



# Science serving sports, industry, medicine and human performance

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The Coto Research Center, led by Dr. Gideon Ariel, is revolutionizing sports, medicine, and industry by applying computer technology and biomechanical analysis. The center uses high-speed cameras, electromagnetic digitizer pens, and unique software programs to study and improve human movement, athletic performance, and injury prevention. The center's work has been recognized globally, with its biomechanical analysis being used by Olympic teams and professional athletes. The center also applies its research to medical rehabilitation, prosthetics, and injury prevention. In the industrial sector, the center's biomechanical analysis has led to improved product design and safety, and has potential applications in robotics and human-machine interaction. The Coto Research Center is located in Coto de Caza, a resort complex between San Diego and Los Angeles.

The article discusses the Coto Research Center located in Coto de Caza, Southern California. The center boasts state-of-the-art facilities including biofeedback laboratories and electronic equipment valued over \$2,000,000. The center also includes a 200-meter indoor-outdoor running track equipped with 8 imbedded Force Platforms connected to a computer complex. The center is staffed by a team of experts in various fields including Dr. Gideon Ariel, the President and Co-Founder, and Vic Braden, the Chairman of the Board and Co-Founder. The center also has an advisory board comprising of experts from various universities and medical centers. Future plans for the center include the addition of two 18-hole golf courses.

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Below find a reprint of the 12 relevant pages of the article "Science serving sports, industry, medicine and human performance" in "Coto Research Center":



**COTO RESEARCH CENTER**  
at Coto de Caza  
an Arvida Resort Community

SCIENCE  
SERVING  
SPORTS  
INDUSTRY  
MEDICINE  
AND HUMAN  
PERFORMANCES



**COTO RESEARCH CENTER IS MAKING NEWS — WORD IS SPREADING ALL OVER THE WORLD!**

“Dr. Gideon Ariel...is training the athlete's neurological patterns and functions as well as the traditional muscular functions by applying computer technology to sports.”  
SMITHSONIAN, Jay Stiller

“Gideon Ariel has been a leading figure in taking the great raw minds of computers and bringing them to bear on movement. In so doing, he has for the first time let us see the line and meter of human motion. Sport can never be the same.”  
SPORTS ILLUSTRATED, Kenny Moore

“Because of Dr. Gideon Ariel, athletes and athletics will never be the same...his knowledge is also working toward the prevention and treatment of injury in sports.”  
MONTREAL STAR, Kay Cassill

“With biomechanical analysis, the coach of an Olympic team has the possibility of comparing his subjective impression with the objective analysis of the computer, and to take advantage of the invaluable assistance given, which enables him to detect more accurately the thresholds of fatigue and intensification of effort.”  
OLYMPIC REVIEW, François Cofrant

“Dr. Gideon Ariel...is deeply and professionally involved in the biomechanical analysis of athletic movement, an area of study within the general field of sports medicine that is beginning to have significant impact on athletics. From this field are coming new, improved and sometimes safer techniques and equipment.”  
GOLF MAGAZINE, Al Barkow

And...the story has only just begun!

COTO RESEARCH CENTER



Gideon B. Ariel, Ph.D., Co-Founder-President

“Our goal is to bring biomechanical research within everyone's reach: Top athletes who wish to obtain optimal performance...sports enthusiasts who want to achieve maximum potential...the physically handicapped who can derive great benefits from the new technology. This—and more—we are prepared to do at the Coto Research Center.”

Gideon B. Ariel, Ph.D.  
Co-Founder-President

**WE INVITE YOU TO EXPERIENCE COTO RESEARCH CENTER...**

**IT COULD BE THE BEST MOVE OF YOUR LIFE.**

In 1700 Sir Isaac Newton formulated the laws of gravity. At Coto Research Center we are applying the laws of Newtonian physics to space-age people and

products...and coming up with winners in sports, medicine, industry and human performance.

For this is the age of miracles. Man has flown faster than sound and walked on the moon. At Coto Research Center we concentrate on a very special miracle...the human body.

Dr. Gideon Ariel began his studies of the body in motion more than 12 years ago. His science, biomechanics, in simple terms, applies engineering methods to biological systems. With the help of high-speed cameras, electromagnetic digitizer pens, computers and unique software programs which have taken more than 10,000 hours to write, Coto Research Center can solve almost any problem of human movement, robotics and related industrial applications.

At Coto Research Center we look far beyond the barriers of human perception. The important things in performance — timing, relative speed of dozens of limbs and body segments, changes in centers of gravity — are all measured, weighed and quantified scientifically.

But Coto Research Center is more than the best laboratory of its kind in the world. Its outstanding facilities and exceptional staff are located in Coto de Caza, a resort complex of incomparable beauty. Among its neighbors in the lush valley are the Vic Braden Tennis College and the Coto Coaches College, a unique entity for coaches, teachers and students. It is home to the U.S. Olympic Womens Volleyball team and other world-class competitors who enjoy the stimulation of the area.

Coto Research Center is midway between San Diego and Los Angeles, the host city of the 1984 Olympics. There is easy access from all major centers.

And, our Research team is prepared to reach out anywhere in the world to serve you, with creative applications of biomechanics, physiology and motor learning.

SPORTS

“Our theory is that everybody is a gold medalist in his or her own body: so we want to allow people to reach their maximum potential in life.”

Dr. Gideon Ariel

**BIOMECHANICAL ANALYSIS WILL CHANGE THE WAY YOU PLAY YOUR GAME...IT MAY EVEN CHANGE YOUR LIFE**

**May We Show You How To Do Your Best?**

Step out on Coto's 200 meter professional track. Pick up a racket on one of the 34 tennis courts and lanes at Vic Braden's famous school. Jump...run...kick...pitch...drive...dive...just do your particular thing to the very best of your current technique.

