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Information resources for the bioinformatician

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Abstract

The collaborative computing project in biosequence and structure analysis (CCP11) was established to foster bioinformatics in the broad community and the UK research community in particular. A World-Wide Web site called 'The Bioinformatics Resource' has been created containing a comprehensive set of information resources of use to the bioinformatician. The activities of CCP11 are complementary to other providers of molecular biology information such as the BIOSCI electronic communication forum, which was established to facilitate communication between professionals in the biological sciences.

INTRODUCTION

The CCP11 project was established to foster bioinformatics in the broad community and the UK research community in particular. Its purpose is to facilitate the transfer of knowledge and expertise through conferences, workshops, a newsletter and the use of the World-Wide Web. CCP11 is funded by the Biotechnology and Biological Sciences Research Council (BBSRC) and is hosted at the Medical Research Council (MRC) Human Genome Mapping Project Resource Centre located on the Genome Campus, Cambridge. In this paper we describe the contents of the web site, summarise the other activities of CCP11 and provide an overview of BIOSCI.

SUMMARY OF CCP11 ACTIVITIES

CCP11 conferences are intended to inform of the latest developments in bioinformatics and their application to solving biological problems. The highest profile event is the biennial 'Genes, Proteins and Computers' conference for functional genomics and proteomics, structural genomics, biosequence analysis and phylogeny. Other more specialised conferences, eg 'Bioinformatics Open Software Development', are also organised.

CCP11 workshops provide hands-on experience of using molecular biology software; they introduce primary and secondary databases and the latest software tools available for access and analysis. The newsletter includes research and technical articles contributed by workers in the field and is distributed world-wide approximately every quarter. As well as informing of CCP11 activities, it provides a platform for getting publicity for research before going to press. The final activity is the maintenance and development of a World-Wide Web site called 'The Bioinformatics Resource' (TBR),¹ containing information resources of use to the bioinformatician. Importantly, TBR is maintained on a full-time basis and therefore should be comprehensive and up to date. Details for forthcoming meetings and newsletter subscription are available via the web site.

THE BIOINFORMATICS RESOURCE

TBR consists of on-line editions of the newsletter, advertisements for training courses and conferences, and a comprehensive set of information resources. The resources include calendars of conferences and workshops and listings of WWW-based and

graduate-level courses run in the UK. Links to study aids, including on-line tutorials, lecture notes and various glossaries of biocomputing terms, are provided as a guide for the undergraduate. Details of PhD programmes and other schemes to support research will help those beginning a research career in bioinformatics. Job lists, with separate resources for postdoctoral, lectureship and industrial vacancies, are also available. In a directory of bioinformatics research groups there are contact details, links and descriptions of research interests. Similar sections are available for world-wide institutes and companies involved in research or service provision.

Bioinformatics programs are organised by category of analysis and all the major programming libraries and software suites are listed, along with primary data sources and integrated databases. Finally, a moderated archive of news articles is provided, excerpts of which are distributed approximately every fortnight to subscribers of this service.

The resources in TBR are summarised in Table 1. Data for each resource are organised into a number of different records and are presented as indexed lists (Figure 1). The resources have a consistent look and feel and online forms are provided for submission of entries from the community.

Table 1: Summary of information resources in TBR

Resource	Description
News section	
CCPII news service	A moderated archive of date-stamped news articles. Excerpts of the news articles are distributed approximately every fortnight to subscribers of the service.
Sources of funding	Sources of funding for bioinformatics research in the UK. All of the schemes run by the British research councils are included.
Webzines and news	Descriptions and links of on-line magazines, meeting places and news services for the molecular biologist on the Internet.
Events section	
Conferences	Conferences in bioinformatics, genomics and biotechnology. Events in specialised fields such as artificial intelligence are included if they have a biological emphasis. Updated at least once a month.
Training courses	Training courses, workshops and seminars for bioinformatics, biosequence and structure analysis, databases, use of software packages and so on. Updated at least monthly.
More events	Links to other list sites and organisers of conferences and training courses in the field.
Study section	
Internet courses	A description and links of WWW-based courses in fields such as bioinformatics, protein structure and drug design. Some of the listed courses are certificated.
Tutorials	A comprehensive listing of online tutorials and lecture notes in bioinformatics and related disciplines.
Journals	A description of all the major journals of interest to the bioinformatician. Links to the journal home-page and instructions for authors are provided.
Books	The title, author, publisher and ISBN of books with a relation to bioinformatics. A majority of the books in the field are listed.
Glossary	Links to various glossaries of biocomputing and molecular biology terms. Includes a description of each resource.
Careers section	
Masters degrees	A listing of graduate-level courses (MSc, MRES, etc.) in bioinformatics and related disciplines run by UK academic institutions.

