

Craig Venter

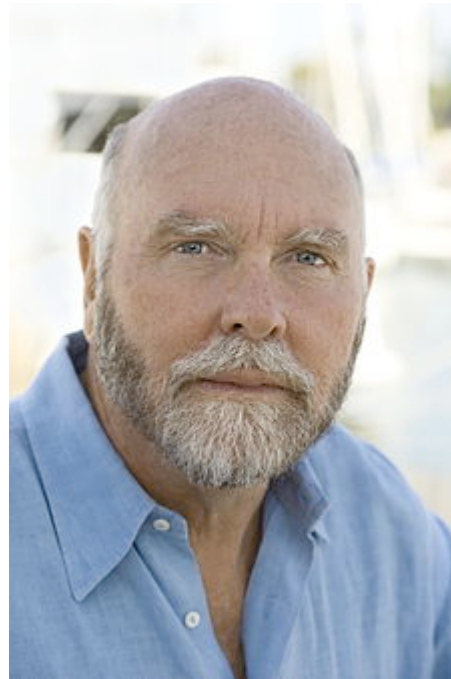
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John Craig Venter (born October 14, 1946) is an American biologist and entrepreneur, most famous for his role in being one of the first to sequence the human genome^[1] and for his role in creating the first cell with a synthetic genome in 2010.^{[2][3]} Venter founded Celera Genomics, The Institute for Genomic Research and the J. Craig Venter Institute, now working at the latter to create synthetic biological organisms and to document genetic diversity in the world's oceans. He was listed on *Time* magazine's 2007 and 2008 Time 100 list of the most influential people in the world. In 2010, the British magazine *New Statesman* listed Craig Venter at 14th in the list of "The World's 50 Most Influential Figures 2010".^[4]

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J. Craig Venter



Craig Venter in 2007

Born	October 14, 1946 Salt Lake City, Utah, USA
Institutions	State University of New York at Buffalo National Institutes of Health J. Craig Venter Institute
Alma mater	University of California, San Diego
Known for	DNA Human genome Metagenomics Synthetic genomics Shotgun approach to genome sequencing
Notable awards	Kistler Prize (2008), ENI award (2008), National Medal of Science (2008)

Early life

Venter was born in Salt Lake City, Utah. In his youth, he did not take his education seriously, preferring to spend his time on the water in boats or surfing.^[*citation needed*] According to his biography, *A Life Decoded*, he was said to never be a terribly engaged student, having Cs and Ds on his eighth-grade report cards.^[5]

Although he was against the Vietnam War,^[6] Venter was drafted and enlisted in the United States Navy where he worked in the intensive-care ward of a field hospital.^[7] While in Vietnam, he attempted to commit suicide by swimming out to sea, but changed his mind more than a mile out.^[8] Being confronted with wounded, maimed, and dying soldiers on a daily basis instilled in him a desire to study medicine^[9] — although he later switched to biomedical research.

Education

Venter graduated from Mills High School and began his college career at a community college, College of San Mateo in California. He received his B.S. degree in biochemistry in 1972, and his Ph.D. degree in physiology and pharmacology in 1975, both from the University of California, San Diego. At UCSD, he studied under biochemist Nathan O. Kaplan,^[10] and married former Ph.D. candidate Barbara Rae.^{[11][12][13][14]} After working as an associate professor, and later as full professor, at the State University of New York at Buffalo, he joined the National Institutes of Health in 1984. In Buffalo, he divorced Dr. Rae-Venter and married his student, Claire M. Fraser,^[12] remaining married to her until 2005.^[15]

Discovery

While at the NIH, Venter learned of a technique for rapidly identifying all of the mRNAs present in a cell and began to use it to identify human brain genes. The short cDNA sequence fragments discovered by this method are called expressed sequence tags (ESTs) a name coined by Anthony Kerlavage at The Institute for Genomic Research. The NIH initially led an effort to patent these gene fragments, in which Venter coincidentally and controversially became involved.^[16] The NIH later withdrew the patent applications, following public outcry. Subsequent court cases declared that ESTs were not directly patentable.^[17]

