

ALL POSSIBLE PATHS

Richard Dryden Field Junior *Me, My Family, and Feynman*

RICHARD FEYNMAN'S CURIOUS LIFE

** The Hollywood Years **

My name is Richard Dryden Field Junior. I was born in Pasadena, California, USA on April 13, 1944 while my father, Richard Dryden Field Senior was away fighting in the war. When he returned from the war, he and my mother quickly divorced and my mother, my little sister Sally (1.5 years younger than me), and I moved in with my grandmother in her house in Altadena, California, together with my grandmother's sister and mother. They called me "Ricky". I felt the responsibility of taking care of Sally. We were very close at that time. My mother took the bus into Hollywood every day to work as an actress at Paramount Pictures. In 1951, she took Sally and myself to the movie theatre to see "The Man from Planet X". My mother starred in the movie as the beautiful heroine that was attacked by the alien from outer space and was saved by an intelligent scientist. Sally left the theatre knowing that she would someday be an actress and I left knowing that someday I would be a scientist.

For many of my young childhood years, I lived in a small house with five women. I grew up feeling very comfortable around women and believing that they were superior to men. In 1952, my mother married Jacques O'Mahoney. He was a Hollywood stuntman and an actor. He was the sword fighter and stuntman for Errol Flynn in many of his movies. My step-father was very evil and cruel and treated Sally and myself very badly. We lived in a large house in Encino, California, in the San Fernando Valley, where I attended high school. I was left alone in my large bedroom with a private bathroom and a door to the outside. I could come and go as I pleased. I rarely saw my mother and sister and I tried to avoid my step-father whenever possible. I studied math and physics books. One day a stuntman friend of my step-father gave me a set of weights and I read a book on weight lifting and began working out every day with the weights. In addition, every night at midnight, I would go out of my outside door and exercise in the backyard. My step-father had a trampoline, a high bar, and a 30 foot rope tied to high tree branch. I started reading gymnastic books and joined the gymnastic team at Birmingham High School.

The only good thing to come from my mother's second marriage was my half-sister, Princess O'Mahoney. She is a wonderful person. I had to find a way out of Hollywood. My parents hosted many "Hollywood" parties. The celebrities I met were not real. They were simply "hype" created by the media and the wealthy people I met were not very intelligent. I arranged for a friend who had a car take me to the Van Nuys High School gym three days a week so I could work out with some older gymnasts that trained there. After several months of intense workouts with them, they told me that they were members of the US Olympic Team. I continued to train with them and I became a very good gymnast. In high school, no one could beat me on the rings, parallel bars, and rope climb. In my senior year, we had an away gymnastics match against our arch rival, Cleveland High School. I easily won my three events. At the meet, something magical happened. I saw and fell in love with one of the Cleveland High School female cheerleaders. She was beautiful and amazing. Her name was Jimmie Curry. She would not speak with me. She hated me and thought that I was arrogant and conceited. It was not until the following year that she and I began to date. Jimmie and I have been together for 55 years and very happily married for 51 years.

At the Los Angeles City High School Gymnastic meet, I came within one-tenth of a second of tying the world record in the rope climb. After the meet a short ex-gymnast came up to me and introduced himself. His name was Hal Frey and he was the gymnastic coach at the University of California at Berkeley. He asked if I would like to attend UC Berkeley on a gymnastic scholarship. I said, "Yes, that is exactly what I want to do". I had found my way out of Hollywood. I left and never returned. I was sad that I could not take my little sister Sally with me. I left for Berkeley with contempt for celebrities and the wealthy, and with a hatred of men. I vowed never to be a "celebrity" and never to be "wealthy". I succeeded at both. Later, my sister Sally provided a counter example to what I had learned about Hollywood. She became a very good actress and is a wealthy celebrity. However, she is kind and intelligent, and not a "phony".

