

**Informed consent for: “The ethos and effects of data-sharing rules: Examining the history of the ‘Bermuda principles’ and their effects on 21<sup>st</sup> century science”**

**University of Adelaide  
Duke University**

Researchers at the University of Adelaide, Australia, and the IGSP Center for Genome Ethics, Law & Policy, Duke University, are engaged in research on the **Bermuda Principles** for sharing DNA sequence data from high-volume sequencing centers. You have been selected for an interview because we believe that the recollections you may have of your experiences with the International Strategy Meetings for Human Genome Sequencing (1996-1998) will be interesting and helpful for our project.

We expect that interviews will last from 30 minutes to much longer, but you may stop your interview at any time. Your participation is strictly voluntary, and you do not have to answer every question asked.

Your interview is being recorded and we may take written notes during the interview. After your interview, we may prepare a typed transcript of the interview. If we prepare a transcript, you will have an opportunity to review it and to make deletions and corrections.

Unless you indicate otherwise, the *information* that you provide in this interview will be “on the record”—that is, it can be attributed to you in the various articles and chapters that we plan to write, and thus could become public through these channels. If, however, at some point in the interview you want to provide us with information that might be useful for us to know, but which you do not want to have attributed to you, you should tell us that you wish to go “off the record” and we will stop the recording. We will, however, take notes for our own use. When you are ready to go back “on the record,” we will resume recording. Anything you say while “off the record” will not be on the audio recording and therefore will not appear in the transcript.

All *materials* from your interview (audio recording; transcript; interviewer's notes) will be available only to members of the research team affiliated with this project, unless you consent to their wider use, as described in the paragraph below. The digital materials will be maintained in a secure, HIPPA-compliant drive at Duke University. The paper materials will be stored in a locked cabinet.

In addition to the scholarly articles and chapters that we plan to write, we also hope to create a resource for other scholars and members of the public. We plan to post some of our research data to online digital archives. While we will use your “on the record” comments to inform and write our articles, we will not post your interview transcript or audio recording online unless you give us permission to do so, in a separate agreement. At the time we send your transcript to you for review, we will also provide a consent form asking your permission to post your interview transcript and/or audio recording online. The form will provide you with different options for how, when, and with whom the materials may be shared. You will, of course, also have the option not to share the materials beyond the Duke and Adelaide researchers.

One risk of this study is that you may voluntarily disclose identifiable information that later could be requested for legal proceedings, or otherwise be used against you. Please take this into consideration when you are speaking. There may be other risks associated with your “on the record” views being made publicly available, such as having your views mischaracterized or misunderstood.

The main benefit of participating in this study is ensuring that your side of the story is properly portrayed in this history of the Bermuda Principles, which have become a model for open and collaborative research in genomics and other fields.

To help us protect the privacy of those parts of your interview that are not public, we have obtained a Certificate of Confidentiality from the U.S. National Institutes of Health. With this Certificate, we investigators cannot be forced to disclose information that may identify you, even by a court subpoena, in any U.S. federal, state, or local civil, criminal, administrative, legislative, or other proceedings. We researchers can use the Certificate to resist any demands for information that would identify you.

The Certificate cannot be used, however, to resist a demand for information from personnel of the United States Government that is used for auditing or evaluation of federally funded projects or for information that must be disclosed in order to meet the requirements of the federal Food and Drug Administration (FDA).

A Certificate of Confidentiality does not prevent you or a member of your family from voluntarily releasing information about yourself or your involvement in this research. If an insurer, employer, or other person or institution obtains your written consent to receive research information, the researchers may not use the Certificate to withhold that information.

Signature Michael Ashburner  
Printed Name MICHAEL ASHBURNER  
Date 2 July 2011

*If you have read this form in its entirety and agree to the interview and its terms, please sign and date above.*

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*If you have any questions about your rights as a research subject, you may contact the **Duke University Institutional Review Board** at 919-684-3030 or [ors-info@duke.edu](mailto:ors-info@duke.edu).*

**Archiving Permissions Form: “The ethos and effects of data-sharing rules: Examining the history of the ‘Bermuda principles’ and their effects on 21<sup>st</sup> century science”**  
**University of Adelaide**  
**Duke University**

A short while ago, you participated in an interview with investigators engaged in a research project exploring the history and consequences of the Bermuda Principles for DNA sequence data sharing. We have prepared a transcript of your recorded interview. As indicated in the Informed Consent statement for this project, you now have the opportunity to review this transcript and make deletions and corrections.

Your transcript has been sent to you in either electronic format (via Dropbox.com or e-mail communication) or hard copy format (via postal service). Please follow the instructions provided with your transcript when making any changes and when returning the document to us. These instructions are specific to the format in which you received your transcript. If you do not want to make any changes to the transcript, please let us know at the time you return this permission form to us.

In addition to the use of your interview materials in our research, we seek your permission (subject to any restrictions you impose) to place the edited, written transcript of your interview, and any related documents, on the Internet in institutionally affiliated, digital archives.

These archives may include:

- Archives affiliated with the **Institute for Genome Sciences & Policy**, Duke University.
- Archives affiliated with the **Duke University Libraries**.
- Archives affiliated with the **Genentech Center for the History of Molecular Biology and Biotechnology**, a part of the Cold Spring Harbor Laboratory (CSHL) Archives,<sup>1</sup> or
- Archives associated with the **Human Genome Archive** at Georgetown University.<sup>2</sup>

Members of the Duke University community, students, faculty and staff at other institutions, or members of the general public may access these digital archives for purposes unrelated to this research project on the Bermuda Principles. Typical research uses of interview materials include scholarly or other publications, visual presentations (i.e., powerpoint presentations), exhibits, class projects, or websites. However there may be other uses made as well, since the materials will be available to the general public. Investigative reporters and lawyers engaged in or contemplating litigation have, for example, used the Human Genome Archive at Georgetown.