Human Genome Project

Venter was passionate about the power of genomics to radically transform healthcare. Venter believed that shotgun sequencing was the fastest and most effective way to get useful human genome data.^[18] The method was controversial, however, since some geneticists felt it would not be accurate enough for a genome as complicated as that of humans.^[19] Frustrated with what Venter viewed as the slow pace of progress in the Human Genome project, and unable to get funds for his ideas, he sought funding from the private sector to fund Celera Genomics.^[20] The goal of the company was to sequence the entire human genome and release it into the public domain for non-commercial use in much less time and for much less cost than the public human genome project. The company planned to monetize their work by creating a value-added database of genomic data to which users could

subscribe for a fee. The goal consequently put pressure on the public genome program and spurred several groups to redouble their efforts to produce the full sequence. DNA from five demographically different individuals was used by Celera to generate the sequence of the human genome; one of the individuals was Venter himself. In 2000, Venter and Francis Collins of the National Institutes of Health and U.S. Public Genome Project jointly made the announcement of the mapping of the human genome, a full three years ahead of the expected end of the Public Genome Program. The announcement was made along with US President Bill Clinton, and U.K. Prime Minister Tony Blair.^[21] Venter and Collins thus shared an award for "Biography of the Year" from A&E Network.^[22] Celera published the first Human Genome in the journal *Science*, and was soon followed by a Human Genome Project Publication in *Nature*.^{[23][24]} Despite some claims that shotgun sequencing was in some ways less accurate than the clone-by-clone method chosen by the Human Genome Project,^[25] the technique became widely accepted by the scientific community and is still the de facto standard used today.

Although Celera was originally set to sequence a composite of DNA samples, partway through the sequencing, Venter switched the samples for his own DNA.^[26]

After contributing to the Human Genome, and its release into the public domain, Venter was fired by Celera in early 2002.^[27] According to his biography, Venter was ready to leave Celera, and was fired due to conflict with the main investor, Tony White, that had existed since day one of the project. Venter writes that his main goal was always to accelerate science and thereby discovery, and he only sought help from the corporate world when he couldn't find funding in the public sector.

Ocean sampling

The Global Ocean Sampling Expedition (GOS) is an ocean exploration genome project with the goal of assessing the genetic diversity in marine microbial communities and to understand their role in nature's fundamental processes. Begun as a Sargasso Sea pilot sampling project in August 2003, Craig Venter announced the full Expedition on 4 March 2004. The project, which used Craig Venter's personal yacht, *Sorcerer II*, started in Halifax, Canada, circumnavigated the globe and returned to the U.S. in January 2006.^[28]

Current work

Venter is currently the president of the J. Craig Venter Institute, which conducts research in synthetic biology. In June 2005, he co-founded Synthetic Genomics, a firm dedicated to using modified microorganisms to produce clean fuels and biochemicals. In July 2009, ExxonMobil announced a \$600 million collaboration with Synthetic Genomics to research and develop next-generation biofuels.^[29]

Venter is a member of the USA Science and Engineering Festival's Advisory Board.^[30]

Media coverage

Venter has been the subject of articles in several magazines, including *Wired*,^[31] *The Economist*,^[32] Australian science magazine *Cosmos*,^{[33][34]} and *The Atlantic*.^[35] Additionally, he was featured on *The Colbert Report* on both February 27, 2007, and October 30, 2007.

Venter appeared in the "Evolution" episode of the documentary television series *Understanding*.

On May 16, 2004, Venter gave the commencement speech at Boston University.^[36]

In a 2007 interview with *New Scientist* when asked "Assuming you can make synthetic bacteria, what will you do with them?", Venter replied:

Over the next 20 years, synthetic genomics is going to become the standard for making anything. The chemical industry will depend on it. Hopefully, a large part of the energy industry will depend on it. We really need to find an alternative to taking carbon out of the ground, burning it, and putting it into the atmosphere. That is the single biggest contribution I could make.

