DNA TESTS FOR GENEALOGY

By Ken McNaughton

At the turn of this century two researchers made major contributions in the field of DNA testing for genealogy—Spencer Wells and Bryan Sykes. Spencer Wells (Fig. 1) is an American geneticist and anthropologist and explorer-in-residence at the National Geographic Society in Washington D.C. He has written two books on the subject [1, 2] and leads The Genographic Project. Attending one of his presentations [3] inspired me to read four books. Bryan Sykes (Fig. 2) is Professor of Human Genetics at the University of Oxford and founder of Oxford Ancestors Ltd., a genealogical DNA testing firm. He has written numerous books on the subject, two of which are referred to here [4, 5].

Figure 1. Spencer Wells on expedition explains the Genographic Project to village leaders in Chad (photo by David Evans).

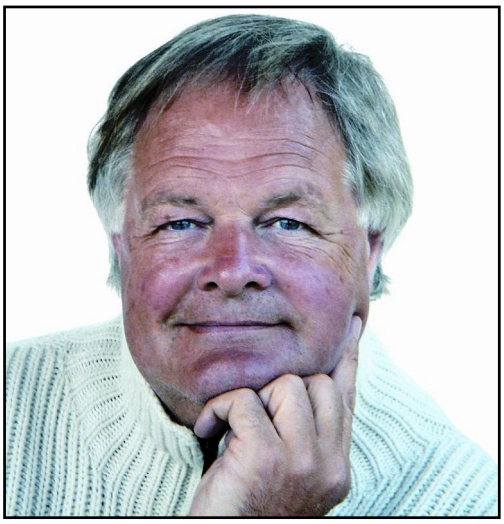
Sykes and Wells and other researchers have made so many fundamental discoveries about genetic anthropology over the last few years that many long-held ideas have been overturned. I visited the National Museum of Natural History in Washington D.C. on 23 December 2008 just after it reopened following a two-year overhaul. In the Anthropology section almost all of the displays had notices to the effect "This exhibit is out of date and is being revised." Wells's books concentrate on our descent from 'Adam' and 'Eve' in Africa and follow migration through the various branches—including seven in Europe—all over the world. Sykes's books concentrate on seven maternal groups in Europe and the streams that populated Great Britain and Ireland. Both authors include a fair degree of technical genetic information.

DNA testing is a powerful tool with limited applications for genealogy. When two donors are available it can prove and disprove paternity and familial relationships. Analysis of the DNA of one person, however, will not provide details about any specific ancestors of that person. It will provide information about the deep ancestry of that person's direct paternal and direct maternal lines, such as where and when these people lived many years ago. It does this by analyzing specific sites on the Y chromosome, which is passed virtually unchanged from father to son, and on the mitochondrial DNA, which is passed virtually unchanged from a mother to her children.

DNA is so stable that, when a mutation does occur in one person, it is passed unchanged down the line for tens of thousands of years. Hence, if a particular mutation is detected in your DNA it may be traced back to the person who initiated that mutation. Because mutations tend to occur only once every few thousand years, geneticists can tell approximately when each of these key mutations occurred by the number that have accumulated. By testing native populations in a geographic location, they can determine the predominant DNA mutations and work out which groups populated that area and when.

Hence a man can have DNA analysis made on his Y chromosome and mitochondrial DNA to find those details about distant ancestors of his father's father's father's … father and his mother's mother's mother's … mother. A woman can find out these details by getting analyses on her mtDNA and on the Y chromosome for a close male relative. I cannot find out these details about my mother's father because he

didn't pass on his Y to her. And I cannot find out these details about my father's mother because he didn't pass on her mtDNA to me.



So, from the second generation of my ancestors (my grandparents) I am only getting 50% of the information about these details. From the third generation (my great grand parents) I am only getting 25% of the information. For distant generations I will only be getting a tiny fraction of this information. But the further back we go the less distance people traveled to find mates. Thousands of years ago Chinese people did not marry Australian aborigines and Native Americans did not marry Arabs. So finding out about my direct paternal and maternal lines will give me valuable information about my ancestors.

