

LEGENDARY AMONG HIS COLLEAGUES FOR HIS BRILLIANCE AND HIS ECCENTRICITY. . .

IT'S HARD NOT TO SMILE ALL THE WAY THROUGH." *Newsweek*

Richard Feynman won the Nobel prize in physics, is one of the world's greatest theoretical physicists, and is a man who has fallen, often jumped, into outrageous adventure. He has been raising eyebrows ever since he shocked a dean's wife at Princeton and she was moved to exclaim: "Surely you're joking, Mr. Feynman!"

"A STORYTELLER IN THE TRADITION OF MARK TWAIN. HE PROVES ONCE AGAIN THAT IT IS POSSIBLE TO LAUGH OUT LOUD AND SCRATCH YOUR HEAD AT THE SAME TIME!" *The New York Times Book Review*

Feynman is surely the only person in history to solve the mystery of liquid helium and to be commissioned to paint a naked female treader; to expertly crack the uncrackable safes guarding the Atomic Bomb's most critical secrets and to play a skillful frigideira in a Brazilian samba band. He has traded ideas with Einstein and Bohr; discussed gambling odds with Nick the Greek; and accompanied a ballet on the bongo drums.

"FEYNMAN'S BUMPTIOUS REFUSAL TO TAKE ANY PROPOSITION ON SECONDHAND OR HEARSAY EVIDENCE, HIS PRISTINE CURIOSITY ABOUT HOW THINGS WORK, IS CLOSELY RELATED TO THE GIFTS THAT UNDERLIE DISTINGUISHED SCIENCE. . . ALL OF US COULD STAND SOME STRETCHING IN THE FEYNMAN DIRECTION. IT MIGHT EVEN BE FUN!" *The Washington Post*

Woven with his scintillating views on science today, Feynman's astonishing life story is a combustible mixture of high intelligence, unlimited curiosity, eternal skepticism, and raging chutzpah.

"BOOKS LIKE THIS ARE TEMPTATIONS TO GIVE UP READING AND DEVOTE LIFE TO REREADING. . . THE BOOK IS A LITMUS PAPER: ANYONE WHO CAN READ IT WITHOUT LAUGHING OUT LOUD IS BAD CRAZY!" *Los Angeles Times Book Review*

NEW YORK TIMES BESTSELLER

**"SURELY
YOU'RE JOKING,
MR. FEYNMAN!"**

...

**Adventures
of a Curious
Character**

"Quintessential Feynman—funny, brilliant, bawdy."—*The New Yorker*

RICHARD P. FEYNMAN

"Surely You're Joking, Mr. Feynman!"

Adventures of a Curious Character

by Richard P. Feynman

As told to Ralph Leighton
Edited by Edward Hutchings

This low-priced Bantam Book
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"SURELY YOU'RE JOKING, MR FEYNMAN!"



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Preface

The stories in this book were collected intermittently and informally during seven years of very enjoyable drumming with Richard Feynman. I have found each story by itself to be amusing, and the collection taken together to be amazing: That one person could have so many wonderfully crazy things happen to him in one life is sometimes hard to believe. That one person could invent so much innocent mischief in one life is surely an inspiration!

RALPH LEIGHTON

Introduction

I hope these won't be the only memoirs of Richard Feynman. Certainly the reminiscences here give a true picture of much of his character -- his almost compulsive need to solve puzzles, his provocative mischievousness, his indignant impatience with pretension and hypocrisy, and his talent for one-upping anybody who tries to one-up him! This book is great reading: outrageous, shocking, still warm and very human.

For all that, it only skirts the keystone of his life: science. We see it here and there, as background material in one sketch or another, but never as the focus of his existence, which generations of his students and colleagues know it to be. Perhaps nothing else is possible. There may be no way to construct such a series of delightful stories about himself and his work: the challenge and frustration, the excitement that caps insight, the deep pleasure of scientific understanding that has been the wellspring of happiness in his life.

I remember when I was his student how it was when you walked into one of his lectures. He would be standing in front of the hall smiling at us all as we came in, his fingers tapping out a complicated rhythm on the black top of the demonstration bench that crossed the front of the lecture hall. As latecomers took their seats, he picked up the chalk and began spinning it rapidly through his fingers in a manner of a professional gambler playing with a poker chip, still smiling happily as if at some secret joke. And then -- still smiling -- he talked to us about physics, his diagrams and equations helping us to share his understanding. It was no secret joke that brought the smile and the sparkle in his eye, it was physics. The joy of physics! The joy was contagious. We are fortunate who caught that infection. Now here is *your* opportunity to be exposed to the joy of life in the style of Feynman.

