

## The Pivotal<sup>1)</sup> Figure In the Decoding<sup>2)</sup> of The Human Genome<sup>3)</sup>

Bill Clinton and Tony Blair linked up by satellite on June 26 to announce the completion of the first draft of the human genome. Even when the hype is discounted, decoding the 3 bn chemical “letters” of the genome is likely to have a huge impact on science, medicine and our perception of what it means to be human. Although thousands of scientists in dozens of laboratories around the world share credit for the achievement, one individual can be singled out for recognition: Craig Venter.

Dr. Venter, president of Celera, the US genomics company, may represent just one side of the race between the private and public efforts to decode the book of life. But no one stands out in the same way among the leaders of the public Human Genome Project. The controversial<sup>4)</sup> Californian has made vital contributions to the whole enterprise, and his competitive pressure spurred on the public project.

That is certainly his view. “I have been the catalyst for making everything happen on the [fastest possible] time course,” he says. “Some of my worst critics have said I only speeded things up by a year—and even that would have biomedical<sup>5)</sup> research—while the most optimistic<sup>6)</sup> ones have said I made 10 years’ difference.”

Some leaders of the public project are happy to acknowledge Dr. Venter’s contribution. Trevor Hawkins, director of the US Joint Genome Institute, says: “The fact that we are sitting here with a completed draft genome is 100 percent due to Craig and his bold initiative of introducing gene sequencing on an industrial scale, with hundreds of machines working round the clock.”

Celera Genomics was founded in May 1998 as a subsidiary of Perkin—Elmer, the scientific instruments company. (Since then Perkin—Elmer has changed name twice, first to PE and then to Applera.) Equipped with one of the world’s most powerful civil super—computer facilities and 300 of the latest gene sequencing machines from PE’s Applied Biosystems subsidiary<sup>7)</sup>, Dr. Venter set up shop close to the National Institutes of Health (NIH) in Bethesda, Maryland—the federally funded research campus where he had started his career in genomics.

Celera’s stated goal was “to substantially complete the sequencing of the human genome” in 2001. The public Human Genome Project, funded mainly by the US government and Britain’s Wellcome Trust, the world’s richest research charity, was then still aiming for the original completion date of 2005, set when the programme had started 10 years earlier.

The leaders of the public programme—alarmed at the prospect of a private company gaining patent<sup>8)</sup> rights to so much genetic information—promptly accelerated their schedule; in September 1998 they promised a “working draft” of the genome by 2001. But Celera was working even faster than expected and by the end of 1999 it was clear that the company might complete its own draft by mid—2000.

Both sides were then becoming concerned about the damage being done to their image by the increasingly vituperative<sup>9)</sup> race between them. They discussed a collaboration but the talks foundered because the public project’s commitment to immediate open access to all DNA sequences was irreconcilable<sup>10)</sup> with Celera’s

commercial need to retain intellectual property rights over its data.

The bickering<sup>11)</sup> resumed early in 2000, although the two sides patched up their differences sufficiently to soak up the politicians' plaudits together at the genome completion ceremony in June.

In retrospect, however, Dr. Venter sees that all the publicity about the "race to the genome" has brought benefits, too. "On my travels this year I have seen how fascinated people are by this [genetic] information, and my view is that the human competition was a primary reason why they became interested. It had all the elements of melodrama you could want."

In scientific terms, Dr. Venter has made two main contributions to gene discovery.

In conversation with Dr. Venter it becomes clear that his primary motivation is scientific discovery, rather than making millions of dollars or even deriving medical benefits from genomics. He says: "The biggest thrill in life is making scientific breakthroughs. No other reward can compare with that satisfaction."

