

BioSync Survey of Structural Biologists – 2001

14 December 2001

This survey was performed by BioSync during July-November 2001. The survey was designed by the BioSync Executive Committee. The questions were available throughout this period on a web site administered by the San Diego Supercomputer Center. The original survey can be found at http://biosync.sdsc.edu/survey_2001.html. Programming and clerical support were provided by Anne Kuller of SDSC and Denise Kranz of BNL. Administrative organization was by Robert Sweet of BNL. There were 235 valid responses. This is a summary of the numerical results. The raw results are available electronic form in two different formats.

Demographic Information:

Years as an independent investigator	Count
1	14
2	16
3	20
4	16
5	18
6	15
7	10
8	12
9	10
10	10
11-15	24
16-20	24
21-25	12
26-30	14
31-35	12
36-40	3

Research Environment	Count
University	174
Other	22
Gov't Lab	21
Industry	17

Source of Research Support	Count
NIH	158
Foundation	71
Other*	59
Industry	44
NSF	43
DOE	24

*Other source of research support located at end of report

Other Research Environment	Count
Nonprofit Research Institute	11
Research Institute	7
Hospital	2
Private Foundation	1
Undergraduate School	1

Annual Support	Count
0	2
1K to 50K	21
50K to 150K	53
150K to 250K	58
250 to 750K	75
750K or more	24

Region of residence	Count
NE	74
Midwest	53
W	41
SE	21
Canada	13
NW	13
SW	11
Mexico	1

Group Size	Postdocs, RA's	Grad. Students	Support Personnel	Group Size in Five Years
0	14	34	16	
1	48	30	79	4
2	30	39	53	6
3	21	26	23	7
4	15	27	13	6
5	9	21	5	23
6	6	4	1	26
7	4	8	1	10
8	6	4	2	32
9	5		1	3
10	1	1	1	44
11-15	5	3		45
16-20	1			11
>20				10

Number of Collaborations with non-crystallographers	1999	2000	2001	Requests not met in 2001
0	19	12	13	71
1	44	38	38	29
2	36	46	42	29
3	22	29	27	19
4	13	16	22	7
5	16	19	19	11
6 to 9	4	5	8	6
10 to 30	4	4	4	2
50			1	

Use of Synchrotron Radiation:

Summary of regional use for one recent year.

Days of beam use	SSRL2001	Chess2001	NSLS2000	ALS2001	APS2001	Row sums
Canada	3	6	31	0	26	66
Mexico	3	0	0	0	0	3
Midwest	79	0	67	4	366	516
Northeast	39	80	672	5	160	956
Northwest	13	0	124	24	4	165
Southeast	44	2	48	0	33	127
Southwest	34	0	16	1	8	59
West	284	13	32	282	14	625
Totals	499	101	990	316	611	2517

For each synchrotron, frequency of response for number of days per year.

SSRL	1999	2000	2001
0	6	7	8
1	2	1	1
2	5	5	7
3	7	4	10
4	6	6	6
5	7	7	5
6	4	4	2
7		3	1
8	3	5	5
9	1	1	
10	7	7	3
11-18	6	4	4
20-29	4	6	7
30-42	5	5	3

CHES	'99	'00	'01
0	4	4	5
1		2	2
2	5	6	5
3	5	2	1
4	3	6	2
5	3	3	3
6	3	2	3
8	1	2	1
9	1	1	
10-25	3	3	3

ALS	'99	'00	'01
0	6	5	5
1	2	7	4
2	9	8	4
3-8	5	11	12
10 - 15	2	5	4
40			1
140			1

NSLS	'99	'00	'01*
0	3	5	
1	3	4	
2	8	15	
3	14	14	
4	19	16	
5	17	8	
6	9	11	
7	4	4	
8	5	10	
9	1	3	
10	6	8	
12	3	3	
14		1	
15	4	6	
16		1	
20	3	2	
25		1	
72		1	
80	1	1	
100	2	2	

* Data for this year for NSLS were lost.

