main website [add link]. Future iGEM teams are invited to engage and develop gender studies as part of their participation in the competition, fostering a community-based active gender policy.

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