# International online education: the S-Star trial bioinformatics course

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Six universities from five continents collaborated to provide the S-Star Trial Bioinformatics Online course (http://www.s-star.org/). The course is a global experiment in Bioinformatics Distance Education. The S* Life Science Informatics Alliance is the result of cooperation between Karolinska Institutet Sweden, the National University of Singapore, Stanford University USA, Uppsala University Sweden, The University of Sydney Australia, and the University of Western Cape South Africa. The S-Star group will be joined by the University of California San Diego, through the San Diego Supercomputer Center.

**Figure 1. The S-Star home page**

Teaching cooperation was initiated because there is an overall global demand for bioinformatics education. The S-Star alliance provides a global, unified bioinformatics learning environment made up of modular courses in the disciplines of genomics, bioinformatics, and medical informatics. The initial aims of the group are to collaboratively provide: (1) a globally accessible online course for training in bioinformatics and genomics; (2) accessibility to the highest possible quality of online courseware available in the world today; (3) high quality assessment, grading and courseware that has been approved by the educators from the host institutions; and (4) an integrated modular learning environment that allows a student to select from both pre-requisite modules and advanced modules in order to build a comprehensive program in genomics and bioinformatics.

The main mission of S-Star is to provide an introductory course in bioinformatics to anyone with Internet access. Classes are given in English, regardless of whether the classes are attended by individuals or in groups.

All lectures are free and constantly available. On entry to the S-Star main server (located at The University of Sydney) or any of the twelve international mirrors, students are presented with a choice of lectures. Each lecture is part of a coherent set intended to provide a broad background education in bioinformatics. On selecting a lecture, students are typically provided with a choice of bandwidth to match their connection mode. Lectures are generally delivered as streamed video recordings of real lectures that partly fill one side of a computer screen, while the other side of the screen shows synchronized slides. When a lecturer refers to the slide, it advances appropriately to maximize the educational experience. Minimal intervention is required by the student by using standard PC interface and software.

In addition to free round-the-clock lectures, S-Star provides occasional courses in which students enroll, learn, are assessed and receive participation certificates. The course is free to all online

registrants. During the course, participants access streaming video course lectures from the S-Star web site and the lecture notes. The management and delivery of the course was facilitated by using the National University of Singapore's Integrated Virtual Learning Environment (IVLE; http://ivle.nus.edu.sg/), which hosted discussion forums and multiple-choice question assessments.

The first trial course was offered by the S\* Life Science Informatics Alliance from October to November 2001. One hundred and fifty initial participants were enrolled from Asia, Australasia, Europe, North America and South Africa with diverse academic backgrounds. Ninety-six students followed the entire course and 70 participants fulfilled the overall course requirements. Problems of bandwidth and Internet connectivity were initially resolved with the set up of mirror sites in South Africa, Singapore and USA as well as regional helpdesks to address these issues. More mirror sites have since been set up in India, China and Malaysia. Those participants who had a low bandwidth problem viewing the lecture video files via real time streaming were able to download their lectures from the mirror sites.

Twelve lectures were provided to cover different basic and advanced topics within bioinformatics. The lectures consisted of streaming video and synchronized slides with follow-up discussion forums and a final assessment. Lectures were timetabled into fortnightly modules. Associated discussion forums and assessments were made accessible to the S-Star course participants following this lecture schedule. In association with each lecture, students participated in the associated discussion forum and assessments during the assigned period.

For the discussion forums, lecturers gave occasional guidance and responses to exceptional issues raised by students. These discussions allowed most participants to learn and clarify collegially, and participate in group and self-learning. Their active participation was considered to be of utmost importance to the effectiveness of the discussion and to their own comprehension and learning.

During each period of a discussion forum for a specific lecture, the relevant lecturer gave guidance and answers to issues raised by students. The discussion provided a sense of community between students and staff. The participants were able to learn from each other, clarify issues and be involved in group learning. The participants' active participation was considered of the utmost importance to the effectiveness of the discussion and to comprehension and learning[1,2].

At the end of the course, 70 participants had fulfilled the course requirements and were awarded a certificate of participation signed by all cooperating universities. Sixty-two students dropped out of the course: 36 did not participate in the first assessment, 18 indicated they did not have time to complete the course, and 8 said that they encountered technical difficulties (Internet access and bandwidth issues).

Feedback from the participants at the completion of the course showed that the course was rated as informative, interactive (because of discussion forums) and above all effective for distance learning. Overall, the participants felt that the course content was useful and well presented with good technical support. They also indicated that the strength of the course lay in the flexible

online accessibility (via audiovisual streaming) to the course content. The discussion forums received a broadly distributed rating from the participants and this is likely to reflect the preferred learning styles represented, as well as varying degrees of comfort and familiarity with the approach.

The lack of live two-way interaction in the course did not seem to limit the participants' ability to learn the course material as judged by our assessment results. We were reassured by the result that 69 out of 71 respondents said they would participate in future S-Star online courses. On the basis of received student feedback we have introduced further rounds of the S-Star Bioinformatics online course. The lecturing staff, their affiliate institutions and links are described in detail at http://www.s-star.org/[3].

## References

1. Hoadley, C. M. and Linn, M. C. (2000) Teaching science through online, peer discussions: SpeakEasy in the knowledge integration environment. *International Journal of Science Education*, **22**, 839-857.
2. Bock, G. E. (1997) The conferencing metaphor: Genres for sharing online information. *Journal of Science Education and Technology*, **6**, 323-327.
3. Lim, Y. P., H��g, J-O., Gardner, P., Ranganathan, S., Andersson, S., Subbiah, S., Tan, T. W., Hide, W. and Weiss, A. S. (2002) S-Star's trial bioinformatics course: An online learning success. *Biochemistry and Molecular Biology Education*, submitted.

## Acknowledgements

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