Your permission to post the edited, written transcript of your interview, and any related documents, to a digital archive is completely voluntary. Unless you consent to their wider use, all materials from your interview will be available only to members of the research team affiliated with this project.

The form below provides you with different options for how, when, and with whom your interview materials will be shared. You also have the option, of course, not to share the materials beyond the Duke and Adelaide researchers. In the meantime, all digital materials are maintained in a secure, HIPPA-compliant drive at Duke University; paper materials are stored in a locked cabinet; and steps are being taken (i.e., via layers of electronic password protection of documents) to maintain the security of your materials during exchanges amongst the Bermuda research team and between researchers and interview subjects.

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<sup>1</sup> The Genentech Center at Cold Spring Harbor Laboratories was established in 2006 with a gift of \$2.5 million from Genentech, commemorating the 30th anniversary of the company’s founding. The mission of the Genentech Center is to identify, acquire, preserve, promote, and provide centralized access to the original papers, correspondence, and research materials of the individuals and institutions that were crucial to the development of molecular biology and biotechnology.

<sup>2</sup> The Human Genome Archive at Georgetown University was established in 1988 under a grant from the National Science Foundation, and was long associated with the National Reference Center for Bioethics Literature and other international resources supported by the National Library of Medicine and other components of the National Institutes of Health.

**PLEASE FILL OUT AND RETURN THIS FORM TO:** Center for Public Genomics, Duke University; c/o Susan Brooks; Center for Genome Ethics, Law, and Policy; 304 Research Drive, Box 90141; Durham, NC, 27708. **OR:** You may fax it to us at (U.S.) 1-919-668-0799.

**Interviewee Information.** Please list an address where we can contact you.

Full name: \_\_\_\_\_ Date of interview: \_\_\_\_\_

Current institutional affiliation: \_\_\_\_\_

Street Address: \_\_\_\_\_

Phone: \_\_\_\_\_ Email address: \_\_\_\_\_

**Interviewer Information.**

Full name(s): \_\_\_\_\_

Affiliations(s): \_\_\_\_\_

I, the undersigned, have read the above, and I **AGREE** to release my interview materials, subject to any restrictions listed below:

(A) \_\_\_ I place **no restrictions** on my interview materials.

**OR**

(B) \_\_\_ My interview materials may be reviewed, used, and quoted by the researchers affiliated with the Center for Public Genomics, Duke University; *and in addition* (check all that apply):

\_\_\_ Researchers unaffiliated with the Center for Public Genomics may **read** the interview transcript and any related documents only after obtaining my permission.

\_\_\_ Researchers unaffiliated with the Center for Public Genomics may **quote** from the interview only after obtaining my permission.

\_\_\_ Researchers unaffiliated with the Center for Public Genomics **DO NOT HAVE** my permission to **read or quote** from the interview.

Posting interview materials to public digital archives: In spite of any restrictions listed above, I give permission for my interview materials to be made publicly available on the Internet by deposit in an institutionally affiliated archive:

\_\_\_ 1 year from the date of this form

\_\_\_ 5 years from the date of this form

\_\_\_ 10 years from the date of this form

\_\_\_ 25 years from the date of this form

\_\_\_ After my death

\_\_\_ Other: \_\_\_\_\_ (please specify a date or condition)

\_\_\_ NEVER: MAY NOT BE DEPOSITED IN A PUBLIC ARCHIVE

**Please specify any further restrictions in the space below:**

Signature: \_\_\_\_\_

Date: \_\_\_\_\_



Interviewee: Michael Ashburner

Date, location, method: 02 July 2011, Cambridge, UK, in person

Interviewers: Kathryn Maxson, Robert Cook-Deegan

MAshburner: Are you meeting John Sulston?

BCD: John's actually coming to Duke with Bob Waterston in November. And I know John fairly well. So yes, we're definitely going to interview both of them.

MAshburner: And you're meeting with Michael Morgan?

KM: Yes, on Monday.

MAshburner: Yeah, the Wellcome Trust (WT) are transcribing everything, aren't they now?

BCD: He's trying to get permission to do that, as far as I can tell. He said he was going back to everybody and asking for permission or something.

MAshburner: Yes, and it would seem to me that the mission is to make them public. Everything is, in fact, transcribed and they've done that in-house, as I understand it, at least. And to make them public they have to get everyone's permission.

BCD: You guys were under the Chatham House Rule, though, at the time of the meeting, right?

MAshburner: I'm quite sure that it's explicit on Bermuda One. I went to two of these meetings, the Bermuda One and to Fort Lauderdale. And I was going to go to the Toronto one, but I was ill, so I didn't go.

KM: We've gotten the names of the people who were invited to all of the Bermuda meetings and the 1996 one is the only one where your name appears.

MAshburner: Yes, I was also in Fort Lauderdale. Why it was held there I have no idea.

BCD: So I guess one thing is, since what we're going to do with this is we're going to transcribe it and the whole purpose of doing this is to make it public so other people can see. And what we're trying to do is reconstruct both the history, but just as importantly, gets folks' views on the significance and ... we're trying to do two things. One is to get a sense of what the history felt like at the time and a second, sometimes different sense, which is looking back on it how significant was it that this set of principles came out, that this set of meetings happened. And I guess what I was thinking is you might actually give us an introduction not only about what happened, but why you were there, why would you have been invited. Because some of the people reading this transcript may not have read your book or may not know that much about the background history.

MAshburner: At the time, so it was '96 the first one was, wasn't it?

BCD: Yeah.

Interviewee: Michael Ashburner

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MAshburner: So in '96 I was probably research program coordinator at the European Bioinformatics Institute. I may have been joint director by that time, joint head. I can't remember when that transition occurred actually now. [*\*\*MAshburner: No, I became joint-head 9/1998.\*\**] So the EBI was the custodian and developer of the European Nucleotide Sequence Data Library. So with Jim Ostell, David Lipman and the DDBJ in Mishima, Japan with Takashi Gojobori we had the responsibility of archiving all nucleic acid sequence data. So we had a direct interest in the access conditions for the human data coming from the public project. And of course this is well before Craig Venter, with his private enterprise bid with Celera that was not until 1999.