Figure 2. Bryan Sykes, founder of Oxford Ancestors, Ltd.

The availability of DNA genealogical information has created a new industry, with all the benefits and dangers of any new industry. Some of the dangers I sense are that irresponsible entrepreneurs may be tempted to charge customers for shoddy DNA analysis, and enthusiastic genealogists may get seduced by the science and spend a lot of time with other people who have got sucked into DNA mania, instead of spending time investigating more immediate ancestors via parish records and contacting like-minded researchers.

At this stage I am not interested in pursuing a Clan Macnachtan group DNA project nor am I willing to act as group coordinator, though such a person may emerge. This article is intended to survey the possibilities for pursuit of an individual's DNA genealogy. It seems there are currently three major routes—The Genographic Project, Family Tree DNA and Oxford Ancestors.

THE GENOGRAPHIC PROJECT

The Genographic Project [6] is a global research partnership of National Geographic and IBM. Dr. Spencer Wells and a group of scientists are attempting to collect and analyze 100,000 DNA samples from indigenous people all over the world to learn about the migration paths our ancestors took and how humankind populated the planet. Anyone can participate by contributing a DNA sample. At the time of writing, a participation kit costs 99.95 USD plus $7.55 shipping and handling plus tax. Each test must be specified as maternal or paternal lineage. Public participant cheek-swab samples are processed at the Arizona Research Lab at the University of Arizona via Family Tree DNA, "the leading genetic genealogy company that has been selected to perform the public participant testing for the Project." Your tests and results will remain anonymous unless your elect a free transfer to Family Tree DNA (see below).

The maternal lineage kit receives the mitochondrial DNA (mtDNA) test on the Hypervariable Region 1 (HVR1: 16023 to 16569) and compares the results to the Cambridge Reference Sequence to determine your Haplogroup assignment. This will give the approximate location of your ancestral maternal clan at various times in history since our common female ancestor lived in Africa about 150,000 years ago. There were other females around at this time, but their progeny have not survived, so we are all descended from "mitochondrial Eve." You may have noticed a similar effect in your own family research, where not all the branches survived because some did not have children and some died out.

The paternal lineage kit receives the Y chromosome test on 12 sites; if this does not conclusively indicate a paternal Haplogroup assignment additional tests may be run. This will give the approximate location of your ancestral paternal clan at various times in history since our common male ancestor lived in Africa about 80,000 years ago. There were other males around at this time, but their progeny have not survived, so we are all descended from "Y Adam." It is curiously unsatisfying from a mythological point of view that this "Adam" and "Eve" did not coexist. On the other hand, perhaps our familiarity with the story of the Garden of Eden can help us understand the scientific facts.

There is only a limited though growing number of Haplogroups so the wanderings of your ancestors will coincide with those of many other people.

Bonus items with participation in the Genographic Project include a DVD with an overview and "The Journey of Man" a PBS/National Geographic Channel production, a National Geographic map illustrating human migratory history and a detailed brochure. You will be able to visit the Genographic Web site to check the progress of your sample, get your genetic profile and check for more detailed updates.

FAMILY TREE DNA

After purchase of a Y test from the Genographic Project it is possible to transfer the results to Family Tree DNA [7], a separate organization, and purchase a mitochondrial DNA upgrade test for $89. This is $10 less than the equivalent Genographic test but is not anonymous. If you decide to start with a Family Tree Paternal DNA test or if you add their Maternal Lineage test to your Genographic Paternal test you gain these advantages—entry into a database for current and future matching with other participants; access to a personal interactive world map showing possible genetic cousins and your probable familial connection to them; a secure email service to these contacts; a printable certificate with your results, ancient ancestral migration map and ancestral Haplogroup name; and an explanation of the science behind the test and your personal ancestral story. Family Tree is an organization familiar to many genealogists who use its Family Tree Maker software and other services.

