S* Alliance
Global Bioinformatics
Online Distance Education

Justin Choo*, Tan Tin Wee,
Shoba Ranganathan

* Presenter
Bioinformatics & Its Challenge

- Rapid growth & evolving field
- Few universities can offer the complete range of Bioinformatics courses
- Lack of trained bioinformaticians in the Asia-Pacific region
Founded in 2000, S* is a collaboration among 6 universities.
1 university joined.
Goals of S*

• Provide a GLObal Bioinformatics Unified Learning Environment (GLOBULE) made up of modular courses in the disciplines of bioinformatics, medical informatics and genomics

• Provide accessibility to the highest possible quality of online courseware approved by the educators from the host institutions.
Goals of S* (cont.)

- Develop an integrated modular learning environment, having a mix of basic and advanced topics
- Employ distance learning technologies over advanced networks
- Unified learning environment over the Internet freely accessible to everyone
History of S*

- 2000 – Sweden, Stanford and Singapore agreement in Singapore
  - Meeting in Sweden: all founders involved in 6 parties MoU

- 2001 – AGM in Copenhagen,
  - 1st S* Global Introductory Course

- 2002 – 2nd S* Global Introductory Course
  - BioEd Conference in Singapore
  - AGM in Singapore
  - MoU with Centre of Instructional Technology (CIT) to use IVLE system
History of S*

• 2003 – UCSD joins
  – 3rd Course (Feb. to May)
  – 4th Course (Aug. to Nov.)

• 2004 – Planned 5th Course
  – Planned Online Tutorials, Workshops
### Geographical Distribution

<table>
<thead>
<tr>
<th>Region</th>
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<th>3rd Course</th>
<th>4th Course</th>
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<td>151</td>
<td>285</td>
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**Legend:**
- 1st Course
- 2nd Course
- 3rd Course
- 4th Course
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</table>
S* Course: Occupation

Cumulative Percentage For All 4 Courses
Based on Feedback From Participants
Course Pedagogy

A. Lectures
B. Discussion
C. Assessment
D. Tutorial
E. Practical
F. Course Feedback
For details of the lecture topics, please see [http://www.s-star.org/lectures_offered.html](http://www.s-star.org/lectures_offered.html)
<table>
<thead>
<tr>
<th>Essential Curriculum</th>
<th>5-STAR</th>
<th>S* Course Curriculum</th>
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<tbody>
<tr>
<td>Molecular biology, cell biology, genetics</td>
<td>🌟🌟🌟🌟</td>
<td>Provide an introductory and overview of the subject</td>
</tr>
<tr>
<td>Core Bioinformatics (sequence alignment, protein modeling, threading, structure prediction)</td>
<td>🌟🌟🌟🌟</td>
<td>There are still topics which S* will be covering in future. Some will be taught through short tutorials.</td>
</tr>
<tr>
<td>Computer science (programming, data structures/algorithms, database, AI, optimization,DB)</td>
<td>🌟🌟🌟🌟</td>
<td>Incorporated as tutorial/practical sessions. (Perl, BioPerl)</td>
</tr>
<tr>
<td>Statistics (probability theory, experimental statistical design and analysis, stochastic process)</td>
<td>🌟🌟🌟🌟</td>
<td>Will be made available in coming course.</td>
</tr>
<tr>
<td>Ethics (effects of technology on society, privacy and security issues)</td>
<td>🌟🌟🌟🌟</td>
<td>This topic is often regarded informal. Currently, this is conducted among the participant in the discussion forum.</td>
</tr>
<tr>
<td>Practical / Hands-on / Mini Research Project</td>
<td>🌟🌟🌟🌟</td>
<td>In the process of implementing</td>
</tr>
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</table>
Delivery & Pedagogy - IVLE

Website: http://ivle.nus.edu.sg

- Via the Integrated Virtual Learning Environment developed (IVLE) @ NUS
Delivery & Pedagogy (cont.)

- Video/Audio Lecture Presentation using MS-Windows Media format. Exploring on other formats that can support multi-platform.

- Powerpoint Slides made available for reference and viewing

- IVLE web-based discussion forum
Delivery & Pedagogy (cont.)

- Email as the main communication tool

Diagram:
- Participants
- Course Coordinator
- Lecturers
- Teaching Assistants

Illustration:
- A person sending an email to various roles.
Sample Lecture
Sample Discussion Forum