APS	'99	'00	'01
0	5	8	5
1	8	5	5
2	7	13	20
3	14	8	7
4	5	5	9
5	8	12	9
6	1	7	8
7			2
8	3	3	6
9	2	1	1
10	5	6	5
12	2	3	2
14		1	1
15	2	3	1
16	1	2	1
18			2
20	1	1	2
22			1
25		1	
30	4	3	3
32			1
34		1	
48	1	1	1

Foreign Sources: days/yr	'99	'00	'01
SRS	9	9	7
LURE	5	0	0
DESY	20	18	7
PhFac	51	50	50
ESRF	68	58	36
Trieste	0	0	0
Japan	33	68	86
Campinas	0	0	0
Lund	10	10	8
Other	100	110	110

Importance of Synchrotron Radiation to Future Research	Count
Critical	188
Very Important	39
Moderately Important	7

Current Use	Major Use	Occasional Use	Once only	Never
Crystal structure determination by monochromatic techniques	139	36	4	21
Crystal structure determination by selected-wavelength techniques (MAD, SAD)	106	52	10	34
X-Ray Spectroscopy, Static	20	8	3	104
SAXS Static	18	12	7	111
SAXS Time-Resolved	14	6	2	115
Other Subjects	10	2	1	111
X-Ray Imaging/Microscopy	8	7		111
PX Laue	2	10	11	119
X-Ray Spectroscopy, Time-Resolved	1	6	1	116
Wide Angle X-Ray Scattering	1	7	1	113

Future Use	Very Frequent	Regular	Occasional	Rare	Never
Crystal structure determination by selected-wavelength techniques (MAD, SAD)	96	60	30	14	11
Crystal structure determination by monochromatic techniques	78	72	33	15	11
Determination of multiple crystal structures for proteins provided by site-directed mutagenesis, or as part of drug/ligand studies	57	71	43	18	12
X-ray spectroscopy	19	5	7	22	103
Direct imaging by X-ray microscopy	13	4	3	12	123
Time-resolved structure analysis	10	15	32	62	58
Time-resolved structure analysis	9	4	9	16	116
Solution scattering of biomolecules and their complexes	9	8	18	31	70
Other research areas	9	5	1	2	112
Infrared applications	5	1	3	7	134
Ultraviolet applications	1		3	7	137

Importance of features	Essential	Important	Helpful	Occasionally Helpful	Unimportant
High brilliance/intensity/flux	170	53	9		1
Fast, efficient X-ray detectors	148	69	8		2
Repeated access for long-term projects	112	98	13	5	
Computing and network services	110	86	20	7	1
High energy resolution	101	88	23	3	2
Detectors with high spatial resolution	97	88	24	4	7
Good ancillary facilities, e.g., cold room, biochemistry lab, stock room	94	84	36	10	4
Rapid access for single experiments or feasibility studies	92	97	29	7	1
Helpful, readily accessible support staff	86	108	28	3	1
User-friendly environment	73	110	41	3	1
User Training	58	101	46	9	5
Good communication e.g., user group, Web site, documentation	54	102	54	9	2
Good ancillary facilities, e.g., cold room, biochemistry lab, stock room	35	83	72	31	6
Good housing and convenient services	32	100	74	8	8
Intellectually stimulating environment	27	58	100	27	10
Availability of trained local staff to take and process data for you (courier-based data collection)	25	41	62	38	52
Availability of robotic systems to automate sample changing	15	33	79	29	58
Other factors	5	3	2	1	14

Factor for Change in Personal Synchrotron Use Between Now and 2006	Count
1	39
2	101
3	46
4 to 5	22
10	7
20	1

Factor for Change in Worldwide Synchrotron Use Between Now and 2006	Count
0.4-1.4	12
2	90
3	26
4	20
5	31
6-10	33
20-100	3

Percent Use of Synchrotrons: freq. of response	Rad'n-based expt's	Publication Data Measured with SR
0%	7	11
5%	8	3
10%	13	4
20%	14	3
30%	17	5
40%	3	1
50%	38	20
75%	45	42
90 - 100%	75	122

Factors Limiting Use of Synchrotron Radiation	Count
Too much time between application for beam time and experiment	120
Can't readily get synchrotron beam time	83
Burdensome requirements for beamtime proposals	59
Insufficient research support to enable travel to the synchrotron	47
Other	41
Too much radiation damage to samples	26
Insufficient user support at synchrotron facility	20
Key instrumentation for experiment unavailable at synchrotron facility	17
Don't need it for my research	9

