One lovely summer's day a few years ago looking up from my microscope, I found myself gazing vacantly at the Woods Hole Harbor and the adjacent islands. My mind wandered. Here I was, an old man of 81 years, still operating on the same gorgeous fish embryos in the same cosy laboratory right at the edge of the same inviting sea. Those beautiful embryos are so transparent that one can actually watch individual cells moving from one site to another inside them. I have had a good life studying these exquisite creatures, and others, trying to unlock some of the secrets of their early development; and, I have succeeded often enough to keep me motivated. How does a single egg cell first form an embryo with many similar cells that then form distinct differentiated cells constituting organs—muscles, bones, a liver, a brain, eyes, and genitalia? My story is a tale of love of science, in particular embryology, of ideas and planning and serendipity, of discovery and failure and yet discovery again. It is also a tale of camaraderie and human warmth. In essence, my long life has been one of frequent great fun, relished and lived fully.

Thus, when a former student suggested that I write a memoir, to get my experiences all down, I decided that I should do just that. At first, I was uncharacteristically unsure of myself, in as much as all of my previous published work had been scientific and technical. Some of my former students encouraged me, telling me to “Just write it all down. We’ll help you polish it, once you have a rough draft.” They have had a hand in this collaborative project, just as I had a role in their development as scientists. This memoir has become a cooperative project, just the sort of thing I have cherished most about my life in science. In it, I will try to convey the excitement and joy of scientific inquiry and make sense of what happened to me and why it happened. Along the way, I will describe some of the complex social interactions and the good fortune and good luck that have enriched my life. I should begin at the beginning.
Ancestors

My paternal grandparents, Johann Philip Trinkaus and Amalia Quittmeyer emigrated from Fränkisch Brensbach, a small town in the west of what is now Germany, almost 150 years ago. Apparently my great-grandfather Johann Peter Trinkaus was an artisan, the village blacksmith, who did various kinds of ironwork in the village. Johann Peter’s father, Johann Wilhelm, and his father before him, going back to the seventeenth century, were also blacksmiths. My mother’s grandparents came from Stettin, which became part of Poland after World War II, and were teachers in a Hochschul. Although many Americans and even some Germans like to add an h to the name Trinkaus after the k, it doesn’t belong there. Trinkhaus is a saloon. Trinkaus means “bottoms up,” certainly a merrier nameplate.

I never met my grandfather, Johann Philip. Members of my family told me that he emigrated from Germany in 1854, at the age of 16, to avoid being drafted into the army. In this he was like several of my later students who were also avoiding the draft during the war in Vietnam. My grandfather carried on the metal-working tradition by becoming a steelworker. Of great interest to us all, Johann Philip had a sister, Elizabeth Trinkaus, who married a Portuguese gentleman, Antonio Sousa, and they, like my parents, named their son John Philip, after my grandfather, his uncle. I actually met the famous “March King” when he was very old and I was a youngster in the school band. I remember a large, ornate, dark mansion on the north shore of Long Island with a long, tree-lined driveway leading me to meet a kindly old gentleman with a closely cropped white beard. Mr. Sousa wrote a few lines of The Stars and Stripes Forever for his awed second cousin. That treasured slip of paper has long since disappeared but not my memory of this grand event.

Family and Home

My father, Charles Edward Trinkaus, was born in 1875 in Bridgeport, Connecticut, then a prosperous small manufacturing city. My mother, Franciska Magdalena Krüger, was born in 1885 in Brooklyn, New York, the daughter of Hermann, an accountant. My father became a salesman for the John Hancock Life Insurance Company and made a moderate living at it. My mother became a housewife after marriage. Although my parents were not at all affluent, there was sufficient income to provide us with a small house and yard, and adequate food. Sunday lunch in fact was quite sumptuous. We all were decently clothed and generally in good health. We even had a car. Hence, in contrast to most people in the world, our physical needs were fully satisfied.

Some of my relatives are worth mentioning because they were rather important to me. Uncle Henry, an older brother of my father, was a Methodist
minister and very close to my parents. Indeed, he officiated at their wedding. He was intellectually vigorous, an independently minded gentleman who was quite fond of me, as I was of him. It seemed that often when we visited Uncle Henry and Aunt Amalia, they were in a different parsonage in a different town. I always suspected that he was too independent politically for his church. Uncle George, my father’s younger brother, and also close to my parents, was a musician, orchestra conductor and composer, a graduate of Yale College and the Yale School of Music. He was quite a distinguished composer and a jolly, funny man. His daughter Ruth tells me that she and her sisters still receive royalties for his music. We children liked to see Uncle George. He was much fun. In addition, I liked one of his daughters, dear cousin Ruth. She was exceptionally pretty and we played house together quite innocently at family gatherings. I had a crush on her about seventy years ago.

I was the third of four boys. My parents’ first-born child, a girl, died in infancy, still an unfortunately common heartbreak in the early years of the twentieth century. I don’t know anything about the circumstances surrounding her death. In my German-American family, heartbreak was endured without discussion. My oldest brother, Charles Edward, named after our father, was born in 1911 and, being almost seven years older than I, is only a dim memory from my earliest years. When I was in my teens and throughout college, however, he became quite important as an intellectual role model. The next oldest, christened Wilhelm Krüger, was born in 1914, at the beginning of the First World War. Bill and I were quite close during my early childhood and, in spite of the four-year age difference, played a lot together. My parents changed his first name to William as the First World War dragged on, after they were asked with pointed curiosity whether Wilhelm K. Trinkaus stood for Wilhelm Kaiser Trinkaus. The K was easily explained as the initial for our mother’s maiden name, Krüger, but in light of that era’s virulent anti-German sentiment, my parents decided William would be easier on my brother. I was born May 23, 1918, toward the end of the First World War, and named after my grandfather Johann Philip. I was the third in line. My younger brother, David George, was only two years younger than I, and a frequent playmate (Figure 1.1).