BRYAN SYKES AND OXFORD ANCESTORS

Professor Bryan Sykes published two books in the U.S. about the same time as the two by Spencer Wells. Neither author seems to acknowledge the work of the other, though they cover similar areas. We have a first-rate anthropological rivalry here, each with its own branch of service reaching out to the public. Sykes writes a lot about the ground-breaking work that he and others have produced and writes in a populist style. He also discusses the root dispute when his research flew in the face of the "father of anthropological genetics," Professor Luigi Luc Cavalli-Sforza, with whom Wells conducted post-doctoral training at Stanford University's School of Medicine (Wells later served as director of the Populations Genetics Research Group of the Wellcome Trust Centre for Human Genetics at Oxford).

According to Sykes, Sforza formulated the theory of European prehistory that dominated the field from the 1970s to 2000—that Neolithic (New Stone Age) farmers from the Near East overwhelmed the descendants of the Cro-Magnons, who themselves had replaced the Neanderthals. Sykes supposedly exploded these ideas at the end of 1995 and start of 1996 by publishing work that showed that most modern Europeans trace their ancestry back to the hunter gatherers of the Paleolithic (Old Stone Age). In other words, it was farming that took over, not farmers. Wells takes the high road and looks at the global picture, incorporating ideas that Sykes espouses.

Oxford Ancestors Ltd. [8] offers a Matriline Service, a DNA-analysis-based determination of your ancient maternal clan. A section of your mtDNA about 400 base pairs long is compared to thousands of others in their database to determine to which of about 36 worldwide maternal clans you belong. There are seven for

Europe. Your "Seven Daughters of Eve World Clans" certificate will assign you a place in the genealogy of the clan and show how you and the clan mother relate to all the others in the human family and to mT Eve. At the time of writing, this costs 180 GBP, plus 4GBP for postage in the U.K. or 10 GBP for Europe and other countries. If you live in the USA this will cost 190 GBP, which is currently 290 USD since 1 GBP = 1.52 USD. But at the start of 2008, 1 GBP = 2 USD, so the cost in the U.S. fluctuates with the currency conversion rate. It's hard to know without buying and comparing whether the Oxford test would be more valuable than the other two and hence justify the higher expense.

A single Y-Clan service from Oxford costs 180 GBP. It is a DNA-analysis-based determination of a 15-digit Y- Clan signature allowing assessment of your ancient paternal clan. All these customers have free access to an online Y-chromosome database. Male providers can purchase additional genealogical services designed to be used by multiple participants in a Surname Study Group or Family Association. Several of these services cost 135-150 GBP but there is one for 25 GBP called "Tribes of Britain," which assesses the probable tribal origin of the Y chromosome for men whose paternal roots lie within the British Isles. This would be of particular interest to me, but how much more detail will I get about my tribe by paying $328 instead of $108?

To sum up, the Genographic Project seems a good way to get a discreet idea of your ancient maternal and paternal clans. Family Tree DNA gives this information plus access to the worldwide community of fellow seekers. Oxford Ancestors is more expensive but gives more detail for men whose paternal roots lie in the British Isles. This is a rapidly moving field so be on the lookout for new books, new offerings and services, and changing prices. At the time of writing, I decided to take advantage of a limited-time two-for-one offer from Oxford Ancestors and get both my maternal and paternal tests for the price of one.

On 15 April 2010 I returned to the National Museum of Natural History to see the new $21-million David H. Koch Hall of Human Origins, which opened one month earlier. It was worth the wait. The 15,000-square-foot space depicts life and environments over the past 6 million years and includes a display of more than 75 fossil hominid skulls (exact replicas). The director, Cristian Samper, calls this "one of the most significant public and scientific achievements in the 100-year history of the museum" (http://humanorigins.si.edu/).

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