BCD: '98.

MAshburner: Well it was announced in '98 (May) and in fact it was really 2000 when the data started coming from Celera, late '99. So we had that interest and we also had a very strong connection of course with Wellcome Trust because the EBI is on the Hinxton campus. And at the time Michael Morgan was the Wellcome officer responsible for the the Hinxton campus. I don't know what his official title was ... I have no idea actually. I'm sure he'll tell you. But he had overall responsibility for the development of the Hinxton campus. And in fact was actually the decision-maker to support the bid for the EBI in '92 by the Trust which led to the Trust purchasing the campus. The history book was published. Have you seen that? It's not publicly available.

BCD: The thing that we've gotten from Wellcome was their review of the genetics program, I think, but I may not have seen the one that you're referring to.

KM: We definitely haven't seen that.

BCD: No.

MAshburner: Now that was produced privately by the Trust.

BCD: So we'll ask for it, thank you for this, because this may have ... we'll ask for this when we go see them on ...

KM: It's called "A Quest for the Code of Life: Genome Analysis at the Wellcome Trust Genome Campus." Just so that I can find it later.

MAshburner: Yeah, so that was published in '97.

KM: '97, Liz Fletcher and Roy Porter.

MAshburner: We can write it down. [Inaudible] was involved.

Interviewee: Michael Ashburner

Date, location, method: 02 July 2011, Cambridge, UK, in person

Interviewers: Kathryn Maxson, Robert Cook-Deegan

Woman: Roy Porter? You didn't tell me you were engaged with such an [expert?]. [Laughter]. *\*\*\*KM: The second woman quoted in the transcript is MAshburner's wife, Francesca Ashburner, who joined the conversation.\*\*\**

MAshburner: I didn't know that. I'd forgotten actually. *\*\*\*MAshburner: I knew Roy, he had been a colleague at my college, Churchill, in Cambridge.\*\*\**

BCD: So we definitely have to get that. Yeah, that's fantastic.

MAshburner: So that is a typical Trust product.

BCD: Oh, but what incredible photographs.

MAshburner: So now I don't know who had the idea of Bermuda One. It could well have been John or John and Bob. They were certainly the dominant figures at the meeting. And having the Wellcome Trust deciding to sponsor the meeting and have it in Bermuda has been ... actually first thought was to hold it in the British Virgin Islands, but apparently nothing was available in terms of facilities.

Woman: It's still British currently. [Laughter].

MAshburner: Well, yeah. British territory but close to the States. It turned out there's nowhere in the British Virgins suitable for the meeting. And also Bermuda of course has direct flight from London, or at least it did then. Coming back we actually landed in Cardiff because of fog, but normally a direct flight from London every day. And so they had it in Hamilton; it's actually a rather horrid place. It was very windy. Not very pleasant at all, at least not that year. And so the Trust having decided to sponsor it, it was natural for both Graham and I to be invited. I think Graham went; I can't remember actually.

BCD: Use your book.

KM: Yeah, Graham ... last name?

MAshburner: Cameron.

KM: Oh, he was there. Yeah.

MAshburner: The reason I'm uncertain is Graham hates traveling. It's quite nice to see who was there actually.

KM: Oh, I've got a list.

MAshburner: I should have actually gone to the lab and tried and find my notes. We probably have notes on the meeting somewhere.



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BCD: Well, that was going to be one of our questions, is if you wouldn't mind, one of the things we're trying to do is just create an archive of material. So if you go back to this ... if you find anything that you think would be of interest to some future scholar let us know.

MAshburner: Well I'm trying to sort out my papers at the moment, and Wellcome Trust and my college, which is Churchill, are in discussions about what's going to happen to my papers. *[\*\*MAshburner: They have gone to the Trust.\*\*]*

BCD: So whether they stay here in Cambridge or go to the Trust library?

MAshburner: Yeah, well they'll go to the Churchill College archive.

KM: You've already got some there, haven't you?

MAshburner: Yeah, that [Inaudible] and there's some in Churchill. *[\*\*MAshburner: In fact some of my political papers from the 60's are in the Churchill Archive.\*\*]*

BCD: So they're going to fund an archivist at Churchill?

MAshburner: It doesn't really matter physically where they are and the Trust has got to pay for it. And I'm actually waiting to meet with, to contact me at the moment. But somewhere I will have notes; there's no question. They've been in [Inaudible].

BCD: In fact the easy thing would be is if you identify somebody who's doing the archiving, what we can do is just link over to it.

KM: And contact whomever is in charge. *[\*\*MAshburner: This is Jennifer Haynes.\*\*]*

BCD: Yeah, and contact that person just so that we make sure that we know.

MAshburner: Yeah, we can do that in a moment, yeah, I'm going to have to find the person. So the reason I was there is because with Graham we were the two senior people at the EBI and we were very involved, and we had lots of discussions with John.

KM: So Graham was there in '97 and '98, but not in 1996. You want to see this?

MAshburner: Maybe he wasn't there in '96.

KM: So I've got them categorized by year.

MAshburner: And see who was there. Good Lord, some of these people I don't even know who they are. What are the highlighted ones?

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KM: Those are the ones that we had contact information for a few months ago.

MAshburner: David Bentley, he was at the Sanger Centre. He went to Solexa, now Illumina, in Great Chesterford.

BCD: Roche, isn't it?

KM: Solexa ... Illumina.

MAshburner: Illumina, yes. He's at Cambridge. David Cox, oh Lord. P. T. Young's in Berkeley. Bruce Roe, Jane [Inaudible]. Bruce Roe is in retirement in Wisconsin; Michael Morgan saw him recently. Michael Palazzolo is gone, disappeared from the face of the planet. Richard Durbin is at the Sanger.