My parents were not well-married. Nevertheless, they provided well for us in many ways. We boys already sensed tension between them as we were growing up. In those days divorce was unthinkable for a respectable, middle-class, white-collar, Protestant couple like my parents. Besides, they had a common project—raising a family. My father was a pleasant, rather meek man who was kindly and took his parental responsibilities seriously. Although he never seemed to take much of a leadership role, he did not spare the rod. I recall his threats to use his razor strop on me when I was too obstreperous, which was often. My mother, in contrast, was dominant, opinionated, driving, and intelligent. Both parents were puritanical, earnest Republicans, and devout
Methodists. They were, by and large, typical bigoted WASPs—anti-Semitic, anti-foreign, and vehemently anti-Catholic. They always referred to Catholics as Roman Catholics. Curiously, they didn’t say much about blacks (called negros in those days). I guess they were too low on the social scale to be considered much of a threat. Anyway, there were not many in our town. My puritanical mother was against a lot of enjoyable activities, but her particular enemy was drinking. She was an active member of the Woman’s Christian Temperance Union (WCTU), and eventually rose to become President of the New York State Chapter. What a waste of ability and energy! My mother’s reaction to alcohol possibly piqued my interest in the grape. Although I don’t think I have led a besotted, dissolute life, I haven’t been exactly a teetotaler either. I enjoy drinking and (especially in my youth) did my fair share of carousing. I still enjoy a good Scotch whiskey before dinner and a beer in the evening.

My mother’s drive and self-righteousness were obviously something to contend with for all of us, particularly our poor father. He was the standard hen-pecked husband. My mother often yelled at my father about seemingly trivial things and was a terrible back-seat driver. We often were sorry for him but felt powerless. I personally mostly ignored her, but I’m not certain it was so easy for my brothers. Our father would often escape outdoors to tend his garden and to listen to broadcasts of games of his beloved Brooklyn Dodgers on a little radio with a long extension cord. Later on, when growing up, if I was in doubt as what to do in a particular situation, I frequently thought of what my mother would advise and then did the opposite. Quite often this ploy worked. The difficulties
posed by my mother’s dominating ways and her endless disputes with my father did not bother me much. They certainly did not interfere with my having a happy childhood. Moreover, I have rarely thought about this family tension as an adult. I was the fourth born (third living) and was quickly followed by my younger brother, David. I think I benefited from some (benign) neglect. My oldest brother, Charles, in contrast, felt the need to visit a psychiatrist frequently when he was in his twenties in New York City while a student at Columbia University. One result of this was to put the blame on our mother. The main effect on Charles was to provide him with a serious understanding of psychoanalysis. I didn’t notice any change in his impatient, short-tempered behavior. I think he wasted a lot of time and money on his bouts with psychoanalysis (a pseudoscience with lots of untestable hypothetical constructs and few controls—almost a religion, really). As he aged, Charles mellowed considerably and was always warm with me.

Our mother’s mother, Grandma Krüger, lived with us. When we boys discovered that her maiden family name was Hirsch, we would occasionally inquire with a twinkle in our eyes whether she was part Jewish. She protested vigorously. I don’t recall that the rest of the family was particularly anti-Semitic but Grandma Krüger certainly was and said so. Many years later when some of my many Jewish friends and colleagues got wind of this, I took a certain amount of razzing, but was grudgingly treated as a member of the tribe.

In spite of the difficulties in their marriage, our parents managed to be good parents. We boys all had good childhoods, as far as I know. I certainly did, and we all went to college to complete our general education. I say “to complete” because our local public schools were so backward in the teaching of math, science, history, and writing, and demanded so little homework that we really needed a “college education” to learn the basics, a widespread aspect of life in the U.S.A. In any case, we all went to college and beforehand simply assumed that we would. We certainly owe this in large part to our parents and the examples of two uncles. Our parents, remarkably, did not even attend high school. I don’t know about my father but in mother’s case it was clear; she had to work. Her father died young, when she was only about 12, so she had to quit school and go to work along with her mother to support themselves and her two young brothers.

Family Life in Rockville Centre

I was born at home, 136 Brower Avenue, (Figure 1.2) Rockville Centre, Long Island, New York. This village, which has now long since become absorbed in the vast, continuous, suburbia of New York City, was about 10 miles from the city and was then a semi-isolated community. It was close to several others—Lynnbrook on the west, Hempstead on the north, Baldwin and Freeport on the
east, and Oceanside on the south, and interacted sparsely with them. But there was space between all of these towns and this space of fields and woods was readily accessible to a roaming little boy. I remember little else of my earliest years, but I know from baby photographs that I was clothed in dresses early on. My blond hair was cut short to signal that I was a boy.

Our house was an ordinary American wooden frame house, typical for the period, but quite adequate. I loved it. There was a living room with a fireplace and piano, a dining room, a kitchen with a pantry, a screened front porch on the first floor and four bedrooms on the second, plus an attic on top. I remember with warmth reading on the porch during hot summer evenings. The house was a little crowded, especially since Grandma Krüger occupied one of the bedrooms. There was only one bathroom for the seven of us. We all had to wait in line a lot. Later, in high school, I moved to an extra bedroom in the attic in order to have my own private castle. It was a long way from the bathroom, but never mind, I wanted a room for myself. We also had a cellar with a coal furnace, where my mother washed and ironed clothes. She frequently talked to herself down there in vigorous, often argumentative conversation with another person who was not there, pausing impatiently while waiting for the other person to respond and often interrupting. I had a small “museum” in a corner of the cellar—a table covered with interesting rocks and shells and other miscellanea, some of them correctly labeled. The house was small but obviously adequate for me.

There was enough land around the house for a garage, a chicken coop, a lawn, a flower garden, and a vegetable garden. We even had an apple tree. We boys and our father constructed a fish pool that we planted with water lilies and
stocked with goldfish. I loved that pool and the fish. When later I visited the old
house with my children, I was impressed to see how small it was. As I grew it
shrank. Apparently, my most lasting special memories of the place come from
my early childhood. Everything is large and lovely in childhood.