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PhDs	A listing of PhD programmes and individual PhDs to support research in bioinformatics and related fields. Vacancies should be current and will be held in institutions from around the world.
Postdocs	Vacancies in bioinformatics for research assistants and research fellows to be held at institutes from around the world.
Lectureships	Lectureships, readerships and chairs in bioinformatics and related disciplines. Another world-wide resource.
UK & Europe jobs	Permanent and short-term vacancies in bioinformatics, pharmaceutical and biotechnology companies based in the UK and mainland Europe.
World jobs	A selection of bioinformatics jobs from the rest of the world.
More UK & Europe jobs	Links to other WWW-based resources for employment in the UK and mainland Europe.
More world jobs	Links to other WWW-based resources for employment in the rest of the world.
Sites & servers section	
Major centres	Descriptions and links to the major centres of bioinformatics research and services around the world. Provides a good starting point for the novice bioinformatician.
Servers	Links to other useful servers of bioinformatics software and data.
Link sites	Descriptions and links to sites providing lists of links useful to the bioinformatician.
Institutions section	
Research groups	Contact details, WWW links and descriptions of research interests for the majority of UK research groups with an interest in bioinformatics. Some non-UK groups are included.
Societies	Details for all of the major societies which relate to bioinformatics.
UK & Europe institutes	Details for UK and European institutes involved in research or service provision in bioinformatics and related fields. All of the EMBnet nodes and the majority of genome centres are included. Details for a contact person for bioinformatics are given in most cases.
World institutes	A listing of some bioinformatics institutes and genome centres from the rest of the world.
UK & Europe companies	UK and other European companies with an interest in bioinformatics. Details for a contact person for bioinformatics are given in some cases.
World companies	A listing of bioinformatics companies from the rest of the world.
Software section	
Programs	Listings of bioinformatics programs organised by category of analysis. A description of the software and appropriate links and contact details are given.
Programming libraries	Details of all the major programming libraries and software suites for use in bioinformatics. Most of the listed packages are 'source code available'.
Commercial software	A listing of commercial bioinformatics software packages.
Programming links	A collection of useful links for C/C++, Java, Corba and Perl.
Data section	
Databases	Descriptions and links for the primary data sources of protein and nucleic acid sequence and structure.
Integrated data resources	Descriptions and links for integrated databases and other data collections.

Information resources are organised into eight different sections and are available at the TBR web site.¹

Bioinformatics Programming Libraries

Please contribute by filling in this [form](#) with details of any bioinformatics programming libraries that are not listed here.

European Molecular Biology Open Software Suite (EMBOSS)
The Bioinformatics Template Library (BTL)

. < data omitted for clarity >

Project: *European Molecular Biology Open Software Suite (EMBOSS)*
WWW: <http://sanda.cryst.bbk.ac.uk/~classlib/bioinf/BTL.html>
Institute: Department of Crystallography, Birkbeck College, Malet Street, London WC1E 7HX
Contact: David Moss
Email: d.moss@bbk.ac.uk
Tel: +44-20-71631-6802
Fax: +44-20-71631-6803
Description: EMBOSS is a collaboration of European biological software developers which aims to integrate a range of currently available packages and tools for sequence analysis into a general, publicly available, suite of programs and libraries.

Project: *The Bioinformatics Template Library (BTL)*
WWW: <http://www.sanger.ac.uk/Software/EMBOSS/>
Institute: HGMP-RC / Sanger Centre, Wellcome Trust Genome Campus, Hinxton, Cambridge, CB10 1SA, UK

Contact: Peter Rice, Alan Bleasby
Email: pmr@sanger.ac.uk
Tel: +44 1223 494967
Fax: +44 1223 494919
Description: A novel application of generic programming techniques in the form of a C++ component library called the Bioinformatics Template Library or BTL. This library facilitates the development of programs by providing algorithms and data-structures for use in bioinformatics and molecular modelling.

. < data omitted for clarity >

Figure 1: Example of an information resource. An excerpt from the programming libraries resource is shown. The data are organised into eight different records. An index at the top of the page provides a summary and hypertext link for each entry in the resource; data for two libraries only are shown. The link given at the word 'form' at the top of the figure is to an online form for data submission

BIOSCI

BIOSCI is a set of freely accessible electronic communication forums intended to promote communication between professionals in the biological sciences. BIOSCI consists of electronic bulletin boards or 'newsgroups' and parallel e-mail lists, and is probably the largest collective for scientific discussion available on the Internet (Table 2). A disadvantage of the published literature is that only the successes of scientific endeavour are recorded. BIOSCI enables collective and ongoing discussion and so helps scientists to overcome technical

difficulties quickly and avoid the costly 'reinventing of the wheel' that so often occurs. BIOSCI is therefore a facility for accelerating the pace and productivity of research.