KM: Yeah, we tried to find him.

MAshburner: No, he keeps quiet. He's at Sanger.

KM: We couldn't find him anywhere.

MAshburner: R. D. at Sanger. She of course is [Inaudible]. Graham's at EBI still. Phil Green is in Seattle. Elke Jordan is at NIH. Jill Kent ... you're sure it's not Jim Kent?

KM: It was Jill ... well it might have been ...

BCD: No, I think Jim Kent was much later.

MAshburner: Yeah, he was actually, yeah.

BCD: I don't think he was even probably a grad student at that point.

MAshburner: Yeah. James [Jim] Weber, he's the co-author on the shotgun sequencing paper [with Gene Myers]. Hans Lehrach in Berlin [Director of Max Planck Institute for Molecular Genetics]... Ansonge is retired but you can probably get hold of Ansonge through the EMBL. John Mattick is in Queensland [Institute for Molecular Bioscience at the University of Queensland]. Good Lord, was he there?

KM: In '97 only.

MAshburner: Yeah. He's director of the Institute in Queensland. Martin Bobrow is retired, but he might still be in Cambridge. [He was Professor of Clinical Genetics in Cambridge and a Governor of the Wellcome Trust.] [Inaudible] Stella [sp?] of course is at NCBI still. Interesting. But you're just doing Bermuda, not Fort Lauderdale...

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BCD: Well, no, we're actually trying to put it in historical context, and in order to do that it's going to spill forward into Fort Lauderdale and all sorts of other ...

MAshburner: So what I would be very interested in and is relevant, and you should talk to Cameron about this at EBI ... Graham's kind of in and out; his wife's got cancer so he's in and out ... he's still there ... [*He will retire this March, 2012.*] Talk to Graham about whether or not the decision to make the archived nucleotide sequence data completely open and freely available was a conscious decision, that they actually thought about it, or whether it happened by default. And what's happened, of course. And I just don't know because the Data Library was developed really independently by the Americans and the Europeans, and Graham and Greg Hamm, who developed it at the EMBL, released it first on a 7-track magnetic tape—it wasn't a database then, and they just sent it to people with no restriction on the use of the data whatsoever. And that happened, of course, a few months later when GenBank started. And that's probably slightly even odd because the EMBL of course is a public institution. But GenBank, I think, began, I really don't know the history of GenBank, but I think it first began within BBN, Bolt, Beranek and Newman, which is a very, very commercial ...

BCD: Yeah, so it started at Los Alamos.

KM: Los Alamos, yeah, in the U.S.

BCD: So at Los Alamos they made a decision that they couldn't be a contractor for another government agency so they partnered with BBN and Howard Bilofsky and so they did this joint...

MAshburner: That's right. I was trying to think of Howard's name the other day.

Woman: Bilofsky.

KM: So Los Alamos is now about to burn down. There's fires over there.

BCD: Oh, is that right? That's where the fires are?

MAshburner: Yeah, there's fires up on the hill. So do you know who made the decision to make the data public?

BCD: No.

MAshburner: It would be quite interesting because I think that in some ways is the key to Bermuda, the Bermuda agreement, because ... and of course that very well entrenched by '96 with the Data Library so '82/'83. And the Japanese followed suit in '86 with DDBJ, and without that, without the fact that the data was open, the Bermuda principles would have made no sense whatsoever. So I think really

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that is the key. Now what I don't know, see, before ... you have to come ... and I wasn't really involved in bioinformatics at the time, but you have to go back to the very early data libraries which are what became PIR for protein sequence. They started with Margaret Dayhoff, and were actually printed, as of course were the first collections in nucleic acid sequences. I mean, there are a couple volumes...

KM: From the protein, yeah.

BCD: Yeah, even GenBank came out with a printed form.

MAshburner: Ah, but there are predecessors to that which most people don't know about at all. I'll show you, I'll bring them down in a minute, they are upstairs. One was by Bart Barrell. I've forgotten who did the other one. I'll show you.

BCD: So it would have been here.

MAshburner: Yeah, one of them is here at LMB. Bart Barrell and the guy who...I can't remember, it's all in the book...and I don't know with Dayhoff, and the Dayhoff atlases were printed. In some ways there's no concept of a Data Library being accessed across the networks because the infrastructure wasn't there. And also the other one was PDB, which was a computer based, I think, *ab initio*, but again I don't know, and it was also open access.

You see, part of the justification for open access for PDB and GenBank, EMBL, DDBJ, which are data archives by deposit, is that it would make no sense if your objective was to be as complete as possible, and you have to encourage people to deposit data, then it would make no sense to wrap restrictions around those data. So it came naturally for the model of both certainly for PDB and for EMBL. Yeah, I know that GenBank used to print. EMBL used to produce CD-ROMs when CD-ROMs became available. But it would be worth talking to, if you can get a hold of Graham, it would be worth talking to Graham. How long are you in town?

BCD: Today and tomorrow, but we can come back.

KM: We can come back.

MAshburner: Yeah, you're not going to have time otherwise. Tomorrow...what day is today?

BCD: Saturday.

MAshburner: Graham would be sailing. [Laughter]. There's no way that Graham will see you over the weekend. I can guarantee that.

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KM: Well you know, we're in London all day Tuesday with no plans.

MAshburner: Phone the EBI and see if we can't get Graham. But so I think that this kind of deep background of the public availability of sequence data, which was of course followed in '86 by Amos Baroch when he started Swiss-Prot. He changed it later but not...because he was forced to basically. So Bob and John of course knew of this. But I think they were motivated by something else. They'll have to speak for themselves, but I think they were motivated by, with the immediate release, of trying to reduce competition between very many groups. You see, this was before the '98 Night of the Long Knives [*when Michael Morgan for the WT and Francis Collins for the NIH decided, in response to the Celera threat, to concentrate human sequencing efforts of only five labs*]. So there wasn't so much of a great difference between the sequencing centers then. I mean Eric Lander was hardly to be seen at that time, and in fact until the early 2000s. And there were a lot of sequencing labs involved in human, people like Jean Weissenbach in France, the guy [Inaudible] ... I've forgotten his name now; he's on the list there.

