For readers interested in more about the science behind *Blood Memory Society, this is for you! – D.A. Field*

Nuclear DNA is the DNA found in the nucleus of the great majority of cells in our bodies.
It is a blueprint that describes our biological construction. Our nuclear DNA is the product of a combining of nuclear DNA from both our parents, each half is taken from the egg and sperm "gametes" of each parent. The resulting DNA may have many segments - genes – similar to either parent but is essentially a new distinctly different code (there is one exception - the Y chromosome - which can only be passed identically from father to son since the mother's egg has no version to contribute; therefore, it too can serve the ancestry-tracing role discussed below).

There is, however, another type of DNA in our cells. Inside the cell are energy production factories called "mitochondria" which have their own DNA. This may be because, long ago, there were two different types of early lifeforms on earth with evolution chugging along at a snail's pace in the oceans. At some point, a dramatic change in the pace of evolution occurred in which the number of species greatly accelerated. This is known as the "Cambrian Explosion. "
Virtually all higher life is known to evolve since that time has had mitochondria serving as a cell within a cell. One acting as a power plant in service to the outer multitasking cell. What's so useful about mitochondrial DNA to people interested in ancestry is that it is not created by blending parental DNA.

The father's gamete, the sperm, uses its mitochondria to power its whip-like tail to allow it to move quickly – the tail is lost during egg penetration. Mitochondrial DNA does not affect anything we'd notice, like hair color or height. It only affects the power plant function of the mitochondria, which only matters in the case of some very rare genetic disorders. Since no combining is involved, this can be viewed as a sort of stamp that exactly identifies your matrilineal line. Thus you, your mother, your mother's mother, etc. , on back through the ages, all have the same mitochondrial DNA, save for the occasional mutation that might mess with one or two genes here and there over the course of millennia.

It is, therefore, possible to figure out where your matrilineal ancestors were from. Genetic memory (aka race memory or ancestral memory) refers to what we know when we're born but never had to learn. Doing more than determining our hair color, our genes can give us an instinctual fear of snakes or equip us with a suckling reflex the moment we are born.

At first glance, genetic memory seems less important in humans than most other lifeforms because humans have a lengthy childhood and big brains in which to learn all that's needed to thrive. A newborn lion cub knows almost enough to survive on its own, but a human baby would have no chance left on its own. Nevertheless, it's long been understood that newborn humans do know some things, like how to suckle. These genetic memories are passed down more or less unchanged across the ages. It has also been demonstrated that some things can be passed down that are less ancient, like the effects of trauma. It was generally assumed that these events only caused genetic damage rather than constructive messages and therefore couldn't be of any long term use. Recent studies are uncovering much more sophisticated
memories being passed across multiple generations in some animals. For example, mice that were subjected to electric shock every time they smelled cherry blossoms sired generations of mice that feared the smell of cherry blossoms.

If DNA can encode simple memories, could it store a vast library of memory? Just a few years ago researchers were able to create DNA that was encoded with content translated from five files, including a PDF and an audio recording. The synthetic DNA was then successfully “read” by another lab and translated back into computer files. The process is frightfully expensive right now, but may be affordable in our lifetimes. Genetic storage is very dense: the researchers estimate that a teacup full of DNA could store about 100 million hours of HD video. Under the right conditions, DNA is very stable – we have viable samples from prehistoric times.

So, could our DNA store our own memories or the memories of our ancestors? The potential stumbling blocks to such an outcome are many, but capacity itself is not the most likely issue. More mysterious is the mechanisms that would be required. Our brains store memories dynamically, not statically. In other words, there isn't a file in your brain somewhere containing your 10th birthday. Instead, certain neural sequences of your thoughts and perceptions of that day were shunted to “long-term” memory. They have been firing ever since like a hot potato that keeps being passed around. Turning that into a coded string and then, somehow, adding that to a portion of DNA that isn't needed for something else, well that fits the definition of Herculean Task nicely.

Still, if there already are some memories getting passed on, somehow, why not more?
Now, let's press these two topics together. Mitochondrial DNA is passed down through the ages, a sort of matrilineal archive. Genetic memory can encode for more than just basic survival skills. Together you get the exciting basis for my new sci-fi novel series, *Blood Memory Society*, that speculates about a group of humans who do possess the collective memories of their ancestors.

***