The BIOSCI web site² has facilities for participating in the discussion, posting new articles and browsing archives of the articles. Articles submitted to BIOSCI are propagated around the world alongside all of the other Usenet News groups, and so should be available at the news server provided by your ISP. Any problems or queries about BIOSCI should be sent by e-mail to biosci@net.bio.net.

Table 2: BIOSCI newsgroup archives

Archive	Description
7tms_r/bionet.molbio.proteins.7tms_r	Research on G-protein coupled receptor systems
Acedb/bionet.software.acedb	Discussions by users of genome DBs using ACEDB
afcr/bionet.prof-society.afcr	American Federation for Clinical Research
ageing/bionet.molbio.ageing	Discussions of cellular and organismal ageing
agroforestry/bionet.agroforestry	Discussion of agroforestry
aibslst/bionet.prof-society.aibs	American Institute of Biological Sciences
amyloid/bionet.neuroscience.amyloid	Research on Alzheimer's disease and related disorders
annelida/prototype	Prototype newsgroup
arab-gen/bionet.genome.arabidopsis	Information about the <i>Arabidopsis</i> project
audiolog/bionet.audiology	Research on audiology and hearing science
autoseq/bionet.genome.autosequencing	Research & support on automated DNA sequencing
bigblue/prototype	Prototype newsgroup
bio-info/bionet.info-theory	Discussions about biological information theory
bio-software/bionet.software	Information about software for biology
bio-srs/bionet.software.srs	Sequence retrieval system (SRS) software
bio-www/bionet.software.www	Information about WWW sources of interest to biologists
biocan/bionet.prof-society.cfbs	Canadian Federation of Biological Societies
biochrom/bionet.genome.chromosomes	Mapping and sequencing of eukaryote chromosomes
biofilms/bionet.microbiology.biofilms	Research on microbial biofilms
bioforum/bionet.general	General BIOSCI discussion
bioherv/prototype	Prototype newsgroup
biojobs/bionet.jobs.offered	Job openings in the biological sciences
biomatrix/bionet.molbio.bio-matrix	Computer applications to biological databases
bionauts/bionet.users.addresses	Who's who in biology
bionews/bionet.announce	Announcements of widespread interest to biologists
biophys/bionet.biophysics	The science and profession of biophysics
bphysoc/bionet.prof-society.biophysics	Biophysical Society official announcements
btechniq/bionet.journals.letters.biotechniques	Discussion of the journal <i>Biotechniques</i>
btk-mca/bionet.metabolic-reg	Kinetics and thermodynamics at the cellular level
cardiors/bionet.biology.cardiovascular	Scientists engaged in cardiovascular research
celegans/bionet.celegans	Research discussions on <i>Caenorhabditis elegans</i> and related nematodes
cellbiol/bionet.cellbiol	Discussions about cell biology
chlamy/bionet.chlamydomonas	Research on <i>Chlamydomonas</i> and other green algae
comp-bio/bionet.biology.computational	Computer and mathematical applications
csm/bionet.prof-society.csm	Canadian Society of Microbiologists
cytonet/bionet.cellbiol.cytonet	The cytoskeleton plasma membrane and cell wall
deepsea/bionet.biology.deepsea	Deep-sea marine biology oceanography and geology
diagnost/bionet.diagnostics	Problems and techniques in all fields of diagnostics
dros/bionet.drosophila	Discussions about the biology of fruit flies
ecophys/bionet.ecology.physiology	Research & education in physiological ecology