** The Berkeley Years **

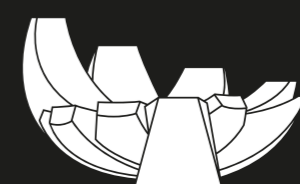
My freshman year at Berkeley was very lonely. I majored in Math. I spent the days studying and working out for gymnastics. I convinced Hal Frey to increase the workouts to twice a day, early morning and late afternoon. I was the top student in all my classes except English. I received a "B" grade in my Freshman English class. It was the only non-"A" grade that I received in my four and one-half years as an undergraduate at Berkeley. Two very important things happened after my freshman year. Jimmie moved to San Francisco to attend San Francisco State University and we spent the weekends together. After one semester she moved in with me at Berkeley. In addition, due to my good freshman grades in math I was asked if I would like to take a new two-year physics course to be called, "The Berkeley Physics Course". I was good at math, but for me math was simply a tool to solve problems. I happily agreed to take the new Berkeley Physics Course. About 30 students started the course; only a few finished the course. For many, it was too difficult and demanding. I loved it and changed my major to physics and engineering.

Jimmie and I were married on November 24, 1966 during my senior year as an undergraduate. Also, during my undergraduate senior year, I was asked if I wanted to be a teaching assistant (TA) for a graduate physics course. They said they were short of physics graduate TA's. Jimmie received her teaching certificate and began working as a teacher in the Berkeley School System and I began to earn money as a graduate TA in physics. Later that year, they asked me if I would like to stay at Berkeley for graduate school in physics and have the job of "Head TA". I agreed and began the job of organising all the graduate physics TA's.

In graduate school, I joined the Chamberlain-Segrè experimental physics group at the Lawrence Berkeley Laboratory (LBL). I had become a good calculator. I loved to calculate things on the LBL computers and began making calculations for the experimental group. At the same time, I was taking graduate physics courses at Berkeley. I signed up for an "Elementary Particle Physics" course to be taught by a new faculty member, John David Jackson. Dave Jackson was previously on the faculty at the University of Illinois and arrived at Berkeley in 1967. Dave was a superb teacher. He was very thorough and meticulous. His course on Elementary Particle Physics was excellent. I received the top grade in his class and Dave agreed to be my Ph.D. thesis advisor. I began working on my Ph.D. thesis in theoretical physics with Dave Jackson and also continued to work with the Chamberlain-Segrè experimental physics group. My first physics publication was with the Chamberlain-Segrè group and my second publication was a theoretical paper with Dave Jackson. I enjoy both experimental and theoretical physics. For me they are one thing, not two things.

First Time I Saw Feynman: While at Berkeley as a graduate student, I attended a physics seminar Richard Feynman gave at LBL. He talked about his "parton model" ideas. Partons are zero radius elementary particles which are the building blocks of protons and neutrons. Previously at Berkeley, I heard mostly about the "bootstrap model", where everything is made from everything else and there are no elementary objects. The creator of the "bootstrap model" was a Berkeley professor named Geoffrey Chew. I never liked the "bootstrap model" and after hearing Feynman, I started thinking more and more about partons.

In 1971, I graduated from Berkeley with a Ph.D. degree in theoretical physics and accepted a two-year post-doctoral position at Brookhaven National Laboratory (BNL) on Long Island, New York. I had a nice office with the Theoretical Physics Group where I sat every day. I was lost! I am a very good problem solver. At Berkeley, I solved every problem I was given, but now nobody was giving me any problems. Now, I was supposed to think up the problems myself and then solve them. Six months went by and I was still sitting in my office. Then one day, two experimental physicists from Nick Samios' group came to my office and said that they had some new bubble



ALL POSSIBLE PATHS

Richard Dryden Field Junior *Me, My Family, and Feynman*

RICHARD FEYNMAN'S CURIOUS LIFE

chamber data and wanted to know what to do with it. They gave me a problem to solve, "What can we learn from this bubble chamber data?" I was on it in a flash. I realised that they measured enough experimental observables to extract information about the scattering amplitudes. I used naïve parton model ideas to tell them which amplitudes were large and which were small. I realised later that I was drawing "Zweig Diagrams", an idea from George Zweig. The Samios Group and I wrote several publications together, which resulted in me being hired in a post-doctoral position at Caltech working in Geoffrey Fox's Phenomenology Group. Phenomenology is the application of theoretical physics to predict experimental data. Phenomenologists are theoretical physicists that work closely with experimental physicists, which seemed perfect for me.