In spite of the frequent acrimonious arguments of my parents with each
other, I had a good home life. Fun with my brothers and our pets, Tommy the cat
and my cockatoo. Tommy was a full male. He went out bumming every night and
had a great time screwing around and fighting with other male cats. Though
frequently beaten up, he always managed to get home in the morning. He was
very affectionate and I’m sure had much to do with making me a cat person the
rest of my life, once I settled into marriage. The cockatoo was completely white
with a black beak and a gorgeous yellow crest. He was a gift from Captain
Fitzsimmons, the father of a friend, from some faraway place like Malaya. He
would cling to my shoulder as I walked about, making me a proud little man.
But, then, one morning when I came down to feed him and give him water, I
found him lying dead on the bottom of his cage. I was devastated. Now, as I write
about it, I still am.

Because of their limited income and our large family, my parents were
by necessity very frugal, so the vegetable garden was an important source of
supplemental food for us all. The garden yielded potatoes, peas, green beans,
corn, melons, and squash. My father was a skilled gardener and loved it. It was
a marvelous little operation and escape for him, especially since he was not very
good at the insurance business and I believe truly disliked it (although he never
said so). He was too shy and retiring to be an aggressive, successful salesman.
Throughout our youth, father kept his job. It was, after all, the Great
Depression—any job was precious.

My father’s garden intrigued me. It was very satisfying picking beans
and peas, digging potatoes and all that from our own garden. So one day, I asked
my father if I could have a garden too. He set aside a small plot for me and gave
me instructions: ordering seeds from Burpee Seed Company in the winter,
planting them in the spring and watching them sprout and grow. I checked
morning and evening with growing impatience, trying unsuccessfully to prevent
myself from digging out a few here and there to see if they really were sprouting.
They grew so slowly. I think the gardening époque was rather brief, a few years,
and ended when I became involved in other things, like going away in the
summer to Wading River and Stony Brook and Camp Wawepex. Curiously, I was
the only one of the boys to show any interest in gardening. I think it was part of
my expanding interest in the growth of things in Nature.

We not only ate the vegetables fresh but canned them as well. Our
mother was good at canning and kept the pantry full of neatly arrayed canning
jars. In the kitchen, there was a coal stove and a gas range but no refrigerator. We
kept food fresh in an icebox and in a window box in the winter. When “The
Iceman Cometh,” we boys greeted him with glee and ran to the back of his horse-drawn wagon to steal and suck shards of ice, a particular pleasure of a hot summer day.

Our proximity to the Atlantic Ocean and its associated estuaries and salt marshes provided many outlets. I learned to swim at an early age in the surf of the Atlantic and one of our favorite sports was riding the waves—surfing, now called body surfing. From time to time in the summer, our father would take us crabbing or fishing. The crabbing was more fun because we always got crabs, two of us working together. One would pull the line with a crab attached to the bait ever so slowly while the other would push the net under the crab ever so carefully. And, then, whoosh, up comes the net with a crab in it unless he had escaped. The blue crab (*Callinectes sapidus*) is an exquisitely sensitive and quick athlete, a marvelous machine (Figure 1.3).

![Figure 1.3. The common blue crab (*Callinectes sapidus*). Photograph used by permission of the Marine Biological Laboratory Archives](image)

Also when crabbing, one of us would accompany our father in the skiff (we called it a rowboat, Long Island style), looking for crabs. We were especially keen to capture soft-shell crabs. They had just shed their hard, calcified exoskeletons and were sluggish, much more easily captured while hardening...
their new exoskeleton of chitin by addition of calcium salts. These soft-shell crabs were splendid fare when cleaned, salted and peppered, dipped in flour, and sautéed for a few minutes in butter. So, we would row while he looked. I hear him yell still. “Slower.” “Stop.” “We just passed one.” “Slower.” Working the lines was more fun than rowing and we caught more crabs.

Fishing was a little scary, out in deeper ocean water; sometimes I felt we were a little too far from land for my taste. It also required some patience. The one occasion I remember well was naturally a big success for me. I hooked a big halibut, which gave me a struggle but we brought it in and I remember our mother cooking it “especially for me.”

The frequent swimming, becoming at home in the water, the crabbing, the fishing, the brisk smell of the sea, the salty stink of the swamps, the sky, sunny or cloudy, and the winds all made a profound impression. The sea has been in my blood ever since. Still now, when I stand at the edge of the sea I involuntarily inspire. I smell. I stand taller. I face the wind. I look far away.

I also fished in little fresh-water ponds for little fish. It was safe, quiet and calm. The proximity of the shore, the shallowness of the water, pond lilies, grasses, sunken logs, the little bobbing float—all reassured me, giving tranquility, without the menace of the sea. These small ponds and their little fish were a happy part of my childhood, but I have seldom returned to them. It is always the sea that beckons.

What do I remember about church and religion? We all went to the Saint Mark’s Methodist Episcopal Church every Sunday. I liked it, mostly singing the rousing Protestant hymns. I still sing some of my favorites like Yield not to Temptation, for Yielding is Sin, Abide with Me, Onward Christian Soldiers, The Battle Hymn of the Republic, and many more. I also liked the King James (of course) Bible, a great book with lots of good useful quotations, e.g., “Let him who is without sin throw the first stone.” Many years later, when I was Master of Branford College at Yale University and lined up on the stage at Woolsey Hall with the other masters and the dean and the president at the yearly baccalaureate service, my great joy was in belting out the old hymns, familiar Protestant favorites. I can’t keep a tune and I was sometimes asked to cool my enthusiasm because I was throwing those nearest me off key. Tough. Back to the Methodist Church. I found the sermons boring, thinking often when in my teens, that I could do better myself. Maybe that is the source of my propensity to deliver a sermon on most any subject to this very day. In addition to the formal church service there was always Sunday school, where we were taught something about the Bible and given some lessons in morality by adult parishioners. The only important part of Sunday school worth mentioning was the socials. There we were, boys and girls, much interested in each other and not much interested in Methodism. I owe much to those socials,
for it was at one of them that I had my first fumbling sex, up and away from everybody, in the choir loft. I also enjoyed the revival conferences held at other churches in other towns. We young people stayed in the homes of local parishioners and were all very religious. At least once, I pledged my life to Jesus Christ at one of the big emotional services that invariably ended each conference. For the record, I attended Sunday school at our church for 12 years in a row without missing a Sunday (except, I suppose, for sickness and vacations)! This brought me a pin and eleven bars, one for each year, suspended from it, which I proudly wore attached to the lapel of my Sunday suit. It could be said that up to about the age of 17 or 18, I was properly exposed to religion.