Furthermore it suggests that one of the main purposes for creating synthetic bacteria would be to reduce the dependence on fossil fuels through bioremediation.^[37]

On May 10, 2007, Venter was awarded an honorary doctorate from Arizona State University,^[38] and on October 24 of the same year, he received an honorary doctorate from Imperial College London.^[39]

He was on the 2007 Time 100 most influential people in the world list made by Time magazine. In 2007 he also received the Golden Eurydice Award for contributions to Biophilosophy.

On September 4, 2007, a team led by Venter published the first complete (six-billion-letter) genome of an individual human — Venter's own DNA sequence.^[40] When on BBC News on October 22, 2007, when asked about his religious view he replied that he thought that a true scientist could not believe in supernatural explanations.

On December 4, 2007, Venter gave the Dibleby lecture for the BBC in London. He outlined his current work and future developments in genetics.

In February 2008, he gave a speech about his current work at the TED conference.^[41]

Venter delivered the 2008 convocation speech for Faculty of Science honours and specialization students at the University of Alberta. A transcription of the speech is available here (<http://venter2008conv.jottit.com/>) .^[42]

Dr. Venter was featured in Time Magazine's "The Top 10 Everything of 2008" article. Number three in 2008's Top 10 Scientific Discoveries was a piece outlining his work stitching together the 582,000 base pairs necessary to invent the genetic information for a whole new bacterium.^[43]

Dr. Venter took part in the inaugural San Diego Science Festival (<http://mysdscience.com/>) and spoke at its press conference on February 26, 2009.

On April 6, 2009, Venter gave a speech at Arizona State University as part of the Origins Symposium.

For an episode aired on July 27, 2009, Venter was interviewed on his boat by BBC One for the first episode of TV show *Bang Goes the Theory*.

On May 8, 2010, Venter received an honorary doctor of science degree from Clarkson University for his work on the human genome.^[44]

On May 20, 2010, Venter announced the creation of first self-replicating semi-synthetic bacterial cell.^[45]

On November 21, 2010 Steve Kroft profiled J. Craig Venter and his research on 60 minutes.

On April 21, 2011, Venter received the 2011 Benjamin Rush Medal from William & Mary School of Law.^[46]

In the June 2011 issue of Men's Journal, Venter was featured as the "Survival Skills" celebrity of the month. He shared various anecdotes, and advice, including stories of his time in Vietnam, as well as mentioning a bout with melanoma upon his back, which subsequently resulted in "giving a pound of flesh" to surgery.^[47]

Individual human genome sequenced

On September 4, 2007, a team led by Sam Levy published the first complete (six-billion-letter) genome of an individual human—Venter's own DNA sequence.^[40] Some of the sequences in Venter's genome are associated with wet earwax,^[48] increased risk of antisocial behavior, Alzheimer's and cardiovascular diseases.^[49] This publication was especially interesting since it contained a diploid instead of a haploid genome and shows promise for personalized medicine via genotyping. This genome, rather immodestly dubbed HuRef by Levy and others., was a landmark accomplishment and as of mid-2010 is probably the highest quality personal genome sequence yet completed.

The Human Reference Genome Browser is a web application for the navigation and analysis of Venter's recently published genome. The HuRef database consists of approximately 32 million DNA reads sequenced using microfluidic Sanger sequencing, assembled into 4,528 scaffolds and 4.1 million DNA variations identified by genome analysis. These variants include single-nucleotide polymorphisms (SNPs), block substitutions, short and large indels, and structural variations like insertions, deletions, inversions and copy number changes.

The browser enables scientists to navigate the HuRef genome assembly and sequence variations, and to compare it with the NCBI human build 36 assembly in the context of the NCBI and Ensembl annotations. The browser provides a comparative view between NCBI and HuRef consensus sequences, the sequence multi-alignment of the HuRef assembly, Ensembl and dbSNP annotations, HuRef variants, and the underlying variant evidence and functional analysis. The interface also represents the haplotype blocks from which diploid genome sequence can be inferred and the relation of variants to gene annotations. The display of variants and gene annotations are linked to external public resources including dbSNP, Ensembl, Online Mendelian Inheritance in Man (OMIM) and Gene Ontology (GO).