*** The CALTECH Years ***

Jimmie and I arrived at Caltech in Pasadena, California in 1973 with our son Jason who was born on Long Island. We purchased a house in Altadena not far from my Grandmother's house where Sally and I grew up.

My First Face-to-Face Meeting with Feynman: The weekly theoretical physics seminar at Caltech provided an opportunity for Murray Gell-Mann and Feynman to banter for one-upsmanship and to roast the speaker. Feynman had great respect for Murray, but he loved to tease him. I was asked to give a seminar shortly after I arrived at Caltech. Feynman and Gell-Mann were among the people who attended my seminar. I talked about the "parton model" calculations I had done for Samios's group at BNL. Something magical happened during my seminar. I was only able to give the first 15 minutes of my one-hour talk. Feynman started asking me questions and I answered the questions. It went back and forth between Feynman and myself for over an hour. Everyone left the room except Feynman and myself. Finally Feynman said, "Why don't you come to my office tomorrow and we can talk more?" I said okay.

The next day I went to his office in the Theoretical Physics Group on the top floor of the Physics Building and we began to talk. He had been working on translating hieroglyphics and not thinking much about high energy physics. We discussed my "parton model" ideas. He was very interested. During the discussion he tried to intimidate me by jumping up on his desk and shouting at me. It did not affect me at all. At this stage of our relationship, I thought of him as a "celebrity" and to me "celebrity" meant a media-created "phony". At first, I treated him as such. It was the last time I went to his office. He began coming downstairs to my office on the experimental physics floor. He would come in almost every day and we would work together. We had fun working on physics together. I wrote computer programmes to make calculations based on the "parton model" and later to make predictions based on the emerging Quantum Chromodynamics Theory of quarks and gluons (QCD). Every night I would make calculations and plots and he would come to my office the next day to see them. He called me Rick. I called him Feynman. I made many plots, but he would always ask for one I had not yet made. We became very close and I learned that he was not a "phony". However, I always knew there was a bit of "Hollywood" in Feynman.

Feynman and I worked together at Caltech for 7 years (1973 – 80) and we wrote five publications together. The first three papers were on the "Naïve Parton Model" and the last two papers were on the "QCD Improved Parton Model". Feynman was a very unique person. He never lost his child-like wonder, curiosity, and enjoyment of learning, which made him fun to be around. He was also an amazingly good calculator. Since I grew up with no father, my mother thought that perhaps Feynman was a father figure to me. However, that is not true. I was closer to Feynman than to any other man. However, Feynman was not a father figure for me. We were more like two children having fun doing "physics". Early in our relationship, Feynman told me that if we worked together people would think that he did it all. I said, "I do not care. The fun is in the doing".

Feynman and Weight-Lifting: Sometimes Feynman and I would work on physics together at his house. He had some weights in his cellar. One day, I asked him if he could pick up his large dumbbell and curl it with two arms. It was too heavy for him. After my gymnastic years, I continued to exercise. I curled it with one arm. He could not believe it. Feynman was very competitive. He did not like the fact that I could do something he could not do. He started working out with weights every day. He said that someday he would be stronger than me. Over the next several years, he became much stronger physically, but not as strong as me.

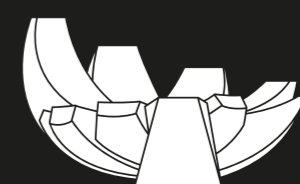
Feynman's Advice about Reading Publications: Feynman instructed me not to read anyone's theoretical physics publications. He said it was okay to read the experimental publications and study the data, but not the theory publications. He said that if I read what other theorists were doing, then I would simply follow their lead. He said that I should work out everything from scratch myself. Only then would I be unbiased and able to come up with new ideas myself.