Out back of the house was the cesspool, which had to be emptied once in a while. No modern septic system this. When the "honey wagon" would arrive to do its job, I made scarce. Quel parfum! But we boys all had certain chores we couldn’t escape. I recall only three of mine. At various times, I took care of the chickens, got the milk, and went to buy bread and eggs. I liked caring for the chickens, especially collecting the eggs. A hen’s egg is so warm, clean, symmetrical, and heavy—nice to hold in the hand. It also held the potential of becoming a chicken, a great mystery to me as a child. Getting the milk was mostly a joy. In my memory it seems that it was always a fresh, sunny spring morning and only a short walk to the little dairy with my pail in hand. I liked the cows, of course, like any child.

The bread was a different matter. Mother baked bread, but felt that we could afford to buy day-old, store-bought bread once in a while, because it was cheaper. My parents were always trying to save money. So I often trudged off to town about a mile away to get the bread and maybe some eggs too. It was boring. So one day a brilliant idea surfaced in my little criminal head. Why not "accidentally" drop the bread on the sidewalk or crack an egg or two. It worked. After a bit, when mother asked one of my brothers to go, they asked, "Why not Philip?" She replied, "Him? Every time he goes, either the bread gets dirty or there’s a cracked egg. Or Both."

We were also expected to earn money at various jobs to provide ourselves with spending money, buy our clothing, and save money for college. I did this mainly by caddying at the local golf course and by delivering the local newspaper. I had a paper route with dozens of customers. I didn’t really mind it and I sure liked the money. Meeting the dogs on the route was an unexpected side benefit. There were several of them, of all breeds, mostly mutts, and I made friends with all but one. The unfriendly one was a chow. This breed has a richly-deserved bad reputation and I stayed away from it. The dogs were loose and followed me as I moved on and picked up other dogs. They all had a good time with me and with each other—like a bunch of kids. We did not have a dog at home so these were my dogs.
Public School

My earliest distinct school memories are of the kindergarden of Morris School, the elementary school that served our part of town. It was three-quarters of a mile from home and I believe I made my way there by myself (but more likely with my older brother Bill, who was in the second or third grade at the time). I was 4 years old. Our teacher, Miss Dana, was a middle-aged lady with dark hair and glasses. She was wonderfully kind and clearly loved her little charges. We mainly sat around in a circle, boys and girls mixed, and played games of various kinds. I must have had a good time, for I have very pleasant and warm feelings about these two years. I was excited by this new adventure. We always made drawings and cutouts for big events like Halloween, Thanksgiving, and Christmas. I remember that we all made a lot of valentines for parents and friends, the people important to us.

Curiously, nothing stands out from my first, second, and third grades, except that I was a restless, bored, and truculent kid. At the beginning of the fourth grade I made a solemn pledge to myself to achieve a U (unsatisfactory) in deportment on my report card every month. I kept this pledge all through the fourth and fifth grades, earning my U’s by throwing spitballs, shooting staples with a rubber band, and initiating other kinds of live combat. I must have driven my poor teachers up the wall. One of them, Miss Stout, was quite strict with me to little avail. I was accused of being incorrigible. During this period, I was part of an obnoxious gang of little thugs. We were about 8-11 years old, a bad age for most males. I recall two of many episodes especially clearly. One day, another kid, Earl Bloxam, tattled on the rest of us for the ordinary rough-and-tumble horsing around during the pee-pee recess in the boy’s room. This being a roundly disloyal and unforgivable act, we righteously vowed to get him after school. So there I was after school conscientiously observing the vow, and ready to beat him up, but none of the other boys showed up. So, I beat him up myself. And then, just after I had finished him off, who should show up but his mother, who then proceeded to beat me up. Poor me! Poor Earl! I was righteously indignant, telling myself, “She had no right to do this. I am not her son.”

Earl was not alone. There was another victim, Clarence. I forget his last name. Clarence was a sissy, not a tough regular guy like the rest of us. I’m sure we young hooligans kicked him around a lot too, but I don’t remember any specific instance. What I do recall is how we would taunt him for his unfortunate name and call out with cruelty “CLAAAAARENCE” whenever we saw him. Poor Clarence! I hope he survived without being scarred for life. I’m sure many another Clarence around the country has innocently suffered a similar fate. It seems now that parents have gotten the message. You don’t find many males named Clarence anymore. Clarence seems to have gone the way of Percival and Fauntleroy and other “sissy” names.
My main pleasurable memories of those years in primary school center on various kinds of bad behavior. My wife says, with love, that I am still like that. I have always enjoyed going against the grain. I like being noticed. Remember, I am a middle child. I have never wanted to be ordinary but have always wanted to be seen as a regular guy. My nascent interest in science, reading, and poetry made me extraordinary and possibly susceptible to the dreaded sissy label. In the culture that I grew up in, a good cover was being an aggressive, often mean-spirited tough. I might have gotten many deportment U's on my report card, but everyone agreed that I was “all boy.” Mission accomplished.

The years merge in my memory, until the fifth grade, when I was about 10 years old. They were wonderful years, full of all the things a child should have—sports (playing baseball, shooting marbles, sledding in the winter), building huts, and shooting arrows. We smoked corn silk behind the chicken coop where we couldn’t be seen and formed gangs of boys to fight other gangs of boys (not much really), being cruel to boys such as Clarence, less aggressive than ourselves. Sometime during this period I discovered that it was more fun wrestling with girls than with boys.

I arrived for the sixth grade a day after school had started, late from our lovely vacation in Stony Brook out on the Long Island Sound (long before the State University of New York was established there), to find myself immediately singled out by Miss Joyce, my new teacher. “I know all about you, Philip Trinkaus, and I’m going to have a cage built for you in the back of the room!” This was a bit of a shock and it set me back a little, as if I’d met my match, an infrequent occurrence until that time, and since, I hasten to add. I don’t recall the details of the succeeding events but soon she had this truculent little hoodlum writing poetry, reading unassigned books, and paying careful attention to her, the teacher. She actually forced me to behave like a normal responsible member of civilized society, something few had been able to do before. I remember that Miss Joyce was quite pretty and extremely nice. She had a wonderful influence on me. Also, she was smart. In retrospect, I think she noted that I was among those who finished lessons faster than most children, and, then, bored and with time on my hands, looked for trouble. With Miss Joyce, there was no time for trouble. She wisely and quickly put me to work on projects I soon learned to like. This marks the end of my early bad boy period. I have such fond memories of Miss Joyce that she might have been my first love (in competition, of course, with Cousin Ruth).