Other Areas of Future Research	Count
Anomalous scattering to determine ion positions around nucleic acids	1
Crystal screening	1
Mosaicity analysis with unfocused synchrotron radiation and super fine phi slicing	1
Phase sensitive diffraction imaging	1
Polymer diffraction	1
Small angle diffraction	1
Small Molecule Crystallography on Difficult Systems	1
Super fine slicing	1
Time-resolved x-ray footprinting	4
Whatever new application I devise.	1
XAFS	1
XPCS, time-resolved surface scattering	1
X-ray fluorescence microscopy	1
X-ray fluorescence of dilute species	1

*Other Source of Research Support	Counts
HHMI	5
NASA	3
Howard Hughes Medical Institute	2
American Heart Association	2
DOD	2
American Cancer Society	1
American Heart Association	1
Max Planck Society, Government	1
NASA, State	1
Startup funds	1
Canadian Government Agencies	1
DOD-BCRP & NASA	1
US Dept. of Education	1
BSF, ISF	1
U.S. Army, American Cancer Society	1
Human Frontier Science Program	1
from University	1
Institutional	1
Private Foundations	1
CIHR, NSERC,	1
Canadian Sources CIHR & NSERC	1
NSREC	1
UK Research councils and charities	1
Start-up	1
U.S. Department of Defense, Massachusetts Dept. of Public Health	1
University	1
CIHR and NSERC of Canada	1
Charity	1
Packard	1
NASA, University Startup	1
Canada Institute of Health Research	1
University Innovation Fund	1
State	1
Startup funds, currently	1
DARPA	1
Start-up funds from State of KS	1
U.S. Army Medical Command	1
USDA	1
State of California	1
Foreign Government	1
NSERC, HSURC, CFI, Res. Corp.	1
University/State	1
startup funds	1
State Grant Agency	1
DoD	1
Dept. of Commerce	1
Mexican gov	1
Templeton foundation, Searle Scholars Program, SurndaFoundation	1
Start up funding	1
American Diabetes Association	1
UK Research Councils; Wellcome Trust; Industry	1
Total count	60

General Comments - BioSync Survey 2001

No response - total = 193

Comments - total = 42

Sum of all responses = 235

Comments follow:

- 1) (bsync2001_survey109) Regarding my answer to #8, we can generally get access to Brookhaven or CHESS. We are close to these facilities and they are very convenient for us. We find traveling to other facilities very inconvenient, although it is necessary to use APS occasionally
- 2) (bsync2001_survey111) It is important to us to have travel arrangements to and from the synchrotron as simple as possible eg
- 3) (bsync2001_survey114) I started my group only 4 months ago. Prior to starting my own group, I had rapid access to beamtime at Brookhaven, CHESS and APS. I anticipate needing access to synchrotron beamtime (that means having crystals for which a single trip to the synchrotron would allow us to determine a structure) within the year. Synchrotron radiation has allowed me to collect high-resolution data on large, multiprotein complexes, for which home sources barely allow me to detect diffraction. It is essential for my success as a young crystallographer.
- 4) (bsync2001_survey116) Good survey! Cheers
- 5) (bsync2001_survey120) Question 8 (the last question) may get a higher positive response if a pooled BioSync site that accesses all of the nation's synchrotrons were actually divided into regions. Travel costs become more prohibitive when collecting only one or two data sets. Distributing such time regionally, according to a 2-6 hour driving time makes more sense. On the other hand, push a pooled BioSync site based on the "Fedex" principle. Then the rapid data collection of only one or two data sets becomes cost effective.
- 6) (bsync2001_survey128) I think there will be a growing need for biological, non-structural, applications for beamlines, i.e. hard x-ray xfm as resolution improves.
- 7) (bsync2001_survey129) Should count undergraduates in research staff. Need mechanism to try small crystals that diffract very weakly at home.
- 8) (bsync2001_survey140) question 8 infers that all beam lines and places are the same. This is not the case. There needs to be a feedback to ensure that one is matched with a particular instrument to ensure success of the experiment
- 9) (bsync2001_survey143) We very much appreciate the efforts of the staff at SSRL to provide a state-of-the-art, user-friendly, and accommodating environment for data collection. We hope funding will not limit any aspects of this service, especially as there will be much greater need of synchrotron radiation in the next few years.
- 10) (bsync2001_survey147) Processing of new users by synchrotron facilities is often inefficient and burdensome. Regulatory requirements for indices checks of foreign nationals (i.e. most post-docs!) seem particularly silly and unnecessary required safety-training procedures for certain specialized activities at especially the APS need to be streamlined efficient use of the existing and future resources requires minimizing all the barrier to access
- 11) (bsync2001_survey156) We are just beginning a major project that will require synchrotron radiation. We are probably typical of many researchers who want to take advantage of newly revealed possibilities with such sources.