ALBERT R. HIBBS
Senior Member of the Technical Staff,
Jet Propulsion Laboratory,
California Institute of Technology

Vitals

Some facts about my timing: I was born in 1918 in a small town called Far Rockaway, right on the outskirts of New York, near the sea. I lived there until 1935, when I was seventeen. I went to MIT for four years, and then I went to Princeton, in about 1939. During the time I was at Princeton I started to work on the Manhattan Project, and I ultimately went to Los Alamos in April 1943, until something like October or November 1946, when I went to Cornell.

I got married to Arlene in 1941, and she died of tuberculosis while I was at Los Alamos, in 1946.

I was at Cornell until about 1951. I visited Brazil in the summer of 1949 and spent half a year there in 1951, and then went to Caltech, where I've been ever since.

I went to Japan at the end of 1951 for a couple of weeks, and then again, a year or two later, just after I married my second wife, Mary Lou.

I am now married to Gweneth, who is English, and we have two children, Carl and Michelle.

R. P. F.

Part 1

From Far Rockaway to MIT

He Fixes Radios by Thinking!

When I was about eleven or twelve I set up a lab in my house. It consisted of an old wooden packing box that I put shelves in. I had a heater, and I'd put in fat and cook french-fried potatoes all the time. I also had a storage battery, and a lamp bank.

To build the lamp bank I went down to the five-and-ten and got some sockets you can screw down to a wooden base, and connected them with pieces of bell wire. By making different combinations of switches -- in series or parallel -- I knew I could get different voltages. But what I hadn't realized was that a bulb's resistance depends on its temperature, so the results of my calculations weren't the same as the stuff that came out of the circuit. But it was all right, and when the bulbs were in series, all half-lit, they would *gloooooooow*, very pretty -- it was great!

I had a fuse in the system so if I shorted anything, the fuse would blow. Now I had to have a fuse that was weaker than the fuse in the house, so I made my own fuses by taking tin foil and wrapping it around an old burnt-out fuse. Across my fuse I had a five-watt bulb, so when my fuse blew, the load from the trickle charger that was always charging the storage battery would light up the bulb. The bulb was on the switchboard behind a piece of brown candy paper (it looks red when a light's behind it) -- so if something went off, I'd look up to the switchboard and there would be a big red spot where the fuse went. It was *fun!*

I enjoyed radios. I started with a crystal set that I bought at the store, and I used to listen to it at night in bed while I was going to sleep, through a pair of earphones. When my mother and father went out until late at night, they would come into my room and take the earphones off -- and worry about what was going into my head while I was asleep.

About that time I invented a burglar alarm, which was a very simple-minded thing: it was just a big battery and a bell connected with some wire. When the door to my room opened, it pushed the wire against the battery and closed the circuit, and the bell would go off.

One night my mother and father came home from a night out and very, very quietly, so as not to disturb the child, opened the door to come into my room to take my earphones off. All of a sudden this tremendous bell went off with a helluva racket -- BONG BONG BONG BONG BONG!!! I jumped out of bed yelling, "It worked! It worked!"

I had a Ford coil -- a spark coil from an automobile -- and I had the spark terminals at the top of my switchboard. I would put a Raytheon RH tube, which had argon gas in it, across the terminals, and the spark would make a purple glow inside the vacuum -- it was just great!

One day I was playing with the Ford coil, punching holes in paper with the sparks, and the paper caught on fire. Soon I couldn't hold it any more because it was burning near my fingers, so I dropped it in a metal wastebasket which had a lot of newspapers in it. Newspapers burn fast, you know, and the flame looked pretty big inside

the room. I shut the door so my mother -- who was playing bridge with some friends in the living room -- wouldn't find out there was a fire in my room, took a magazine that was lying nearby, and put it over the wastebasket to smother the fire.

After the fire was out I took the magazine off, but now the room began to fill up with smoke. The wastebasket was still too hot to handle, so I got a pair of pliers, carried it across the room, and held it out the window for the smoke to blow out.