I have no clear memory of my studies in grammar school. It seems odd, considering how intellectual I became soon after in junior high and high school. I certainly had no homework. I know that when my son Erik was in the “classe de septieme” (equivalent of the sixth grade) in L’École Alsacienne in Paris, he had serious homework. I guess Morris School, like so many American public schools, was not very demanding, hence not very good. Whatever the case, we
were ecstatic when school was over in June and the long summer vacation began. I can hear us now chanting, "No more pencils. No more books. No more teachers’ dirty looks,”, and singing, “In the good old summer time, In the good old summer time...."

As for most children in our society, Christmas was an especially extraordinary occasion for me. I absolutely adored it and would count the days during the whole month of December. In my tender years, I fervently believed in Santa Claus. We followed an exciting and heart-warming tradition in our family. My father would buy the Christmas tree, a really big one. It would be put up in its stand, always in the same place in the living room. We decorated it Christmas Eve as a happy family activity with the same large variety of ornaments as in previous years. We children would hang our stockings from the mantelpiece of the fireplace, all of us hanging the biggest stockings we could find. Then, after the tree was decorated and its lights turned on (one of the loveliest of sights), we children would go to bed and leave the place to Santa Claus. I really believed in him and clung to this belief well beyond the usual time of intruding skepticism. I guess I loved being a child and didn’t want to give it up (and still don’t to a degree even as I contemplate the end of my life). My older brother Bill fostered my clinging belief. I went to bed for what I recall seemed invariably a sleepless night. Certainly all four children were awake and dressed at the crack of dawn. But we couldn’t go down yet. First, our father had to check “to make sure Santa had come and left.” His stalling tactics simply increased our excitement. Finally, we went tumbling down the stairs to be greeted by the big Christmas tree all lit up and surrounded by all sorts of toys and gifts. A wondrous moment!

I should add a word about the town library. I naturally expected to have a good public library available. Indeed I did as a child and this is still generally true in the U.S.A. I haven’t made a careful survey but I have since learned that in a highly advanced country like France, a good local public library is not a usual accompaniment of small-town or even urban living. These libraries are truly one of the outstanding benefits of life in America! It was especially important for us because we had few books at home. I well remember going often to the village library during this period to check out books. The ones I remember best are the usual: Treasure Island, Tom Sawyer, The Swiss Family Robinson, Robinson Crusoe, and all the rest and, in particular, the Henry Ware series. Henry Ware was the epitome of the clean-cut, strong, courageous, young American white male conquering the wilderness in the West with his three comrades, Paul, the young scholarly one, and two others who were canny woodsmen and knew the Indians so well they had become like them. I identified with all four of them. I remember playing woodsman often by myself, out in the fields and woods, leaving signs for my “comrades” to follow, building campfires, whittling sticks, and hiding in thick bushes listening for the merest rustle that might reveal the approach of a stealthy enemy.
An important part of my youth, especially with respect to my later development as an embryologist, involved unstructured exploration of nature. I watched frogs lay eggs and pollywogs metamorphose into frogs. I watched fiddleheads spring up from the pungent humus-rich edges of swampy places in the woods and expand into cinnamon ferns (*Osmunda cinnamomea*), topped with elaborate reddish-brown “flowers.” I dug up rotten logs and found incredible spotted salamanders (*Ambystoma maculatum*) under them. These amphibians were up to eight inches long, were jet black all over, except for a series of large mustard-yellow spots along their backs. I wondered nervously if they were poisonous, dangerous, or aggressive. Finding a bird’s nest with eggs or baby chicks was also exciting. One day a meadow was empty and the next day a fairy ring of mushrooms had appeared as if by magic. Puffballs the size of softballs would suddenly appear and then turn brown, releasing great clouds of dark smoke (spores) when kicked just so. I was careful not to inhale the smoke because I had been warned that mushrooms were poisonous. I spent countless hours roaming aimlessly but attentively in the woods and fields around home. I didn’t wonder consciously how all this came about, but I knew intuitively that it had to do with reproduction and therefore sex, so it interested me. I suspect experiences like these led me into a life investigating the growth and development of living organisms.

My frequent forays in the woods and my interest in nature were apparently noticed by my parents. One Christmas, when I was 10, I received a six volume set of books just at the right time. They were the works of Ernest Thompson Seton, naturalist, storyteller and artist—*The Book of Woodcraft, Two Little Savages, Wild Animals I Have Known, Rolf in the Woods*, etc. I played Little Savage, even adopting an Indian name for myself—Black Tomahawk, leaving my sign in various spots in the woods as a warning. Indeed, I was so inspired by *Two Little Savages* that I started to write a novel of my own along the same lines, but I didn’t get very far in it. Perhaps most important for my later years, these wonderful books brought me closer to wild animals and plants. I looked for tracks in the fields and woods, especially after a light snow. I became interested in identifying birds, trees, and curious plants such as the ghostly white Indian pipes (*Monotropa uniflora*), so named because they resembled tobacco pipes with their long stems topped by a solitary drooping flower. I later learned that these plants are saprophytes, i.e., they obtain their nutrients from decaying organic matter in the leaf litter. Thus they are able to forego photosynthesis and its attendant green pigment, chlorophyll. I became immersed in the lore of Nature. An activity that stands out in memory of these years was frequent trips to the Jones Beach Bird Sanctuary with my brothers, Bill and Dave.