BCD: Was that when Lehrach ... where was Lehrach at that point?

MAshburner: God, I'm not sure where Hans was right then. He could still be in London. Yeah, as you see by the fact that people like Ed Southern and Hans were at these meeting, it wasn't obvious that Sanger technology was going to be the defining technology for the human genome. I mean probably it was obvious to people like John, but there were people like Hans Lehrach and Ed Southern who still, I think held hopes that hybridization techniques would actually make a major contribution. And you had people with alternative technologies like Wilhelm Ansorge, who actually produced a commercial machine which was marketed by Pharmacia. And it was actually used in clinical practice quite a lot, but which eventually got totally dominated by the present technology with ABI. I'm very bad on dates. I can't remember when the first ABI machines came out.

BCD: '86, '87.

MAshburner: That early?

BCD: Yeah, the prototype was '86 and then the ABI machine I think they started marketing it in '87.

KM: The paper was '85 and then '86 was when the first machines came out.

MAshburner: Lee Hood's paper.

KM: Yes.

MAshburner: Was it Lee Hood?

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KM: Yes, Lee Hood and Hunkapiller?

BCD: The Hunkapiller brothers and Lloyd Smith.

MAshburner: Yeah, you tend to forget these things.

BCD: So could you talk a little bit about the ... one of the things we're interested in is also, so John and Bob are from the *C. elegans* community. You're from *Drosophila*, Maynard Olson, there's a whole cluster of Europeans who are doing yeast. What about the ethos and kind of the sociology of those communities and how did that interact with data access and how people were thinking about sequencing data access?

MAshburner: John and Bob, who were doing worm, and again the timing of it ... the worm sequence was published in '97, early '98?

BCD: I should know that, but I don't remember.

KM: I think it was '97 or '98.

MAshburner: Yeah, probably. [*I think the worm sequence paper in Science was December '98.*]

KM: It's in Rachel's paper. It may have been earlier than that.

MAshburner: Before Price. I think it was '98. December '98, my memory. And they had a policy of releasing sequence data, which I think had two motivations. The first is that as a quid pro quo for their funding, it was a *community* project. They weren't doing it for themselves. They were doing it for the community; therefore, it only made sense that they released the data. And the second is, they knew damn well that they didn't have resources to do complete analysis, and the only way of getting analysis done was to get the data out there. And I think those were probably the two primary motivations.

We basically had the same motivation. And of course it had been preceded, as with the worm, by public release of the mapping data. When they were building the maps, physical maps. In those days of course, it was all before shotgun. It was all sequencing of mapped clones. And again with flies we regarded the public and open availability of the data as a selling point to our funders. Because we weren't solely doing it for our own glory, which is rather different from conventional ROI funded research. And this idea of community project, with both the worm community and the fly community, really kind of formalized with white papers. So even to this day I think there's still an annual *Drosophila* white paper. And this idea of white papers was taken up and used by lots of different communities. They're still there but there used to be a website ... at NCBI, with white papers

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for sequencing almost anything. And that's how people made the case for community support for funding. So it makes the only way you can do that is by releasing the data. And other communities haven't caught on to that so much. I was contacted fairly recently by a namesake of mine [*John Ashburner at the Functional Imaging Laboratory in London*] who is involved in MRI imaging databases, and that community is not open at all. If you want access to data you have to sign all sorts of ...

BCD: Nondisclosure agreements?

MAshburner: Yeah.

BCD: Really?

Interview: Yeah, uh-huh.

KM: *C. elegans*, the genome for *C. elegans* was completed in '98.

MAshburner: Yeah, it was in December '98, I'm pretty sure.

KM: It's Rachel's paper.

MAshburner: One of the few genome papers published in *Science* [Laughter]. [*Later, the genome community boycotted publishing in Science because that journal published the Celera human sequence and the Syngenta rice sequence without public data release: that is why so many of the early complete genome papers are published in Nature.*] So I think with the fly community it was actually a no-brainer. No one ever considered, even discussed, not having the data completely open. The *Drosophila* community has a very long tradition of openness anyway, and people in *Drosophila* community hate having to sign MUAs. In fact I banned them in my lab. If someone wanted to sign an MUA we just ripped it up. Just refused as a matter of principle. And I don't think anyone ever suffered. And there was quite a lot of resentment when we knew that data or materials were there but not freely available, for example, with Exelixis in the early days, or in fact, Exelixis, period. And there was a Korean company making stocks, and people didn't like it at all.

BCD: So at this meeting did it feel like...so the part that everyone uses out of the Bermuda principles as the touchstone is the data disclosure element. Did it feel like that was the most important problem that was being solved? Or were these other things about making sure that ...

MAshburner: Yeah, the immediacy. You don't ... the concept that the sequencing of the human, and it really was concentrated on human, the concept that the sequencing of the human was being done, without being overly pompous, for the public good. It

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wasn't being done as part of normal scientific research. It was being done as a resource. That concept, which came over very strongly I think, is a very important part of the Bermuda agreement, of Bermuda One. And its acceptance by everyone there, including Craig Venter, despite what he may say, he actually agreed, because Michael Morgan kind of bullied everyone to physically vote their agreement.

KM: Into immediate release.

MAshburner: Yeah, immediate release, yeah, and by raising their hands. And Craig actually I think was shamed into voting. He denies it, I think. I don't know.

KM: Yeah, I think he does.

MAshburner: Yeah, he does. Now I'm sitting next to him and I know damned well he agreed, and I know he denies it, but then he would, wouldn't he?

KM: What about patenting?