BI5002
05. Representations and Algorithms for Computational Molecular Biology

Forum Headings
Current Archive Sorting Sort by Date

Re: Importance of RNA folding? olivio motta 24/03 03:04
Re: Importance of RNA folding? oludia olbanu 24/03
Re: Importance of RNA folding? alan wardroper 24/03
Re: Importance of RNA folding? russ altman 25/03 11
Re: Importance of RNA folding? natalya klyueva 26/00
Re: Importance of RNA folding? megha kadam 26/00
Pseudoknots krishnakumari 23/03 15:23
Fractal attractors? alan wardroper 23/03 12:26
Reverse engineering alan wardroper 23/03 2:27
Some questions on symbols alan wardroper 23/03 0:34
TRNA structure tutorials alan wardroper 22/03 22:29
What is position 0 in RNA? alan wardroper 22/03 21:12
RNA Folding Algorithm dattatraya bhat 22/03 10:21
Is mRNA a snapshot of protein? natalie plant 22/03 11:11
RNA - why not T? dattatraya bhat 22/03 1:22
Simple energies dennis pike see 21/03 16:57
Genetic network khashayar sonjar 20/03 16:05
Primer on computational molecular biology sdaramdare
How to treat discrete parameters in calculating distances
Gene Expression and Tissue mousheng xu 20/03 5:41
Symmetry of genetic code again natalya klyueva 20/03 5
Supporting slides dattatraya bhat 20/03 1:00
Attractors tsul hong teng steven 19/03 22:59
Pseudoknots nohemisa gviwa 19/03 22:25
Networking anjali beadmore 19/03 19:26
Compare DNA chips with PROTEIN chips gundu kameswar

Reply | Reply/Quote | Show All | Edit | Delete | Email to Poster

From: ASSOC PROF RUSS ALTMAN
Date: 25/03/2003 11:36:00 AM
Heading: 2003
Topic: Re: Importance of RNA folding?
I agree with the previous answers. RNA folding is actually arguably more important than protein folding prediction because

1. RNA has been harder to crystalize or study by NMR.
2. RNA secondary structure is much more predictable than protein secondary structure because of the nice Watson-Crick (and variant) rules.
3. If we can predict secondary structure and pseudoknots, we have a chance of putting together reasonable 3D models. One of the best examples is the Westhof model of the tetrahymena group (intron which many biologists use extensively to generate hypotheses about function).

Russ Altman
Sample Assessment Session

**Assessment Objective & General Instruction**

Important note: Before you start answering the MCQs, please note that you are expected to have accessed the lecture. Failure to do so is inadvisable and will be reflected in the standard of your answers in the MCQs and in the participation of the on-line forum. Please note that you can only access each assessment ONCE and only when you are READY to take it. On clicking the Begin button, you are to COMPLETE the assessment and submit your answers within the allowed timeframe.

Students who genuinely encountered problems when trying to submit their answers may appeal for a retake. If you are using Netscape 4.1, DO NOT resize the browser. Netscape browser will automatically refresh a page whenever you resize the window and as a result of refreshing, your answers will not be captured by the system. Internet Explorer does not have this problem.

**IVLE System Instruction**

Please read the following instructions carefully:

1. An assessment attempt is considered as "incomplete" if you do not click on Submit button. You are allowed to resume the latest incomplete attempt if there is still time left, i.e., if you begin your attempt at 09:00:00 hours (time limit: 5 mins) and resume it at 09:01:30 hours, then you have 3 mins and 30 seconds left to resume the "incomplete" attempt.
2. After you have clicked on the "Submit" button do not stop the downloading process. Your answers will be lost if you do.
3. Do not refresh/reload your browser as each refresh/reload will be a new attempt.

<table>
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<tr>
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<td>CHO O K HENG</td>
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<tr>
<td>Opening Date</td>
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<tr>
<td>Closing Date</td>
<td>29/03/2003 11:59 PM</td>
</tr>
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</table>

This Assessment is not published. Your students won't be able to see it on workspace or search it.

You have 1 incomplete assessment attempt(s). Click on the **Resume** button to resume the latest incomplete attempt.
# Tutorials

## A Tutorial on Bioinformatics

### Overview of Bioinformatics

A/P Shoba Ranganathan

<table>
<thead>
<tr>
<th>Description</th>
<th>Lecturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introductory Molecular Biology</td>
<td>Anthony Weiss (Australia)</td>
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</tbody>
</table>

### Part I: Introduction to Protein Structure

- by Kong LeSheng & Shoba Ranganathan
- email: [Email]

### Part II: Introduction to Protein Structure

- by Victor Tong Joo Chuan & Kong LeSheng
- email: [Email]

### Part III: Introduction to Protein Structure

- by Cao ZhiWei
- email: [Email]

### Finding Patterns

- by Barnett Lee Teck Kwong
- email: [Email]

### Pattern Database

- by Gopalan Vivek
- email: [Email]
Example Program 4.2.1: Copy and paste the code into a new file. Then type `./<filename>` to execute the program.

```perl
#!/usr/bin/perl
use strict;

# Initialize a scalar and then print the value
my $sequence = "ATGCGAGATGCC";
print $sequence;

# Initialize an array of strings and then print the 1st value
my @taxonomy = ("archaea", "eubacteria", "eukarya");
print @taxonomy[0], "\n";

# Initialize a hash with key/value pairs and then print values
my %dna_sequences = {
  "AY258503" => "E.coli hemolysin plasmid p0113",
  "AY131333" => "E.coli 16S ribosomal RNA gene",
  "AY319289" => "E.coli strain K12 transposon Tn10.10"
};
print %dna_sequences("AY258503"), "\n";
```