Up to the age of about 12, I had an inseparable pal, Johnny Fitzsimmons. We did almost everything together—sports, building huts in the woods, shooting firecrackers on the Fourth of July, Halloween stunts, and so on.
Halloween for us was an occasion for “trick or treat,” but we meant it. If people weren’t prepared to treat us we would find a way of tricking them, mess up their yard, dump the ash can, spilling ashes over their lawn. The old flaming-bag-of-dog-shit-on-the-porch trick really works and is hilarious if you are twelve. Truth be told, it still makes me laugh. Let’s face it. We weren’t very nice. A curious thing about my friendship with Johnny is that, although for a considerable number of years we were together part of almost every day, at one point we grew apart. There was no sudden acrimonious break. Our interests just diverged as we matured. Somebody in my family said that I suddenly grew up and Johnny didn’t. Anyway, I became involved in the Boy Scouts and he did not. I remember also that Johnny had an older sister, Sheila, whom I thought was very attractive. I had a little case of puppy love for her. I also remember with great pleasure Johnny’s parents. His mother was a warm, generous lady with whom I always felt at home. In fact, I felt pretty much at home in their whole house, where I spent a lot of time. Johnny’s father was a seafaring man—captain of a freighter that seemed always to take trips around the world. So he would only be at home from time to time. But when he returned home from a long voyage at sea, he would bring all sorts of mementos from far-away romantic places, like the Philippines and Singapore. He kindly gave some treasures to me, such as an ebony elephant and a model outrigger canoe. These gifts occupied a special place in my room and were, during my entire youth, my most impressive, concrete personal contacts with those far-away places. An elephant carved out of real ebony with real ivory tusks by some person in some remote place! That was special.

My ongoing contacts with the rest of the world were from the National Geographic Magazine, The Book of Knowledge (an inexpensive children’s encyclopedia sold by earnest door-to-door salesmen touting to parents the educational benefits of these books), and my stamp collection. I poured over The Book of Knowledge (what a great name) incessantly, not understanding all that I read, but getting a sense of what I needed to know more about when I became more sophisticated. The twenty or so volumes were printed on glossy paper and were richly illustrated. The earnest salesman was right and so were my parents for spending some of their hard-earned money on these stimulating tomes. For a period, collecting stamps was a real passion and I built up a pretty good collection. When I got a stamp of a country I had never heard of or knew little about, I would look it up in The Book of Knowledge, which was a well-worn staple in our household.

There were also movies to extend our horizons. My brothers and I would frequently join friends to go to the Saturday matinee downtown. The usual fare was westerns, with the hero Tom Mix, and big extravaganzas like Ben Hur. But my favorites were the comedies (farces) and certain women. I had the good fortune of growing up during the “Golden Age of American Comedy” and spent
many a hilarious afternoon with Charlie Chaplin, Abbott and Costello, Laurel and Hardy, the Three Stooges, Harold Lloyd, and, not to forget, the Marx Brothers. My favorite women were both scantily clad—Maureen O’Sullivan, the beautiful mate of Johnny Weissmuller’s *Tarzan*, and the sexy Clara Bow. Maureen, of course, lived in the torrid jungle, so she had to be almost unclothed, but demurely. Clara was quite blatant with her sexuality, to my delight, obviously aiming to arouse sensual interest. She certainly succeeded with me.

**The Boy Scouts of America and Life after Miss Joyce**

With my juvenile naughty period terminated by Miss Joyce and as my interest in natural history blossomed, the opportunity to join the Boy Scouts of America was a boon. This date is certain. It was at the end of May 1930, because one had to be 12 to enroll. And enroll I did, with consummate enthusiasm, for at least two reasons. There was a familial precedent. My oldest brother Charles was an Eagle Scout (the highest achievement). My brother Bill was well on his way to this rank. My father was a parent counselor. Most important, it was a “natural” for me. Natural history was my passion and was then the heart of scouting. I went through all the various tests with vim and vigor and rapidly moved from one rank to the next. Then I zipped from one merit badge to the next with the double incentive of moving up the ranks and receiving a beautiful little embroidered badge for each, which my mother dutifully sewed to my sash (Figure 1.4). Not surprisingly, I loved all of these achievements. They were mostly on subjects in which I was passionately interested anyway and, moreover, I now realize that it was very easy to pass the tests. They were given by nice gentlemen who wanted nothing more than to encourage eager boys like me (and probably knew less about the subject than I did). Anyway, I quite soon became an Eagle Scout (at the age of 14). A proud moment it was. I shall never forget the ceremony at which that beautiful Eagle medal was publicly pinned to my swelling chest. Looking back, it was a seminal event, not just in my young life, (which it surely was), but for later life as well. This was my first major personal accomplishment, one that required research, application of new knowledge, and sustained effort that lead to a symbolic reward. I surely loved that medal.

An important part of those scouting years was Camp Wawepex, the summer camp for Nassau County. It was in the pine-barrens of outer Long Island (in the town of Wading River, between Port Jefferson and Riverhead), a rather desolate wooded area of sandy soil and scrubby pitch pine, infested with mosquitoes. It was on a lake—named Deer Pond. It was a small lake like many another, but for me it was pure limpid water in the wilderness, with sunfish, perch, bass, pickerel, painted turtles, a huge, dangerous snapping turtle that must have been two feet across the carapace, and leeches.
I began attending this camp right at the beginning of my Boy Scout period, first for two weeks and then longer and longer, through seven summers. My main memory of the first time was homesickness. It was a haunting desire to see my mother. I realized that I loved my mother after all. There were the wonderful activities such as swimming nude, which I remember so vividly because of my small underdeveloped member, as compared to those already swelling dorks of some of my fellows, as we all lined up on the shore for our early-morning dip before breakfast. I also loved canoeing, nature hikes, and bird-watching. There were some fine, wild swamps not very far away. I found retreat a stirring ceremony. Retreat was the formal taking-down of the flag at the end of the day, to the mournful tune of taps on a bugle. I hated the mosquitoes, but relished the formality of the ceremony. Years later when I entered the armed services, I was quickly impressed with how much of it was familiar: retreat, marching, saluting. The Boy Scouts clearly had strong military and patriotic elements.