MAshburner: Well yeah, but that follows, I mean that is part of the human genome program—you don't patent because that would be counter-productive and John is, and I think many of us were, politically rather anti-patent anyway. And I think when we see what's happened to things like *BRCAl* from Myriad, quite rightly so as well. And so patenting I don't think was...I can't recall patenting being discussed because really a non-issue.

KM: That's really interesting because ...

MAshburner: My memory may well be ... this was 15 years ago? Yeah, well there you are.

KM: Lots of accounts of the Bermuda meetings after the fact have focused on the meetings as if it were very largely a patenting issue.

MAshburner: No, I don't think so.

KM: I mean am I wrong, or is that ...

BCD: This is something we're going to have to dig up. Certainly after '98 it became a big deal but that was post-Celera.

KM: Yeah, I guess that's true because over the course of the meeting ...

MAshburner: Yeah, but Celera didn't patent, they just kept it secret, which is different; there was quite a lot of patenting, but I think it was secondary. And Celera patented ... I mean Celera even patented some sequences from *Drosophila*, the *Drosophila*



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sequence, that had ... and they had a full-time patent agent working with them – I got to know him because he had the only espresso machine in the building. [Laughter]. I've forgotten his name ... long hair.

BCD: Gosh, I should remember, we've got an interview with him. Not in this series but the patent lawyer for Celera.

MAshburner: In the early days. I remember his office because we used to ...

BCD: I should remember his name. He's kind of a cowboy.

MAshburner: Yeah. He had the only espresso machine in the building, basically had decent coffee, so we tolerated him. But Celera patented some of the fly sequences. Had no discernible effect because eventually all the sequences were made public. And Celera actually tried to stop that initially.

BCD: So did this feel at the time like it was a historic occasion, or did it feel like you were just getting things organized or ...

MAshburner: Just getting things organized, I think, and not particularly historic. Because it was before the open access movement on publications as well, which came later and was really motivated out of Stanford by Pat Brown and Harold Varmus. Well, Stanford and UCSF and Harold Varmus. But the motivation for the open access I think was triggered by the libraries, interesting enough. The libraries were just getting totally fed up with being ripped off, and particularly by Elsevier.

Woman: They used to be next door to us.

BCD: Here? They had an outpost here?

MAshburner: The *Trends* offices ... the *Trends in Genetics* offices were here. *Science's* European offices in this building just here. We could see the Elsevier office through my bathroom. And then Elsevier moved them out. It was a great pity actually, because they were most at Cambridge and we always met with them. But one of the most awkward occasions of my life was in '95, I guess ... would it be '95? The year of Tim Hunt Nobel Prize, I think it was. My dates are getting mixed up, aren't they? I'm not sure when we published the open access letter in *Science*. I can look it up, but the one that 12 of us signed, it called for a boycott in journals in the six months that they were open access.

*R.J. Roberts, H. E. Varmus, M. Ashburner, P. O. Brown, M. B. Eisen, C. Khosla, M. Kirschner, R. Nusse, M. Scott, B. Wold. 2001. Building A "GenBank" of the Published Literature. Science 291: 2818. (Letter). <http://www.sciencemag.org/cgi/content/full/sci;291/5512/2318a>.*

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KM: I'm not sure; '95 or '96. 2001!

MAshburner: And I addressed the STM, the Scientific, Typical and Medical publishers at Frankfurt book fair, and they are dominated by Elsevier. They were very polite. The only thing that kept me going was, I flew in from the States to Frankfurt, had CNN news on in the morning and then Tim Hunt and Paul Nurse had won the Nobel Prize. So I think it was really the rapaciousness of Elsevier and Wiley which motivated us. It took a long time for us to kind of tweak that we were providing everything free, the Journals, and then they were charging our universities arms and legs to get the information back. And then later when Pat Brown and Michael Eisen found a cause which I think has been very successful. Now, of course, everyone's talking. Even *Nature* goes open access ... except Elsevier, who seem to have...but the other open access source which is very important is Medline. And of course there's no coincidence of course that GenBank now is actually funded through Medline, and is physically and essentially with Medline. So I think David Lipman, actually his boss is ...

BCD: Donald Lindberg.

MAshburner: Yeah. Those guys have been there for years, haven't they? Really have. And David's been talking about retirement for years as well. I think he's retired from ...I think he was a captain in the military. He's Navy. Oh yeah, as a younger kid he used to put uniform on. I've seen him in his Navy uniform. [Inaudible] wasn't, but David was. But the happy [Inaudible] want Medline. See, at one time Medline was not freely available. If you wanted Medline you had to go through a commercial company, a commercial intermediary, like Lockheed had access at one time. But that was the time really when if you wanted Medline you actually had to get the tape because it was before...but there also was a period which you had to go through a commercial dial-up service to get Medline. But then I think ...I don't know what...again, it would be interesting to talk to Medline when Medline is now totally free to all and we have copies of Medline at the EBI. They don't release the entire data set to many people. We have a set at the EBI on disc. But essentially it's open access.

KM: It's used as a teaching tool for Duke biology.

MAshburner: And of course Elsevier hates it because it competes with Embase [[www.embase.com](http://www.embase.com)], their commercial product,.

BCD: So as you think back about this, do you have a sense of, how significant was it that there was a formal statement of principles?

MAshburner: I think that was significant. I think that was significant because it was then open. Again, in the interest of openness, and had it not been widely publicized as an open statement it would be rather paradoxical. So I think that was important.

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KM: Because it seems like policies beforehand weren't really policies; you were just sort of borrowing from other communities or relying on tradition.

MAshburner: Yeah, it was tradition really. I think that Bob, John and Michael Morgan knew exactly what they wanted when they went into that meeting. And what they wanted, the policy which went through, but what they needed was, in my interpretation, is as wide a community agreement as they could possibly get, and to make that public so people couldn't then go back on it. I mean Craig did, but Craig's a maverick anyway. But no one else tried to. Can't think of anybody.

Woman: Don't think it was partly their funding structure?