embl-db/bionet.molbio.embl databank	Info about the EMBL nucleic acid database
emf-bio/bionet.emf-bio	Interactions of EM fields with biological systems
fluorpro/bionet.molbio.proteins.fluorescent	Fluorescent proteins & bioluminescence
freerad/bionet.molecules.free-radicals	Research on free radicals in biology & medicine
gdb/bionet.molbio.gdb	Messages to and from the GDB database staff
gen-link/bionet.molbio.gene-linkage	Discussions about genetic linkage analysis
genbank/bionet.molbio.genbank	Hot off the presses!
genstruc/bionet.genome.gene-structure	Genome and chromatin structure and function
glycosci/bionet.glycosci	Carbohydrate and glycoconjugate molecules
gnomepr/bionet.molbio.genome-program	The international Human Genome Project
grasses/bionet.biology.grasses	The biology of grasses
hiv-molbiol/bionet.molbio.hiv	Discussions about the molecular biology of HIV
immuno/bionet.immunology	Discussions about research in immunology
info-gcg/bionet.software.gcg	Discussions about using the ACEDB software
insulin/bionet.cellbiol.insulin	Biology and chemistry of insulin and related receptors
jrnlnote/bionet.journals.note	Advice on dealing with journals in biology
maize/bionet.maize	Research on maize
methods/bionet.molbio.methods-reagents	Requests for information and lab reagents
microbio/bionet.microbiology	The science and profession of microbiology
mol-evol/bionet.molbio.evolution	Discussions about research in molecular evolution
molluscs/bionet.molbio.molluscs	Discussions about research on mollusc DNA
molmodel/bionet.molec-model	The physical & chemical aspects of molecular modelling
molreps/bionet.molecules.repertoires	Generation and use of libraries of molecules
mutation/prototype	Prototype newsgroup
mycology/bionet.mycology	Research with fungal life
n2fix/bionet.biology.n2-fixation	Research issues on biological nitrogen fixation
navbo/bionet.prof-society.navbo	North American Vascular Biology Organization
neur-sci/bionet.neuroscience	Research issues in the neurosciences
p450/bionet.molecules.p450	Research on cytochrome P450
parasite/bionet.parasitology	Research discussions in parasitology
peptides/bionet.molecules.peptides	Research involving peptides
phbiotec/prototype	Prototype newsgroup
photosyn/bionet.photosynthesis	Discussions about research on photosynthesis
plant-ed/bionet.plants.education	Education issues in plant biology
plantbio/bionet.plants	Discussion about all aspects of plant biology
plsignal/bionet.plants.signaltransduc	Research on plant signal transduction
pop-bio/bionet.population-bio	Technical discussions about population biology
prenatal/bionet.diagnostics.prenatal	Research in prenatal diagnostics
proteins/bionet.molbio.proteins	Research on proteins and protein databases
protista/bionet.protista	Discussion on protists (protozoa; algae; zoosporic fungi)
pseudomo/bionet.organisms.pseudomonas	Research on the genus <i>Pseudomonas</i>
radoncj/prototype	Prototype newsgroup
rapd/bionet.molbio.rapd	Research on randomly amplified polymorphic DNA
recom/bionet.molbio.recombination	Research on the recombination of DNA or RNA

rna/prototype	Prototype newsgroup
rust-mil/prototype	Prototype newsgroup
schisto/bionet.organisms.schistosoma	Discussions about <i>Schistosoma</i> research
sci-res/bionet.sci-resources	Information about funding agencies, etc.
staden/bionet.software.staden	Using the Staden molecular sequence analysis software
str-nmr/bionet.structural-nmr	Exploring the structure of macromolecules using NMR
symbios/bionet.biology.symbiosis	Research in symbiosis
tibs/bionet.journals.letters.tibs	Letters to Editor of <i>Trends in Biochemical Science</i>
toxicol/bionet.toxicology	Research in toxicology
trop-bio/bionet.biology.tropical	Discussions about tropical biology
urodeles/bionet.organisms.urodeles	Research scientists using urodele amphibians
vect-bio/bionet.biology.vectors	Research & control of arthropods which transmit disease
virology/bionet.virology	Research into virology
wantjob/bionet.jobs.wanted	Requests for employment in the biological sciences
womenbio/bionet.women-in-bio	Discussion of issues related to women in biology
x-plor/bionet.software.x-plor	X-PLOR for 3D macromolecular structure determination
xtal-log/bionet.xtallography	Discussions about protein crystallography
yeast/bionet.molbio.yeast	Molecular biology and genetics of yeast
zbrafish/bionet.organisms.zebrafish	Discussion group for zebrafish (<i>Danio rerio</i>) researchers

A summary of the BIOSCI newsgroup archives accessible at the URL.³

CONCLUSIONS

After many years of successful running at Stanford University, BIOSCI has run from the HGMP-RC since December 1999. There is clearly scope for further development of TBR and integration with BIOSCI. Future enhancements will include calendars of events and catalogues of software directly derived from the BIOSCI newsgroups, and an improved interface to the resources including full search and query facilities. Further resources for software developers, including catalogues of

molecular biology tools and source code will also be added.

Acknowledgement

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References

1. Bioinformatics Resource is at the URL <http://www.hgmp.mrc.ac.uk/CCP11/>
2. BIOSCI is available at biosci@net.bio.net; URL <http://www.bio.net>
3. <http://www.bio.net/archives.html>