12) (bsync2001_survey166) NSLS Beamline X9B is excellent in terms of equipment, management and support staff assistance.

13) (bsync2001_survey168) increasingly, we need routine access to synchrotron radiation to screen crystals for diffraction quality.

Because of the great variability between beamlines and facilities in terms of user training and support, unless we were absolutely desperate, we would really try to collect data at the facilities with which we're familiar. Our experience collecting data at beamlines that we're not familiar with is not very good - and for a "quick" data collection run, we probably couldn't collect 1 or 2 data sets in a short amount of time. I'd much rather FedEx the crystals and have someone at that beamline collect the data.

14) (bsync2001_survey169) It is nice to have an organization to which users submit proposals. We are so much suffering from the lack of information on sites of each SR facilities.

15) (bsync2001_survey172) I don't understand question 8? Is there such a proposal process? Might be a good idea, but I'd need to know more about it.

16) (bsync2001_survey174) I have little time to personally travel to the synchrotron sources to use x-rays for my experiments, but I do not hesitate to refer collaborators to the synchrotron facilities when their experiment could benefit from x-ray small-angle scattering (or other related) experiments.

17) (bsync2001_survey18) Synchrotron use is important for us, closeness is an issue. We mostly travel to Brookhaven because we can drive by car, which is cheaper and crystal transport is easier.

18) (bsync2001_survey186) In general, the beam proposal process takes too long between application and actual beam time. As a consequence, many of the recent proposals I have reviewed are people wanting to do experiments before they even have protein, since they are anticipating this lag.

19) (bsync2001_survey19) Although each protein crystallography facility is similar, they are all unique in several ways. If there were standardization of the different facilities, then it would be easier to collect data at each.

20) (bsync2001_survey191) These questions could be written more clearly.

21) (bsync2001_survey192) Much of the synchrotron work I have done recently involves collaboration with another experienced PI. His use and mine overlap, but both of us have independent projects that use synchrotron radiation. The use statistics provided are for my direct use and our collaborative use.

22) (bsync2001_survey200) I currently have access to a beamline on a repeated access basis, which is always be the preferred resource

23) (bsync2001_survey220) For rapid access to synchrotron beamlines, proximity to home lab is very important.

24) (bsync2001_survey228) Synchrotron research is vital to the biological and the physical sciences during this next century!

25) (bsync2001_survey31) It would be very helpful if the interface between the user and the beamline could be standardized. This would lessen the learning curve and make more efficient use of the beamtime.

Also, it would be much more helpful to get small increments of beamtime on a more frequent basis. If this means that more technical help is required at the experimental station, I would support user charges at such a facility to pay the salaries of such personnel.

26) (bsync2001_survey41) Synchrotrons have been the biggest boon to macromolecular crystallography since the invention of the computer.

27) (bsync2001_survey42) The NSLS at BNL labs is an excellent environment. As a Canadian, I am very grateful for access to this world-class facility.

28) (bsync2001_survey44) for those with small budgets, a pool with undefined lightsource can be a problem due to budget constraints

29) (bsync2001_survey45) I believe that as scientists, we can no longer afford the luxury of an "ivory tower" attitude. We have a tendency to expect our efforts to be continually funded without the requirement to enter into a wider arena of discussion and present our case for their importance.