MAshburner: Well, the Trust ... yeah, and that is actually another fact of course is that with the NIH, it's public money. The Wellcome Trust of course isn't. So *prima facie* it's not obvious that the Wellcome would be so open access. They've always had that tradition, and I don't know why. It may be interesting to talk to people in the early days of the Trust like Bridget Ogilvie, and again, Michael Morgan who was around at the time, to know just how much a conscious decision that was.

BCD: That does raise a question though. So you were not there in '97 but I suspect that you because of your other hats, you were involved in it. One of the issues that came up clearly in 1997 was that the German government did not want to support the open access, and that was partly because their genome funding was seen in part as economic development investment. How did that affect your role at EBI?

MAshburner: Not at all actually. I think our attitude was, and obviously is, on sequence data that if it's not publicly available it doesn't exist. We couldn't care. And now of course it's totally irrelevant. Because there is simply so much sequence but even then if people didn't release data, they didn't exist. And [Inaudible] who was of course what was then ... no, post the fall of Germany... but was one of the few people at Bermuda One who was really opposed to open access. But peer pressure is quite powerful, particularly with people like John and Bob who are fairly forceful personalities when they want to be. And Eric ... was Lander at the first meeting? I don't think he was.

KM: I don't think so.

MAshburner: He wasn't on the horizon; he really wasn't on the horizon then.

KM: I was just looking up the actual statement ...

MAshburner: Let me just get go and get this ...

Woman: I remember the property from the seventies and early eighties and so on, but when patenting was like Aztec gold, you know, every research scientist thought, ooh,

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I'm going to make me some money. And of course left on the tide by their universities. But I do remember my [Inaudible] school, the Banbury scientist could toddle along with patenting stuff and the pharmaceutical lawyers would just run rings around them. So it was the idea that people would make money out of patenting has kind of died naturally. And the companies that were set up for that time never got anywhere. There were probably a couple in California. So he had become acquainted with Duke. Obviously, you think later when there was big money in ...

MAshburner: Brian Clark and [Inaudible] sequences.

KM: So Eric Lander was there in 1996 but not in 1997 and then again in '98.

BCD: So he was there.

KM: Yeah, he was there.

BCD: Oh, so these are tRNA sequences. That makes sense, doesn't it?

MAshburner: I thought it was. I may even have the first sequences. What date is that?

BCD: Does this have a date? Yeah, 1974.

MAshburner: Oh no, it wouldn't have sequences. In '74, yes, of course they were done. He was doing that in '72/'73.

KM: So do you feel like Bermuda succeeded, like has it made a significant impact on science?

MAshburner: Oh, I think so, yes. Yeah, I think it has. I think ... that's proteins, so it's Croft.

KM: *Handbook of Nucleic Acid Sequence.*

MAshburner: See, Bart's retired now but Bart was Fred Sanger's technician initially and later was head of the pathogen sequencing unit. But Bart's still working at the Sanger, but he works in an office with no phone. He doesn't want to be bothered.

Woman: You make the Sanger sound very [icy?] ... which it isn't ...

MAshburner: Yeah, I don't know why. Well Richard [Durbin] doesn't want to be bothered either really.

KM: So what if Bermuda hadn't happened?

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MAshburner: What if Bermuda hadn't happened? Well I think the...that's an interesting question. If there had been no agreement ...

KM: Or maybe perhaps no formal written policy.

MAshburner: Yeah, I can imagine that some sequencing sectors would not have released their data. I can think of one or two; certainly the Germans wouldn't.

KM: What about the Japanese?

MAshburner: Japanese didn't contribute much in genome sequencing anyway. They did a bit in yeast. But you see, the yeast data was not open initially. And the EU data, EU consortium, did not release their data. And there's a lot of bad feeling about that in Europe. And I remember in...when was the eclipse... '99, there was a meeting in Heidelberg. Now my memory's going, and there was a huge row between the Belgian, whose name I've lost, who directed the EU yeast program ...

BCD: It wasn't Hallen?

MAshburner: Who?

BCD: Manuel Hallen.

MAshburner: No.

BCD: He was the administrator for years.

MAshburner: No, no, this was a Belgian who was actually the scientific, and there was a huge row about data access. [*The Belgian was Andre Goffeau.*]

KM: This is from the yeast? Right.

MAshburner: On European yeast, yeah.

BCD: What were the stakes there? Who's on which side on the rationale for not sharing? Was it a scientific rationale or an economic rationale?

MAshburner: I don't know.

Woman: They did not share ... people repeated that process.

KM: Right.

MAshburner: I didn't think they really had the concept of it being a community project, which it very much was. Again, it would be interesting if you can get him to talk or get

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access to him. You can talk to Bart about that because Bart was very involved with yeast.

BCD: So, this Bart; Bart Barrell.

MAshburner: Bart Barrell, yeah, he was very involved in yeast. I don't get to Hinxton much, but I think he's still at Hinxton. His son certainly is. I'm not sure they're talking to each other. So there was a lot of bad feeling about yeast in the community, in that people outside the consortium, the European consortium, didn't have access to data. And that would have happened with human. And of course if that happens in the community very widely then it gets difficult to fund these very big projects. There was enough opposition to the human genome sequencing program, first mapping and then sequencing it, as it was, because it was big science, it was very expensive, it was going to divert money from RO1 guys. So that if the data were not public then there would be huge resentment. And that opposition to the public funding project could well be insuperable. And I think that's another important factor. I think, again, having a public declaration as we did in Bermuda helped overcome that.

KM: Resentment from smaller laboratories?

MAshburner: Well, yeah, that's who would access the data but weren't involved in sequencing, because they were interested in one gene. If they knew that the sequence of that gene was out there, but was not being made public ...

KM: And then they'd have to pay to sequence it themselves.

MAshburner: Yeah.

Woman: They had some other funding issues.