But because it was breezy outside, the wind lit the fire again, and now the magazine was out of reach. So I pulled the flaming wastebasket back in through the window to get the magazine, and I noticed there were curtains in the window -- it was very dangerous!

Well, I got the magazine, put the fire out again, and this time kept the magazine with me while I shook the glowing coals out of the wastepaper basket onto the street, two or three floors below. Then I went out of my room, closed the door behind me, and said to my mother, "I'm going out to play," and the smoke went out slowly through the windows. I also did some things with electric motors and built an amplifier for a photo cell that I bought that could make a bell ring when I put my hand in front of the cell. I didn't get to do as much as I wanted to, because my mother kept putting me out all the time, to play. But I was often in the house, fiddling with my lab.

I bought radios at rummage sales. I didn't have any money, but it wasn't very expensive -- they were old, broken radios, and I'd buy them and try to fix them. Usually they were broken in some simple-minded way -- some obvious wire was hanging loose, or a coil was broken or partly unwound -- so I could get some of them going. On one of these radios one night I got WACO in Waco, Texas -- it was tremendously exciting!

On this same tube radio up in my lab I was able to hear a station up in Schenectady called WGN. Now, all of us kids -- my two cousins, my sister, and the neighborhood kids -- listened on the radio downstairs to a program called the Eno Crime Club -- Eno effervescent salts -- it was *the* thing! Well, I discovered that I could hear this program up in my lab on WGN one hour before it was broadcast in New York! So I'd discover what was going to happen, and then, when we were all sitting around the radio downstairs listening to the Eno Crime Club, I'd say, "You know, we haven't heard from so-and-so in a long time. I betcha he comes and saves the situation."

Two seconds later, *bup-bup*, he comes! So they all got excited about this, and I predicted a couple of other things. Then they realized that there must be some trick to it -- that I must know, somehow. So I owned up to what it was, that I could hear it upstairs the hour before.

You know what the result was, naturally. Now they couldn't wait for the regular hour. They all had to sit upstairs in my lab with this little creaky radio for half an hour, listening to the Eno Crime Club from Schenectady.

We lived at that time in a big house; it was left by my grandfather to his children, and they didn't have much money aside from the house. It was a very large, wooden house, and I would run wires all around the outside, and had plugs in all the rooms, so I could always listen to my radios, which were upstairs in my lab. I also had a loudspeaker -- not the whole speaker, but the part without the big horn on it.

One day, when I had my earphones on, I connected them to the loudspeaker, and I discovered something: I put my finger in the speaker and I could hear it in the earphones; I scratched the speaker and I'd hear it in the earphones. So I discovered that the speaker

could act like a microphone, and you didn't even need any batteries. At school we were talking about Alexander Graham Bell, so I gave a demonstration of the speaker and the earphones. I didn't know it at the time, but I think it was the type of telephone he originally used.

So now I had a microphone, and I could broadcast from upstairs to downstairs, and from downstairs to upstairs, using the amplifiers of my rummage-sale radios. At that time my sister Joan, who was nine years younger than I was, must have been about two or three, and there was a guy on the radio called Uncle Don that she liked to listen to. He'd sing little songs about "good children," and so on, and he'd read cards sent in by parents telling that "Mary So-and-so is having a birthday this Saturday at 25 Flatbush Avenue."

One day my cousin Francis and I sat Joan down and said that there was a special program she should listen to. Then we ran upstairs and we started to broadcast: "This is Uncle Don. We know a very nice little girl named Joan who lives on New Broadway; she's got a birthday coming -- not today, but such-and-such. She's a cute girl." We sang a little song, and then we made music: "*Deedle leet deet, doodle doodle loot doot; deedle deedle leet, doodle loot doot doo. . .*" We went through the whole deal, and then we came downstairs: "How was it? Did you like the program?"

"It was good," she said, "but why did you make the music with your mouth?"

One day I got a telephone call: "Mister, are you Richard Feynman?"

"Yes."

"This is a hotel. We have a radio that doesn't work, and would like it repaired. We understand you might be able to do something about it."

"But I'm only a little boy," I said. "I don't know how --"

"Yes, we know that, but we'd like you to come over anyway."