"Why? It's importance should be obvious to anybody ..." etc. etc.

Current synchrotron facilities are simply insufficient to meet the levels of demand for their use. I believe that this is also a double-edged sword in that many investigators may think twice before committing their time and energy to the pursuit of synchrotron beam time, since they may feel that even if it is successful, a beamtime allocation may be "too little, too late" for a project (especially in the current competitive atmosphere).

If this perception were different, I feel sure that synchrotron facilities would see a much greater volume of excellent proposals even than they receive now (the corollary to this is that the perceived squeeze on synchrotron beam time may even be having a negative impact on current research).

To some extent, this could be addressed by improving the turnaround time for applications at current facilities, but ultimately, the real bottom line is that we simply need more synchrotrons!

Everybody, from the taxpayers whose dollars may fund them, on up to the politicians and CEO's who ultimately give the green light for their construction, needs to be given the chance to understand how essential and beneficial synchrotron facilities can be for the future. Just look at NASA's experience. Focused only on lobbying the big fish in Washington, they learned the hard way about the perils of failing to address the demands of public opinion.

Intelligent and persuasive advocacy at all levels, by the scientists who will ultimately design and use these instruments, could win the day.

I have worked at 6 synchrotron facilities in 5 different countries and have served as an institutional liaison for a joint industrial/governmental partnership to build new beamline facilities for structural biology in Europe. I would be more than willing to contribute in any way I was able, to the advocacy of extending the existing synchrotron infrastructure and constructing new facilities to meet (and fuel) future demand.

It's great to see an initiative like BioSync and I strongly support it.

30) (bsync2001_survey5) I want to go to a place where I can be sure to get the data I need. This doesn't have to be the theoretically best beamline, just one that works predictably and is of sufficient quality to get the job done. It is better to get optimal data from a non-state-of-the-art beamline than to get non-optimal, or no, data from a state-of-the-art beamline. Beamline user interface and hardware stability/predictability are extremely important. It would also be nice if some day there would be a unified user interface such as BLU-ICE to make it easier to visit multiple synchrotrons.

31) (bsync2001_survey50) It would be extremely helpful if there was some type of standardization of data collection software between different beamlines within one synchrotron, and even better among

several synchrotrons. It's frustrating spending so much time learning how to use a beamline as opposed to how to most effectively collect data.

32) (bsync2001_survey51) Improved access to small-angle x-ray scattering would be very useful.

33) (bsync2001_survey59) More beam lines like X25 at NSLS and 19ID at APS are needed.

34) (bsync2001_survey61) It's funny that no matter how early we arrive , and no matter how many times we have already been to a particular beamline, our data collection time always starts 3-4 hours after our scheduled starting time.

35) (bsync2001_survey64) I would use a pooled BioSync site (see question 8) if there was a preference to which synchrotrons. I prefer to use ALS or SSRL, because I know the people and the setup, and both are less than 1-hour drive for my group.

36) (bsync2001_survey65) Demand will increase exponentially

37) (bsync2001_survey69) The availability of use of synchrotron radiation has allowed us to pursue the answers to a different set of questions than we would have otherwise pursued. I believe that the questions that we can pursue with the use of the synchrotron are of more fundamental importance than those that we would otherwise pursue.

38) (bsync2001_survey74) My goal is to do all the preliminary experiments at home. If I could have even 1 or 2 shifts without having to wait, when I urgently need it, it would be a big help.

39) (bsync2001_survey80) SSRL is essentially perfect for my research needs in all regards. The resources, staff support, access, user-friendliness are essentially ideal in every regard.

40) (bsync2001_survey82) travel expenses would greatly affect application to a "pooled" application for beam time

41) (bsync2001_survey88) My lab is in it's initial start up so as yet we have not needed synchrotron sources. However, as we develop new crystals our need for synchrotron sources will increase dramatically. The speed and quality of MAD-phased structures makes this a primary consideration for determining any new structures and will be a key factor for our demand for synchrotron radiation.

42) (bsync2001_survey92) "Fedex" synchrotron use looks interesting. This could save a lot of travel time, stress, and expense. Synchrotron radiation is absolutely essential for structural biology.