MAshburner: So the other aspect of Bermuda is of course at the time it was ... the sequencing strategy was to map and then sequence. And the idea, which I think was discussed in quite some detail, was that different labs would lay claim to different chromosome regions, and it was divvied up. So again, if a guy doing kind of tip of chromosome one was hiding and keeping the data but not releasing it, then as the guy doing the next bit was making data public, it just made no damn sense at all. So I think that again was a justification.

KM: So the coordination necessary.

MAshburner: The coordination, and coordination...we were, at the time what the cost of sequencing was then, right, a dollar a base? I think at one time a dollar a base was...

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BCD: That was the target.

MAshburner: ...was a target. It was a dollar a finished base I think, not a dollar a sequence base. I often wondered what sequencing cost us when we first started in the early '80s; we were at 20 bucks a base. So that I think was an important consideration because it was really 2000 before people accepted shotgun, which was Craig's great success. Well no, I take that back. I mean Gene Myers and Jim Weber had the idea, it was far from widely accepted [*see Phil Green's rebuttal in Genome Research*], but Craig backed them, and he hired Gene. I've got great admiration for Craig. He announced Celera in May '98. I went to get Gettysburg in early December '98 when they had just purchased the two buildings in Gettysburg, which were office parks and they were converting them. And the only habitable space, which was not hard hat, was Craig's office and the conference room. The computer room had a JCB in it, and that was in December '98. And in August '99 they had sequenced the *Drosophila melangaster* genome, just the logistics of getting it up and running and getting one of those ABI machines, and they didn't work initially. The sequencing machines didn't...they had enormous teething problems. And then getting all the software written to do the assembly, which Gene did, and that also didn't work initially. They had enormous debugging problems and yet at the Miami meeting in September '98 they had a sequence.

BCD: And you were part of the jamboree?

MAshburner: Yeah.

BCD: And how did that feel?

MAshburner: It took years off my life. [Laughter]. That was great. Gerry [*Rubin*] and I organized that. And again, Craig didn't have to fund that. Craig, of course, he got, unrelatedly, at least a million bucks worth of consultancy for free, for funding the jamboree, but they didn't have analyzed sequence data. And the only people who did on that scale were...well it's not the only people, but...were people like Gerry Rubin's lab and particularly, Martin Reese. And they had a company called Neomorphic, which bought this house. [*When they sold out. I had a stock option.*]

KM: So where was Jim Watson in all of this? He was there in '96; was he vocal about anything related to the meeting?

MAshburner: I can't remember actually.

Woman: Who were the computer geeks who were messing about that you gave the shares to? The ones who were involved with the software?

MAshburner: I had paper in that company. The sold for somewhere over 100 million \$\$... something absolutely outrageous!

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BCD: So what was the name of that company? This must have been one of the original bioinformatic companies.

MAshburner: Neomorphic. Came out of Gerry's lab. And Martin Reese ...

BCD: When he was still in California?

MAshburner: Yeah, sure. Martin Reese, Gregg Helt and Cyrus Harmon I've forgotten...they were all graduate students of Gerry, they started this sequence analysis company called Neomorphic. It changed its business aims every three months and I was a consultant for them. And then one day it got bought out by...not by InCyte...the other one...*[Affymetrix]*.

BCD: Human Genome?

MAshburner: No, not HGS, no; they were crooks. *[Laughter]*.

BCD: Don't worry about it; we'll track it down.

MAshburner: You can find it out, yeah. I can't remember. They're a bunch of kids in a shed in Emeryville *[Laughter]* and they never...I was a consultant for them since they started and they never paid me a penny. I think they bought me dinner in Miami once. And that was it really. They gave me shares; we bought this house. At least paid off the mortgage.

Yeah, I think the jamborees were, that concept was Suzanna Lewis' idea, but backed by her boss, Gerry. The idea of getting a lot of people together to analyze the sequence, which was then novel but has been copied many times since. Again, it could only be done within the context of openness because the initial jamboree was, I think, two weeks at Celera, and no one was paid. I don't even know... Celera certainly paid my hotel bill, but whether they did that for everyone...but they watered and fed us certainly. I presume they paid accommodation for everyone, but no one was paid for their time. And could only be done in the context of openness, which is why when Craig tried to control access to the sequence there was such a huge row, which he initially claimed was done in error but later admitted it was a deliberate attempt to try to get away with it. In addition they were licensing the data. They were licensing access to their database, because I consulted for a Swedish company, Pharmacia...actually wasn't Pharmacia...was it AstraZeneca? Or Pharmacia? I can't remember, who licensed.

BCD: Licensed Celera?

MAshburner: Yeah.

BCD: For the human data?



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MAshburner: For all the data.

BCD: For all the data.

MAshburner: All the data. This license was when all they had was *Drosophila*. And they really tried ..I don't think they got paid anything out of it at all. But I think it was AstraZeneca; can't remember. At least AstraZeneca needs to pay me. It was much money. And I don't think they got anything out of it. So I guess...sorry, I got lost.

BCD: That's all right, and I sense that we're tiring you out so we should leave you to your own home.

MAshburner: I'm not sure I've been much use to you.

BCD: Well no, it's been incredibly helpful.

KM: Extremely helpful; thank you so much. Thank you so much, both of you.

BCD: And if you happen to think of anything, actually this alone is worth the admission price here so...just knowing that this book exists, and we'll track that one down.

MAshburner: No one knows about this.

Woman: Are you writing a book on the Bermuda conference itself and its impact?

BCD: Yes.

MAshburner: First edition '74; last edition '74 as well I think. [Laughter].

KM: What are the two authors on this?

MAshburner: Bart Barrell, who was Fred's technician at the time, and Brian Clark, who was at LMB here, and then went to Aarhus in Denmark and has presumably retired by now. Slightly difficult man. [Laughter.]

BCD: Well thank you so much, this is incredibly generous of you. And I'm so glad that ...and especially on a Saturday on very short notice ...

MAshburner: Well I'm retired so Saturday's much like any other day really.

BCD: So thank you very, very much, and thank you for the coffee.

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