During those seven summers, I extended the length of my stay and rose in the ranks of the camp. I had jobs first as an assistant cook (which was very hard work, but fun with a crazy, sexually obsessed Polish cook—no problem for me) and then as assistant nature counselor. I reveled in that job. It was my meat. I enjoyed so much being the assistant nature man, that I have absolutely no recollection of who was the head nature man. I guess I was pretty self-centered. It was the animals and plants and teaching younger boys that I remember, and the snakes. Ah yes, the snakes. My one young worry about that job, my first real position of prestige and authority, was that I was scared shitless of snakes. How could I teach other kids only 2-3 years younger than I to recognize snakes and not to have fear of them, when I myself was deathly afraid. However, I knew I had to do it. So I read about snakes and tried handling little ones on my own, privately. Grasp them firmly behind the neck and enjoy the feel of them. They are dry, smooth and cool. I followed what I read and it worked. This was tough at first, even with the little ones, like garter snakes. I soon found myself handling snakes without neurotic fear and teaching other boys to do the same. Of course, I did get bitten a few times, especially by big black snakes. These bites were like slight cuts by a sharp knife across the finger, minor really, but a good lesson for the other boys. I actually grew quickly to like snakes! Fortunately, there were no poisonous snakes in that region.

It was then that I befriended the camp physician, Morris Brand. He was a gentle, genial, rotund gentleman who was taking a vacation from New York City. He took a liking to me, and I to him. He would return to New York frequently to see his family. Each time when he returned from New York, he would bring back bacteriological culture tubes with slants of nutrient agar for me. With his instruction, I cultured practically everything and incubated the
tubes by carrying them in my breast pocket where they would be warm. I grew a lot of bacteria and fungi. The nicest thing of all that he did was give me his medical school text of bacteriology by Hans Zinnser, who also wrote *Rats, Lice, and History*. It was my first real book of science, which I read avidly in part and which I still have. I never saw him again. Did he realize how wonderful he was to me? Did he understand what a profound effect he had on a budding boy biologist?

The Boy Scouts of America has quite a moralistic oath:

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On my honor I will do my best  
To do my duty to God and my country  
and to obey the Scout Law;  
To help other people at all times;  
To keep myself physically strong,  
Mentally awake, and morally straight.
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The Scout Law demands that a Boy Scout be “…trustworthy, loyal, helpful, friendly, courteous, kind, obedient, cheerful, thrifty, brave, clean, and reverent.” Well, all this was no doubt a good thing for early teenage boys but not necessarily a guide to life in the real world of adults. The “God” part was typically American and no guide at all when I had grown up. “Obedient?” “Brave?” “Cheerful?” “Reverent?” That depends on the situation. The motto “Be Prepared” was ruined forever for me later by the singer Tom Lehrer in his hilarious and famous *Be Prepared, the Boy Scout Marching Song*. I read recently, with amusement, that a certain Harvard professor finds all these scout lessons on morality to be a good guide for adult life. Maybe his, not mine. I guess I have had most difficulty with “Obedient and Reverent,” but 10 out of 12 isn’t bad. The Scout Slogan admonishes us to “Do a Good Turn Daily.” Not a bad idea. I often do several a day. All in all, I must admit that I learned a lot in the Boy Scouts and had great fun to boot.

My younger brother David also eventually became an Eagle Scout and this apparently made us the first family in the U.S.A. to have produced four Eagle Scouts. Somehow the word was gotten to *Boys Life*, the official Boy Scout magazine, and a picture of us with our father was published therein (Figure 1.4). Such a proud moment! It was a bit ludicrous, though. Dave was 17 when he became Eagle. Thus Bill, who was 23, and Charles, who was 26, and I, 19, all had to dress up in our old Boy Scout uniforms for the picture.

There is a sequel. About twenty years later, an article appeared in the *New Haven Register* reporting that some other family claimed to be the first family in the United States to have four Eagle Scouts. Our mother, then a widow and living in a New Haven suburb, saw the article, was indignant, and sent a rebuttal to the paper, with the picture as evidence. I was by then an assistant
professor at Yale and, as you can imagine, took a certain amount of crap the next day from colleagues giving me a mocking scout salute as I crossed campus. But the best response happened first thing in the morning the day after the picture appeared in the newspaper. When the janitor came in to clean my office, he promptly opened the window, lecturing me, "As a former Boy Scout, you should know how important it is to get plenty of fresh air."

Figure 1.4. My 62-year-old father Charles, with his four Eagle Scout sons, left to right Charles, William, Philip, and David.

From Natural History to Biology

When I was 14 years old and beginning the ninth grade, I took my first course in biology, the only course in biology in my school. Although in retrospect, the course wasn’t very good, the teacher, though nice, didn’t really know much. Nonetheless, the course was an introduction to the structure and physiology of plants and animals. I suppose, also in retrospect, it introduced me systematically to biology, as opposed to natural history. Also, sometime around then, my perceptive parents presented me with a microscope for Christmas—a child’s microscope, of course, but a good one made by Bausch and Lomb. During those years, I became fascinated with tropical fish, which I raised and bred in aquaria at various places around the house, especially near radiators to keep the water warm (to the constant distress and bitching of my mother). My, how exciting it was to come down in the morning and find that a fat female guppy or platy-fish had given birth to a whole small aquarium full of babies!

I set up my microscope on a table at the north window of my room and quickly assembled a primitive little laboratory around the microscope. This led me into the hitherto hidden world of the minute. I looked at more or less everything I could lay my hands on, but pollen grains, Protozoa, diatoms and rotifers quickly became centers of attention. The geometric regularity and
specific distinctness of pollen grains and diatoms introduced me to the beautiful and comforting orderliness of Nature. I remember well how I learned to identify different trees, e.g., the Norway maples adorning our street, by peculiarities of their pollen. It was the Protozoa, however, that really excited my interest. I filled jars with hay and water, left them to soak for a day or two, (making a hay infusion) or collected readily available pond or aquarium water. Then, with my trusty microscope, I became friends with Protozoa such as *Paramecium*, *Amoeba*, *Vorticella*, *Euplotes*, *Euglena*, and many others whose names I have forgotten or never knew. I never did anything systematic with these wonderful creatures. I did watch endlessly and began to daydream at my little table laboratory of how some day I would be a scientist and have a real laboratory of my own and discover new phenomena, like Pasteur, Ehrlich, Metchnikoff and Koch, about whom I had begun to read. At this time I read Paul de Kruif’s *Microbe Hunters*, *The Life of Pasteur* (by his son), and Sinclair Lewis’s *Arrowsmith*, all of which had a strong reinforcing effect on my growing interest in biology and research. *Arrowsmith*, a novel in which the scientist is a hero for a change, dramatized in a very personal way the excitement of a life dedicated to research. How marvelous that after not so many years later, I achieved such a dream laboratory of my own and have worked in it ever since! Also, how wonderful and fortunate that all these books were easily available in the local town library.