Users can search the HuRef genome using HUGO gene names, Ensembl and dbSNP identifiers, HuRef contig or scaffold locations, or NCBI chromosome locations. Users can then easily and quickly browse any genomic region via the simple and intuitive pan and zoom controls; furthermore, data relevant to specific loci can be exported for further analysis.

Mycoplasma laboratorium

Venter is seeking to patent the first life form created by humanity, possibly to be named *Mycoplasma laboratorium*.^[50] There is speculation that this line of research could lead to producing bacteria that have been engineered to perform specific reactions, for example, produce fuels, make medicines, combat global warming, and so on.^[51]

In May 2010, a team of scientists led by Venter became the first to successfully create what was described as "synthetic life".^{[52][53]} This was done by synthesizing a very long DNA molecule containing an entire bacterium genome, and introducing this into another cell, analogous to the accomplishment of Eckard Wimmer's group, who synthesized and ligated an RNA virus genome and "booted" it in cell lysate.^[54] The single-celled organism contains four "watermarks"^[55] written into its DNA to identify it as synthetic and to help trace its descendants. The watermarks include

1. Code table for entire alphabet with punctuations
2. Names of 46 contributing scientists
3. Three quotations
4. The web address for the cell.^[56]

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Venter is an ISI highly cited researcher and has authored over 200 publications in scientific journals.^[57]

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See also

- Artificial gene synthesis
- Full genome sequencing
- Genetic testing
- *Genome: The Autobiography of a Species in 23 Chapters*
- Metagenomics
- Personal genomics
- Pharmacogenomics
- Predictive medicine

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External links

- J. Craig Venter Institute (<http://www.jcvi.org/>)
- Sorcerer II Expedition (<http://www.sorcerer2expedition.org/version1/HTML/main.htm>)
- Synthetic Genomics (<http://www.syntheticgenomics.com/>)
- The Institute for Genomic Research (TIGR) (<http://www.jcvi.org>)
- HuRef Genome Browser (<http://huref.jcvi.org>)

Media

- Craig Venter (http://www.ted.com/speakers/craig_venter.html/) at TED Conferences
- Craig Venter (<http://www.charlierose.com/guest/view/81>) on *Charlie Rose*
- Craig Venter (http://topics.nytimes.com/top/reference/timestopics/people/v/j_craig_venter/) collected news and commentary at *The New York Times*
- Cracking the code to life (<http://www.guardian.co.uk/science/2007/oct/08/genetics.scienceandnature>) , *The Guardian*, October 8, 2007
- Craig Venter interview (http://www.pbs.org/kcet/wiredscience/video/289-craig_venter.html) , *Wired Science*, December 2007 (video)
- Radio interview (<http://philosophytalk.org/pastShows/Genomics.html>) on Philosophy Talk
- Video of interview/discussion with Craig Venter (<http://bloggingheads.tv/diavlogs/398>) by Carl Zimmer on Bloggingheads.tv
- Craig Venter: A voyage of DNA, genes and the sea (<http://www.youtube.com/watch?v=E5X6Qy772YU>) – TED (Technology Entertainment Design) conference (video)
- Webcast of Venter talk 'Genomics: From humans to the environment' (http://www.21school.ox.ac.uk/video/200710_venter.cfm) at The James Martin 21st Century School
- The Richard Dimbleby Lecture 2007 – Dr. J. Craig Venter – A DNA Driven World (<http://video.google.com/videoplay?docid=4893602463025557866>)
- A short course on synthetic genomics. Edge Master Class 2009 (http://www.edge.org/3rd_culture/church_venter09/church_venter09_index.html)
- "J. Craig Venter: Designing Life (http://www.cbs.com/primetime/60_minutes/) ". *60 Minutes*. CBS. 2010-11-21.

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