CHAPTER 6.

MAKING MORE BY MAKING LESS. The Evolution of Female Menopause.

Section 3.

If one were playing God or Darwin and trying to decide whether to make older women undergo menopause or remain fertile, one would draw up a balance sheet, contrasting the benefits of menopause in one column with its costs in the other column. The costs of menopause are the potential children that a woman forgoes by undergoing menopause. The potential benefits include avoiding the increased risk of death due to childbirth and parenting at an advanced age, and gaining the benefit of improved survival for one's grandchildren and prior children. The sizes of those benefits depends on many details: How large is the risk of death in and after childbirth? How much does that risk increase with age? How large would the risk of death be at the same age even without children or the burden of parenting? How rapidly does fertility decrease with age before menopause? How rapidly would it continue to decrease in an aging woman who did not undergo menopause? All these factors are bound to differ between societies and are not easy to estimate. Hence anthropologists remain undecided whether the two considerations that I have discussed so far—investing in grandchildren and protecting one's prior investment in existing children—suffice to offset menopause's foreclosed option of further children and thus to explain the evolution of human female menopause.

But there is still one more virtue of menopause, one that has received little attention. That is the importance of old people to their entire tribe in preliterate societies, which constituted every human society in the world from the time of human origins until the rise of writing in Mesopotamia around 3300 b.c. Textbooks of human genetics regularly assert that natural selection cannot weed out mutations tending to cause damaging effects of age in old people. Supposedly there can be no selection against such mutations because old people are said to be "post-reproductive." I believe that such assertions overlook an essential fact that distinguishes humans from most animal species. No human, except a hermit, is ever truly post-reproductive in the sense of being unable to benefit the survival and reproduction of other people bearing one's genes. Yes, I grant that if any orangutans lived long enough in the wild to become sterile, they would count as post-reproductive, since orangutans other than mothers with one young offspring tend to be solitary. I also grant that the contributions of very old people to modern literate societies tend to decrease with age—a new phenomenon at the root of the enormous problems that old age now poses, both for the elderly themselves and for the rest of society. Today, we moderns get most of our information through writing, television, or radio. We find it impossible to conceive of the overwhelming importance of elderly people in preliterate societies as repositories of information and experience.

Here is an example of that role. In my field studies of bird ecology on New Guinea and adjacent Southwest Pacific islands, I live among people who traditionally had been without writing, depended on stone tools, and subsisted by farming and fishing supplemented by much hunting and gathering. I am constantly asking villagers to toll me the names of local species of birds, animals, and other plants in their local language, and to tell me what they know about each species. It turns out that New Guineans and Pacific islanders possess an enormous fund of traditional biological knowledge, including names for a thousand or more species, plus information about each habitat, behavior, ecology, and usefulness to humans. All that information is important because wild plants and animals traditionally furnished much of the people's food and all of their building materials, medicines, and decorations.

Again and again, when I ask a question about some rare bird, I find that only the older hunters know the answer, and eventually I ask a question that stumps even them. The hunters reply, "We have to ask the old man [or the old woman]." They then take me to a hut, inside of which is an old man or woman, often blind with cataracts, barely able to walk, toothless, and unable to eat any food that hasn't been pre-chewed by someone else. But that old person is the tribe's library. Because the society traditionally lacked writing, that old person knows much more about the local environment than anyone else and is the sole source of accurate knowledge about events that happened long ago. Out comes the rare bird's name, and a description of it.