Feynman and the "Turkey": Feynman enjoyed classifying physicists. There were two categories, "Average Good Guy" and "Turkey". "Turkey" meant incompetent. Feynman thought that we had invented the word "Turkey" to mean incompetent. One day, the Caltech theoretical physics seminar was being given by a well-known theoretical physicist that was a friend of mine. During the seminar Feynman turned to me and said in loud voice, "Please pass the cranberry sauce". That night at dinner at my house, the friend asked me, "What did Feynman mean by pass the cranberry sauce?" I lied and told him I did not know. I do not like classifying people, but I played the game with Feynman. In this case, I agree with Feynman, my friend was a bit of a "Turkey".

Feynman and Acting "Smart": Feynman told me that people who act like they know everything are not smart enough to know that they do not know very much. He said that the smartest people are humble because they know there is much to learn. After our first meeting, Feynman never acted arrogant or conceited around me again. He was very humble and would say to me, "little steps for little minds", referring to himself. Feynman never thought of himself as a genius. He felt he was different, but different because he could understand things without being a "genius." He would say to me, "if it takes a genius to understand it, then we don't understand it".

The Caltech Preprint Librarian: During my years at Caltech, the internet was just beginning to develop. If someone wanted a copy of a research paper before it was published in a journal, they would send a postcard requesting a copy of the preprint. The preprint librarian at Caltech would then mail the preprint to them. After the birth of our second child Aimee in 1975, my wife Jimmie began working as the physics preprint librarian at Caltech. We needed the extra money. She had an office at Caltech where the postman delivered the preprint requests. She had small boxes with the names of all the physics faculty and would put the request in the appropriate box and then later mail out the preprint. Feynman & Field had a huge barrel where she would place our requests. She received hundreds of requests for the Feynman & Field papers. She was amazed and proud of what I accomplished.

ICHEP 1978 Tokyo: In 1978, the International Conference on High Energy Physics was held in Tokyo, Japan. Feynman agreed to attend the conference and give a one-hour plenary talk on our QCD predictions for hadron-hadron collisions. I wrote computer code and made the calculations using the Caltech and LBL computers. Feynman would make checks by hand with a pencil and paper. About a month before Feynman was scheduled to leave for Tokyo, he became very ill from stomach cancer and underwent surgery. Feynman asked the organisers of the conference to let me give the talk on our work. They were very reluctant to have me talk. Feynman insisted and



ALL POSSIBLE PATHS

Richard Dryden Field Junior *Me, My Family, and Feynman*

RICHARD FEYNMAN'S CURIOUS LIFE

explained to them that I made the calculations and no one could explain what we had done better than me. They yielded and I left for Tokyo using Feynman's airline ticket. When I arrived at the then brand new Narita airport in Tokyo, I was met by the Governor of Tokyo and an entourage of beautiful women from the Miss Tokyo Beauty Pageant. They expected to see Feynman

get off the plane. When they saw me they all quickly scurried away. I very much enjoyed presenting our QCD model predictions for hadron-hadron collisions at the conference. I was sure QCD was the correct theory of the strong interactions. At the end of my talk, I said, "This is a very exciting and fun time. We have a theory and it is up to all of us to confirm that it is indeed the correct theory of strong interactions".

*** The Move to Florida ***

In 1980, I accepted a position in the physics department at the University of Florida and Jimmie and I and our three children moved to Gainesville, Florida. Our two daughters, Aimee and Amanda, were born in Pasadena at the same hospital that I was born in. Moving to Florida was a difficult decision for me to make since I very much enjoyed interacting with Feynman. Feynman was sad to see me leave Caltech.

