are like files packed and stored in a file cabinet.

In addition, the team discovered how DNA manages to compact itself into the nucleus. Lieberman-Aiden was looking for a physical model that could explain the group's data when he found the answer: in a 1988 physics paper predicting that a molecule similar to DNA could form a structure resembling a Peano curve—a fractal design discovered in 1890 by an Italian mathematician that allows a continuous curve to densely fill a space without ever crossing itself (see the image above).

DNA, it turns out, crumples into a hierarchical series of folds that enable it to pack densely without forming knots or tangles. The researchers call this structure a fractal globule. And Lieberman-Aiden says it makes perfect sense as a way to manage the information in the genome. “If I was trying to build a library, I’d want the volumes to be compact in one place, I’d want them to be organized, and I’d want them to be accessible,” he explains. A fractal globule allows the genome to follow these same principles.

Although the current study provides a fundamental insight into genome organization, Dekker says the “resolution of the current spatial map we’ve built is not high enough.” Right now, the map is at the level of a single megabase, or one million base pairs—the equivalent of breaking the entire genome into 3,000 pieces. It will require many more iterations of the technique to be able to resolve structure on a smaller level.

Lieberman-Aiden says other scientists “have realized that this type of approach to studying the three-dimensional structure of the genome is really quite transformative.” An improved three-dimensional map of DNA’s structure could help answer questions about how genes work that aren’t apparent in the genome sequence—for instance, how genes are controlled by other DNA sequences in the genome called regulatory elements. These stretches of DNA often are not adjacent to their target genes in sequence, but they may turn out to be close together in physical space. The researchers also plan to study how the DNA map varies among cells from different species and among different cell types. The mapping technique could even offer new insights, they believe, into differences between cells that are healthy and those that are diseased. —COURTNEY HUMPHRIES

A QUANT’S QUANDARY

**Family or Fortune**

**T**hat investment banking isn’t a relaxing career is perhaps obvious. But new research by Lee professor of economics Claudia Goldin and Allison professor of economics Lawrence Katz shows just how bad the quality of life is for financial-sector workers. The field stacks up as even more inflexible than other professions with a reputation for being demanding, such as medicine and law.

And their research shows the particularly high price paid by women who go into finance. In their Harvard and Beyond survey of 6,500 Harvard and Radcliffe graduates from various classes between those of 1969 and 1992, Goldin and Katz found that women who had gone on to earn an M.B.A. after graduating from Harvard were far less likely to be employed and have children at the time of their fiftieth reunion than were female respon-

dents holding M.D. degrees: less than half of the M.B.A.s reported both having children and working, versus two-thirds of the M.D.s. Among the M.B.A.s, only 30 percent worked full-time, year-round, and had children, whereas 45 percent of the M.D.s did.

Women have undoubtedly made gains in terms of access to business careers: the female component among entering M.B.A. classes nationwide has surpassed 40 percent, up from 10 percent in the 1970s. But in terms of being able to choose careers they want within those fields, as opposed to having to abandon professional goals for the sake of family, women still have far to go.

Goldin and Katz conclude that female M.B.A.s with children select professions with shorter hours, compared to their male peers with children and childless peers of both genders. Analysis of data from a different survey—this one of 2,500 male and female University of Chicago M.B.A.s from the graduating classes of 1990 through 2006, conducted by Goldin, Katz, and University of Chicago economist Mari-anne Bertrand, Ph.D. ’98—showed that only 8 percent of respondents working in venture capital were women; among those in investment banking, only 15 percent were. But among those working in human resources, 71 percent were women; in advertising, that number was 59 percent.

The researchers also asked the M.B.A.s how many hours they worked per week; the occupations with the highest numbers of men also had the highest average number of hours worked (investment banking and consulting, at 74 and 61 hours per week, respectively). Conversely, those with the highest numbers of women had the shortest hours (human resources and advertising, at 51 and 52 hours a week, respectively).

A similar sorting occurs in medicine,
where specialties with shorter and more predictable hours tend to be more heavily female. Women now make up 41 percent of new M.D.s nationwide, but less than 30 percent of physicians under 35 practicing emergency medicine or general surgery. Meanwhile, 70 percent of gynecologists and nearly 60 percent of dermatologists in that same age bracket are women.

But in balancing work and family, women in finance make especially large sacrifices. In the Harvard and Beyond survey, Goldin and Katz found that female M.B.A.s took more time off after having a child than did their peers with other advanced degrees, and that even after correcting for the amount of time out of work, this group of women saw the largest pay decrease compared to peers who took no time off. Female M.B.A.s who took a year and a half off made 41 percent less than their counterparts who had worked continuously. For J.D.s who took time off, the pay gap was 29 percent. And for M.D.s, the gap (16 percent) was even less than the gap facing women with no graduate degree (25 percent).

People who opt out of investment banking for some other financial specialty (as women more commonly do) also forgo compensation. Nine years after graduating, the Chicago M.B.A.s working in investment banking (both male and female) were making, on average, $570,000 a year (the median was $470,000), compared to an average income for the entire survey pool of $370,000, and a median income of $190,000.

There wasn’t much difference between the incomes of male and female respondents in their first jobs after graduation, but the genders’ incomes diverged further with each subsequent year, in part due to choosing different specialties. Although the number of Harvard graduates pursuing financial careers has dropped, it is still substantial:

last spring’s Crimson senior survey showed that, among College graduates entering the workforce, 20 percent were heading for finance and consulting—down from 47 percent in 2007 and 39 percent in 2008 (see “Flocking to Finance,” May-June 2008, page 18).

Goldin advises students considering those fields to go in with eyes open. For the most part, she says, “you choose a sector because of your passion, not because of work-life balance.” Within any sector, she adds, “people assume that they can find some choice and some accommodation.” But if the field they are considering is finance, they may want to weigh those issues more carefully. ～ELIZABETH GUDRAIS

CLAUDIA GOL DIN E-MAIL ADDRESS: cgoldin@fas.harvard.edu
CLAUDIA GOL DIN WEBSITE: www.economics.harvard.edu/faculty/goldin

PROFESSOR ANDREW BERRY, LECTURER ON ORGANISMIC AND EVOLUTIONARY BIOLOGY

Undergraduates sequencing their own DNA as part of a new course that combines the history of Darwinism with the science of evolutionary biology

[REINVigorating Liberal Arts Education]

Support the Harvard College Fund