That old person's accumulated experience is important for the whole tribe's survival. For instance, in 1976 I visited Rennell Island in the Solomon Archipelago, lying in the Southwest Pacific's cyclone belt. When I asked about consumption of fruits and seeds by birds, my Rennellese informants gave Rennell-language names for dozens of plant species, listed for each plant species all the bird and bat species that eat its fruit, and stated whether the fruit is edible for people. Those assessments of edibility were ranked in three categories: fruits that people never eat; fruits that people regularly eat; and fruits that people eat only in famine times, such as after—and here I kept hearing a Rennell term initially unfamiliar to me—after the hungi kengi. Those words proved to be the Rennell name for the most destructive cyclone to have hit the island in living memory—apparently around 1910, based on people's references to datable events of the European colonial administration. The hungi kengi blew down most of Ren-nell's forest, destroyed gardens, and drove people to the brink of starvation. Islanders survived by eating the fruits of wild plant species that normally were not eaten, but doing so required detailed knowledge about which plants were poisonous, which were not poisonous, and whether and how the poison could be removed by some technique of food preparation.

When I began pestering my middle-aged Rennellese informants with my questions about fruit edibility, I was brought into a hut. There, in the back of the hut, once my eyes had become accustomed to the dim light, was the inevitable, frail, very old woman, unable to walk without support. She was the last living person with direct experience of the plants found safe and nutritious to eat after the hungi kengi, until people's gardens began producing again. The old woman explained to me that she had been a child not quite of marriageable age at the time of the hungi kengi. Since my visit to Rennell was in 1976, and since the cyclone had struck sixty-six years before, around 1910, the woman was probably in her early eighties. Her survival after the 1910 cyclone had depended on information remembered by aged survivors of the last big cyclone before the hungi kengi. Now, the ability of her people to survive another cyclone would depend on her own memories, which fortunately were very detailed.

Such anecdotes could be multiplied indefinitely. Traditional human societies face frequent minor risks that threaten a few individuals, and they also face rare natural catastrophes or intertribal wars that threaten the lives of everybody in the society. But virtually everyone in a small traditional society is related to each other. Hence it is not only the case that old people in a traditional society are essential to the survival of their own children and grandchildren. They are also essential to the survival of the hundreds of people who share their genes.

Any human societies that included individuals old enough to remember the last event like a hungi kengi had a better chance of surviving than did societies without such old people. The old men were not at risk from childbirth or from the exhausting responsibilities of lactation and child care, so they did not evolve protection by menopause. But old women who did not undergo menopause tended to be eliminated from the human gene pool because they remained exposed to the risk of childbirth and the burden of child care. At times of crisis, such as a hungi kengi, the prior death of such an older woman also tended to eliminate all of her surviving relatives from the gene pool—a huge genetic price to pay for the dubious privilege of continuing to produce another baby or two against lengthening odds. That importance to society of the memories of old women is what I see as a major driving force behind the evolution of human female menopause.

Of course, humans are not the only species that lives in groups of genetically related animals and whose survival depends on acquired knowledge transmitted culturally (that is, non-genetically) from one individual to another. For instance, we are coming to appreciate that whales are intelligent animals with complex social relationships and complex cultural traditions, such as the songs of humpback whales. Pilot whales, the other mammal species in which female menopause is well documented, are a prime example. Like traditional hunter-gatherer human societies, pilot whales live as "tribes" (termed pods) of 50 to 250 individuals. Genetic studies have shown that a pilot whale pod constitutes in effect a huge family, all of whose individuals are related to each other, because neither males nor females resettle from one pod to another. A substantial percentage of the adult female pilot whales in a pod are postmenopausal. While childbirth is unlikely to be as risky to pilot whales as it is to women, female menopause may have evolved in that species because non-menopausal old females tended to succumb under the burdens of lactation and child care.

There are also other social animal species for which it remains to be established more precisely what percentage of females reach postmenopausal age under natural conditions. Those candidate species include chimpanzees, bonobos, African elephants, Asian elephants, and killer whales. Most of those species are now losing so many individuals to human depredations that we may already have lost our chance to discover whether female menopause is biologically significant for them in the wild. However, scientists have already begun to gather the relevant data for killer whales. Part of the reason for our fascination with killer whales and all of those other big social mammal species is that we can identify with them and their social relationships, which are similar to our own. For just that reason, I would not be surprised if some of those species too turn out to make more by making less.