By this time, my high school friends had become mainly boys interested in natural history. We went bird-watching together, getting up at some God-awful early hour of the morning, and went on various kinds of hikes. We also founded a club at our school, which we named “The Naturalists.” I don’t recall that it amounted to much; it gave a title to what we did anyway. I have not forgotten one thing we did. I had learned from my Uncle Henry that a classmate of his in college, A.F. Blakeslee, was Director of the Carnegie Laboratory of Genetics and Experimental Evolution in Cold Spring Harbor, just across from us on the shore of the Long Island Sound. I had enough nerve to think we might be able to visit the laboratory on a Saturday afternoon. So I wrote to Dr. Blakeslee, quickly receiving a cordial invitation. So off we went. It was indeed a Saturday afternoon but nevertheless, Dr. Blakeslee, Dr. Satina, his assistant, and a certain Dr. Demerec were there to receive us. I particularly remember Dr. Demerec for he was a *Drosophila* geneticist and showed us salivary chromosomes, which display bands indicating the positions of certain genes—my first introduction to modern cytogenetics. A few years later I was thrilled to learn that he was Milislav Demerec, an internationally known leader in *Drosophila* genetics. This visit to the laboratories of genuine working biologists, set in a charming little campus, made an indelible impression.

The Naturalists also took advantage of the proximity of New York City to visit the great and rich American Museum of Natural History. The zoological
exhibits and the wonderful dioramas of course drew our attention, but more and more we were attracted to the darkness of the Planetarium. There each of us would watch the stars in the close company of his favorite girl friend—a rendezvous that became closer and more affectionate with each succeeding heavenly visit. Quite soon, for all my love of zoology, I could hardly wait to get to the Planetarium.

Clearly, but coincidentally, it was with these friends—Laddie Chapin, Paul Koenig, and Earl Holthausen—that my serious interest in sex began—girl friends, parties, dancing. There was a lot of awkwardness and colossal naiveté but I sure enjoyed it. There was nothing special about it. We were growing up and this was part of it. Incidentally, I had grown to six feet, which was tall in those days. I liked being tall. I wonder what has happened to all of them, males and females. After all those long, philosophical conversations, those many good times, we all left to go to college or just drifted apart.

My years in high school, grades 7-12, were very formative, as I suppose they usually are. I quickly became quite intellectual. It all started with the wonderful Miss Joyce in the sixth grade. I studied the usual subjects: some science, English literature, a foreign language (German) and Latin. I took 4 years of Latin, the usual introductory course, reading Caesar, Cicero and Virgil. I read Caesar’s writings on his military triumphs, and Cicero’s boring speeches. A previous student had written in my Cicero book, “Latin is a dead language, as dead as it can be. It killed the dead Romans, and now it’s killing me.” Virgil was a delight. The poetry was beautiful, our teacher dedicated and enthusiastic; and there were only four of us. That certainly was my best course in high school. I was an excellent student in most subjects, but it was easy; there was little heavy homework. I soon learned in college that I was poorly prepared. The main problem with my high school was that they didn’t work us hard enough and didn’t spend much time teaching us how to write properly in our own language, a common problem in American public schools.

My most vivid memory of high school was extracurricular—drama. I suddenly learned that I liked acting. So I acted, in one-act plays and had a leading role in a big three-act play, The Enemy, where I appropriately played the role of the pacifist, Professor Arndt. Under strict tutelage, I gradually improved, or so our coach said. She taught me the pregnant pause and all that. I also won second place in the extemporaneous speaking competition. I remember being annoyed at winning only second place, for I quickly learned that two of the judges awarded me first place but the third judge, the local Congregational minister, judged me way down, probably because he knew I was a Methodist.

I do not remember when it started, but, gradually, during my years in high school I became impressed with the horrendous inequities of society and, inevitably, with the possibility of correcting them. My eldest brother Charles was somehow a stimulus, for he was already a graduate student in medieval and
EMBRYOLOGIST

renaissance history at Columbia University and very committed to the Marxist interpretation of history. In addition, there was a student at my school who fed me radical publications, which I devoured. I suppose I was prepared in part for this by my religious training. Although most religion in the end is on the side of the establishment, the Methodism I knew preached equality of opportunity and respect for other humans. I took it seriously. At any rate, I plunged into the radical literature of the day with increasing passion, reading secretly in bed at night in my own private room in the attic, separated from the rest of the house.

Reading *The New Masses*, the most important Communist magazine of the day, introduced me to the left-wing movement in America and, above all, with much that was wrong with American society. Then I branched out, or, better, dug more deeply, and read *The Communist Manifesto* by Marx and Engels and a big book by Engels dealing mostly with science. I also read Kropotkin on anarchism, Rosa Luxembourg and especially Lenin’s *Imperialism* and others by him. I could buy these books at the Worker’s Bookshop in Union Square in New York City. I found them mostly right and still do (except that I now realize that matters are not quite that simple). I put virtually none of this leftist political theory into practice in those idealistic, visionary days, but it all made a profound impression on me and, from time to time, has led me into vigorous political activity.

An unforgettable political experience during my last year in high school was a lecture by Norman Thomas, the dynamic leader of the Socialist Party and its perennial candidate for President of the United States, in the high school auditorium. He was a great orator, with a rasping, penetrating voice that reached to the rafters. Thomas cut a tall charismatic figure with his handsome face and shock of white hair. I was entranced by the whole show and absorbed totally his denunciation of capitalism and the need to change America. After the lecture, I hung around up front and managed to get permission to ride in the car with him to the train station. What a thrill that was!