□by Clive Cookson

## 克瑞格·温特破译人类基因组的关键人物

(2000年)6月26日,比尔·克林顿和托尼·布莱尔通过卫星联合宣布人类基因组第一份框架图已完成。就在人们对宣传将信将疑之际,破译人类基因组30亿个化学“字母”的密码可能对科学、医学以及对人类的观念带来巨大的冲击。虽然全世界数十个研究机构的数千名科学家共享了这一重大成果的荣誉,但是其中一个人却是功劳卓著。他就是克瑞格·温特。

温特博士是美国赛莱拉基因组公司总裁,是在破译生命之书的私营与公家竞赛中独挡一面的私方代表人。相比之下,公家一方的人类基因组计划领导人中,根本找不出一个如此出类拔萃之人。这位加利福尼亚人,是个备受争议的人;但他对揭示人类基因组密码的全部事业做出了无可替代的贡献。由他产生的竞争压力刺激了公家研究工作的进展。

这无疑是他的观点:“我一直在扮演催化剂的作用,即在尽可能短的时间内(以最快速度)促成一切事物”。他说,“一些最恶毒的批评我的人说,我只不过把事情进展的速度加快了一年---甚至对生物医学的研究也是如此---而最乐观的批评者则说,我之所为造成了10年的差距。”

公共项目的一些领导人倒是乐意承认温特博士的贡献。美国联合基因组研究所主任特雷弗·霍金斯说:“事实上,我们今天坐在这里手拿已完成的基因组框架图,百分之百应归功于克瑞格,和他首次大胆地把工业化规模引进到基因测序中,而且是几百台机器不分昼夜地连轴干。”

赛莱拉基因组公司作为伯金艾尔莫科学仪器公司的附属公司成立于1998年5月。(此后伯金艾尔莫两次易名;开始改为PE,后来改为阿普莱拉。)得到世界最强大民用超级电脑设备的装备,和PE应用生物系统附属公司提供的300台最先进的基因测序机器。温特博士把工作间建在位于马里兰州贝塞斯达的全国卫生研究所附近---该研究所是由联邦政府出资的研究机构,他就是在那里开始了其基因研究生涯。

赛莱拉称它的目标是在2001年“真正完成人类基因组测序工作”。而在10年前启动的公共人类基因组项目---主要由美国政府与英国维尔考姆信托基金(世界上最富有的研究赞助机构)出资赞助,当时仍然将他们的计划完成日期定在2005年。

公共项目的领导者们对一家私人公司打算将那么多遗传信息申请专利，感到惊慌失措。于是，他们加快了他们的进程。1998年9月，他们承诺到2001年可以拿出基因组“研究草图”。然而，赛莱拉的工作进程比预期的更快。到1999年底情况已经很清楚，这家公司可能在2000年中期完成它的草图。

于是，双方开始担忧彼此不断升级的相互指责会损害各自的形象。他们协商合作。但是，协商失败。因为公共项目组要求立即开放所有DNA测序方法，这与赛莱拉控制资料想获取知识产权的商业需求构成不可调和的矛盾。

就这样，2000年初又恢复争吵，尽管在6月双方充分弥和了分歧以响应政治家们的撮合---共同出席了完成基因组发布会。

然而，回过头一想，温特博士发现“基因组揭秘竞赛”的宣传也有好处。“这一年里在我所到之处，我发现人们对有关遗传的信息是那么的着迷。在我看来，人类的竞争是他们感兴趣的根本原因。这其中你可以找到你想要看的情节紧张剧中的一切要素。”

从科学角度上看，温特博士在基因发现中做出了两大贡献。

在与温特博士的谈话期间，我们发现事情已很清楚，他的原始动机是为了科学发现，绝不是为了赚大把大把的美钞。或从基因组学中捞到医学方面的好处。他说：“人生最大的快慰莫过于科学突破，没有什么奖赏能与之相比。”

### NOTE 注释：

pivotal ['pivətəl] adj. 枢轴的，关键的

decoding [di'kəudiŋ] n. 译码，解码

genome ['dʒi:nəʊm] n. [生]基因组，染色体组

controversial [ˌkɒntre'vɜ:ʃəl] adj. 争论的，争议的

biomedical [ˌbaɪəu'medɪkəl] adj. 生物(学和)医学的

optimistic [ˌɒptɪ'mɪstɪk] adj. 乐观的

subsidiary [səb'sɪdʒəri] adj. 辅助的，补充的

patent ['peɪtənt, 'pætənt] n. 专利权

vituperative [vɪ'tju:pərətɪv, -reɪ-, vaɪ-] adj. 责骂的，指责的

irreconcilable [ɪ'rekənsaɪləbl] adj. 不能协调的，矛盾的

bickering ['bɪkərɪŋ] n. 争吵[论]