4.3 Comparison Operator

<table>
<thead>
<tr>
<th>Operator</th>
<th>String</th>
<th>Numeric</th>
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<tr>
<td>Equal</td>
<td>==</td>
<td>==</td>
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<tr>
<td>Less than</td>
<td>&lt;</td>
<td>&lt;</td>
</tr>
<tr>
<td>Greater than</td>
<td>&gt;</td>
<td>&gt;</td>
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</tbody>
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Problems Encountered

- Bandwidth problem
  - Slow connection

- Delivery format (video/audio)
  - Made different quality video/audio encoding files
  - Participant using different platforms
Solution

- Overcoming the bandwidth problem
  - network of mirror sites
  - MoU tie up with APBioNet (Asia-Pacific Bioinformatics Network)

- Pressing of CDs (to countries like Africa, rural areas of India)
Mirroring lessons for Asia Pacific students using APAN (Asia-Pacific Advanced Network) network infrastructure coordinated by APBionet.
Strength Of The Course

• Online content allow anytime-anywhere access
• Presented by world renowned experts from different institutions
• Made available to a broad audience
• Well-organised
• User friendly system
Advantages

• Member organizations do not need to wait until experts in all domains of bioinformatics are hired (if at all possible)
• Re-usable courseware
• Easily updated content
• Uniformity of curriculum and evaluation
• Globally accessible education
Feedback

• To think that a world-class, web based education with such valued lectures is brought to your desk free of cost is impossible elsewhere. The course was wonderfully well managed. Our requests and problems were quickly and well attended to. I had a great time doing this course and thank the S*STAR team whole heartedly for making me a fortunate participant with this fantastic experience.
  ~ Naidu Ratnala Thulaja, Singapore

• I think it is a very useful course, it is exactly what it says it is: an introduction to bioinformatics. It covers nicely major topics and provides enough information in order for us to understand what bioinformatics is all about. I enjoyed it very much and I am even a bit sad it is over. Thank you very much! ~ Patricia Severino, Romania
Feedback (cont.)

• Pretty good. A few rough edges but I'm sure you'll work them out over time. I really enjoyed it. Most of the lectures were very well presented and the participants in the forums helpful. I'm very impressed at the amount of work that has obviously gone into setting up the course. ~ Alan Wardroper, Thailand

• The relevance of the field of bioinformatics in meeting the biomedical needs of today. The level of communication provided by the IVLE system enhanced learning considerably. The range of professional and academic background of students. The technical support provided by SStar was rapid and efficient to queries. ~ C.A.O. Idowu, England
Exploring ...

new ways, new ideas, new activities
Problem-Based Learning (PBL)

- Started at McMaster University Medical School over 25 years ago

- Encourages hand-on and critical thinking. Its hands-on approach is particularly suited for bioinformatics where many of the skills require practical execution and the problems encountered are generally open-ended.

- PBL encourages:
  - acquisition of critical knowledge.
  - problem-solving proficiency; problems tackled are generally open-ended.
  - self-motivated learning.
  - team participation.
Role Change

• In PBL, there’s a fundamental change in the role played by the participants.
  ● a facilitator guides the entire session.
  ● a scribe records the entire session.
  ● some participants field questions; others try to brainstorm and provide answers. There will not be student-teacher relationship, everybody is treated equally.
  Focus is on peer learning.
PBL Session

• S* is experimenting PBL session using web-based collaboration platform – TWiKi (http://twiki.org)
• Conduct project-based practicals

• Consideration/Issues to resolve :
  ● How to accommodate so many participants
  ● How to host so many TWiKi page
  ● Will participants with slow connection able to access?
Online Delivery Mechanism

- Explore various advanced networking technologies particularly on video conferencing software, interactive or multimedia-rich learning
- e.g. AccessGrid™
  
  http://www.accessgrid.org/

... a grid community.
Immersive Learning

- Enable group-to-group interactions across the Grid.

- Activities such as large-scale distributed meetings, collaborative work sessions, seminars, lectures, tutorials, and training are made possible.

Fig 1: Controlling Audio/Visual Quality

Fig 2: Group-to-Group Live Interaction
Benefits

- Reduce the costs and time of traveling.
- Enable live lecture presentation by the prominent lecturers.
- Allow bi-direction interactive discussion forum
- Conduct virtual seminars and workshops
- Empower group-to-group collaboration work.
Issues & Consideration

- Infrastructure (high speed network, connection/bandwidth)
- Cost of setting up
- Location of set-up
- Manpower required
- Technical competency
Delivery Format

• Participants using various operating systems (e.g. Windows, Linux/Unix, Mac OS)
• Need to support multi-platforms
• Speed up and simplify authoring, management, delivery and tracking of presentation.
• Macromedia Breeze
  http://www.macromedia.com/software/breeze
**Contact Information**

**S* Web Site:**
http://www.s-star.org

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Fax: +65-778-2466

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  - tinwee@bic.nus.edu.sg

- A/P Shoba Ranganathan
  - Chairman
  - shoba@bic.nus.edu.sg
End Of Presentation

Thank you