Feynman Letter of Recommendation: The University of Florida asked Feynman to write a letter of recommendation for me. Many years later, I saw the letter. All Feynman said was, "Please do not take Rick away from me." I got the job. Feynman's Visit to Florida: In 1981, Feynman visited us and stayed several days in our house in Florida. At that time our son Jason was 8 years old, Aimee was 6 and Amanda was 2. One evening at our house, Feynman got down on the carpet with our three children and began to crawl around with them. He said, "I bet I can make you laugh". The children accepted the challenge and refused to laugh. Feynman crawled around and said the word "jello". He then crawled around and again said "jello". He repeated this over and over again until all three children were laughing hysterically.

Feynman and the Bathroom Scale: In our house in Florida, we had recently purchased a new battery-operated digital scale that we used to weigh ourselves. While visiting us, Feynman went into the bathroom and shut the door. After about 30 minutes, I began to worry about him so I knocked on the door. He was weighing himself over and over again many times. He was fascinated with the digital scale. It was the first one he had seen. He said he wanted to see if it would always give the same reading for his weight. He was trying to determine the precision of the digital scale. Later, we bought another identical digital scale and mailed it to Feynman. I believe he used it the rest of his life.

In early 1988, I participated in a six-month workshop held at the Institute for Theoretical Physics at the University of California at Santa Barbara entitled, "QCD and its Applications". Jimmie and I, together with our three children, drove from Florida to California in our large Dodge conversion van and rented a house near the institute. After gymnastics, Jimmie and I and our three children trained to become good tennis players, and I used the Dodge van to take our family to tennis tournaments around the state of Florida and around the nation. The van had beds in the rear with a television. During the beginning of the workshop, the Institute hosted a two or three-day physics conference on QCD and its applications. Feynman wanted to see me and to attend the conference. Feynman's secretary at Caltech, Helen Tuck, told me that Feynman was too weak to attend the conference. His cancer had progressed to an advanced stage. I told her that I would pick up Feynman in my Dodge van and take him to conference. I reserved a room at the conference motel for him. I promised to take good care of him. He very much wanted to go. When I picked him up, I was sad to see how weak and frail he had become. Even though my van did not have "Feynman Diagrams" painted on the side like Feynman's van did, he liked my

van very much. During the drive from Caltech to Santa Barbara, I was anxious to tell him about the new data from Fermilab which showed that our QCD calculations in 1978 were indeed correct. He wanted to tell me about his involvement in the Space Shuttle Challenger incident. I remember taking my children to school on that very cold day in Florida in January 1986. From our house, we saw the Challenger lift-off. Feynman said that he very much enjoyed interacting with the workers at NASA in his attempt to determine the cause of the disaster.

Feynman was fantastic at the physics conference. He was his usual self, asking many questions and enjoying the physics. Everyone was happy to have him there. He made the conference better.

My Last Meeting with Feynman: At the end of conference, I drove Feynman back to his house in Altadena. When we arrived at his house, he asked me not to leave. He wanted to talk more with me about the Fermilab data. I told him I had to get back to my family in Santa Barbara. He grabbed me and said, "Rick, I am dying". I did not know what to say. I said, "So am I", and got in the Dodge van and headed back to Santa Barbara. Feynman died several days later.

Feynman's Funeral: Soon after Feynman's death, I received an invitation to attend the private funeral arranged by his wife and children. It was held at a cemetery in Altadena, California, not far from his home. I drove the Dodge van from our rented house in Santa Barbara to Altadena and attended the funeral. It was very nicely done. Many of Feynman's friends were there. I believe only two physicists were there, me and Murray Gell-Mann. At the end of the ceremony, I helped shovel dirt on Feynman's casket and felt lost without my close friend. At the end of the Santa Barbara workshop, Jimmie and I and the three children drove back to Florida in the Dodge van. There will never be another Feynman. Feynman was one of a kind! I miss him very much and dream of him often.

Rick Field (with help from Jimmie)
Florida – June 2018