It was a hotel that my aunt was running, but I didn't know that. I went over there with -- they still tell the story -- a big screwdriver in my back pocket. Well, I was small, so *any* screwdriver looked big in my back pocket.

I went up to the radio and tried to fix it. I didn't know anything about it, but there was also a handyman at the hotel, and either he noticed, or I noticed, a loose knob on the rheostat -- to turn up the volume -- so that it wasn't turning the shaft. He went off and filed something, and fixed it up so it worked.

The next radio I tried to fix didn't work at all. That was easy: it wasn't plugged in right. As the repair jobs got more and more complicated, I got better and better, and more elaborate. I bought myself a milliammeter in New York and converted it into a voltmeter that had different scales on it by using the right lengths (which I calculated) of very fine copper wire. It wasn't very accurate, but it was good enough to tell whether things were in the right ballpark at different connections in those radio sets.

The main reason people hired me was the Depression. They didn't have any money to fix their radios, and they'd hear about this kid who would do it for less. So I'd climb on roofs to fix antennas, and all kinds of stuff. I got a series of lessons of ever-increasing difficulty. Ultimately I got some job like converting a DC set into an AC set, and it was very hard to keep the hum from going through the system, and I didn't build it quite right. I shouldn't have bitten that one off, but I didn't know.

One job was really sensational. I was working at the time for a printer, and a man

who knew that printer knew I was trying to get jobs fixing radios, so he sent a fellow around to the print shop to pick me up. The guy is obviously poor -- his car is a complete wreck -- and we go to his house which is in a cheap part of town. On the way, I say, "What's the trouble with the radio?"

He says, "When I turn it on it makes a noise, and after a while the noise stops and everything's all right, but I don't like the noise at the beginning."

I think to myself: "What the hell! If he hasn't got any money, you'd think he could stand a little noise for a while."

And all the time, on the way to his house, he's saying things like, "Do you know anything about radios? How do you know about radios -- you're just a little boy!"

He's putting me down the whole way, and I'm thinking, "So what's the matter with him? So it makes a little noise."

But when we got there I went over to the radio and turned it on. Little noise? *My God!* No wonder the poor guy couldn't stand it. The thing began to roar and wobble -- WUH BUH BUH BUH BUH -- *A tremendous* amount of noise. Then it quieted down and played correctly. So I started to think: "How can that happen?"

I start walking back and forth, thinking, and I realize that one way it can happen is that the tubes are heating up in the wrong order -- that is, the amplifier's all hot, the tubes are ready to go, and there's nothing feeding in, or there's some back circuit feeding in, or something wrong in the beginning part -- the RF part -- and therefore it's making a lot of noise, picking up something. And when the RF circuit's finally going, and the grid voltages are adjusted, everything's all right.

So the guy says, "What are you doing? You come to fix the radio, but you're only walking back and forth!"

I say, "I'm thinking!" Then I said to myself, "All right, take the tubes out, and reverse the order completely in the set." (Many radio sets in those days used the same tubes in different places -- 212's, I think they were, or 212-A's.) So I changed the tubes around, stepped to the front of the radio, turned the thing on, and it's as quiet as a lamb: it waits until it heats up, and then plays perfectly -- no noise.

When a person has been negative to you, and then you do something like that, they're usually a hundred percent the other way, kind of to compensate. He got me other jobs, and kept telling everybody what a tremendous genius I was, saying, "He fixes radios by *thinking!*" The whole idea of thinking, to fix a radio -- a little boy stops and thinks, and figures out how to do it -- he never thought that was possible.

Radio circuits were much easier to understand in those days because everything was out in the open. After you took the set apart (it was a big problem to find the right screws), you could see this was a resistor, that's a condenser, here's a this, there's a that; they were all labeled. And if wax had been dripping from the condenser, it was too hot and you could tell that the condenser was burned out. If there was charcoal on one of the resistors you knew where the trouble was. Or, if you couldn't tell what was the matter by looking at it, you'd test it with your voltmeter and see whether voltage was coming through. The sets were simple, the circuits were not complicated. The voltage on the grids was always about one and a half or two volts and the voltages on the plates were one hundred or two hundred, DC. So it wasn't hard for me to fix a radio by understanding what was going on inside, noticing that something wasn't working right, and fixing it.

Sometimes it took quite a while. I remember one particular time when it took the