Meanwhile...we will film the action at a high speed of up to 10,000 frames per second, and project these high-speed images one frame at a time onto a screen over an array of 20,000 extremely sensitive electromagnetic fields. Your motion will be reduced to three-dimensional computer images which can simulate your body's full sequence of movement (a golf swing, a backward dive, a sprinter's start, a football kick, gymnastics, etc.).

We can freeze the movement at any point for closer observation. We will interpret the significance

and control of each body segment—forearm, leg or a particular muscle or joint—and its contribution to the performance.

Then we create a computer pattern of the very best series of motions for you, correcting angles that the naked eye could never see. And finally, we show you, your parents, or your coach, how to use the talent you possess and how to consistently do your best.

**A World of Winners:**

No one can yet predict with total accuracy the psychology of the will to win, but we can measure talent and potential skill with scientific precision.

At Coto Research Center we deal with all biological systems. We have biomechanically analyzed the great winner of the Kentucky Derby, Spectacular Bid. We have helped trainers select horses of outstanding promise and shown them how to maximize a horse's gait.

Coto Research Center is a world of winners...and we can point you towards the top.

**Going for the Gold:**

An Olympics competitor in 1960 and 1964, Dr. Gideon Ariel has a personal empathy for those individuals who are striving to optimize their physical potential and minimize their vulnerability to injury. He has been serving as Chairman of computer sciences and biomechanics for the United States Olympic Committee from 1977 to date.

The Coto Research Center has analyzed many of the Olympic teams for coaches in America and other countries; e.g., Germany, England, France, Italy, Spain, the Netherlands.

The sports include swimming, gymnastics, diving,



cycling, fencing, weight-lifting and all athletic events (track and field, etc.).

The results have been written into records and stored in the Coto Research Center's Computer Library. But many of the success stories have also been written in Gold.

■ **SHOT PUT**, after utilizing our biomechanical analysis, two world records in the shot put event were established in U.S. Olympic training competition.

■ **DISCUS**, many world class discus throwers have utilized our system. After our analysis, most achieved their best performances and in one case it led to a Gold Medal in the Olympics.

■ **DIVING**, our divers learned that accelerating their arms during takeoff on a backward dive allows for a higher spring.

■ **VOLLEYBALL**, Arie Selinger, U.S. Olympic Womens Volleyball Team coach says, "Our biomechanical analysis of spiking, serving, and passing helped us re-evaluate what we've been doing." The team has won victories over top-rated Cuban, Japanese, USSR, East Germany, Rumanian and Bulgarian teams in world competition.

It is looking for Gold at Los Angeles in '84.

**Professionals Come to Coto Research Center too:**

"I can't coach a professional team, but I can give it the information it needs to play at its peak. I can tell football players, how to hit their opponents, how to create the greatest force in blocking, how to improve helmets."

Dr. Gideon Ariel

**The Coto Research Center works with...**

■ **Coaches...** showing them how to maximize performance. It also houses an unusual Coaches College where coaches learn the most sophisticated means of training champions. It utilizes data collected from athletes and teams to make coaches more aware of the basic principles of their sport.

■ **Recruiters...** measuring potential in multi-talented individuals and discovering in which area they are most apt to excel.

■ **Players...** correcting deviations in motion, working for injury prevention, strengthening performance and helping them to better their own best records.

■ **Horse owners/trainers...** by analyzing a schooling horse's gait and profile, we can advise owners and trainers if the horse has the potential of becoming a champion.



"Human beings are creative, but we have terrible memories. Computers are ignorant, but their memories are infinite. You have to guide them step-by-step and channel your creativity through the computer software—which is the program created by human ingenuity."

Dr. Gideon Ariel

in SPORTS ILLUSTRATED

Coto Research's Sophisticated World of Computer Software

This is how the system works:

**INDIRECT ANALYSIS**



**HIGH SPEED CINEMATOGRAPHY**

High speed cameras are used to take motion pictures from multi-angled views to provide accurate positional data. Above, Flo Hyman of the U.S. Womens Olympic Volleyball Team.



**DIGITIZING**

After high speed movies are taken, the image is projected, frame by frame, onto a sophisticated digitizer which inputs into the computer memory the location of each of the body's joint centers. This procedure is repeated for each camera angle. Dr. M. Ann Penny demonstrates this digitizing process.

**DIRECT ANALYSIS**

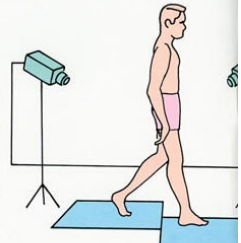
The Direct Analysis method is possible because of the following:

- A. Advanced state of the art equipment — The Kistler Force Platform and the Selspot II System
- B. Coto Research Center's Software Programs.

The Kistler Force Platform measures component forces exerted by the person's foot. The Platform allows the evaluation of various components of forces and utilizes the latest developments in electronic solid state design to

provide precise data for non contact motion analysis of objects in two and three dimensions. The well-proven position sensitive detector generates information to the Selspot II System.

Both the Force Platform and the Selspot II in conjunction with the computer, provide real time analysis for immediate feedback to the performer or his/her coach. THIS SOPHISTICATED SYSTEM CAN OPTIMIZE ITS CAPACITY ONLY BECAUSE OF THE UNIQUE PROGRAMS DEVELOPED BY COTO RESEARCH CENTER.



KISTLER force plates



**FIGURES**  
Megatek system automatically the coordinates of any point touched being pen to create on a special monitor figure. These stick figures can be rotated at a joy stick to any angle, giving a mensural quality.



**EVALUATION**

Dr. Ariel evaluates the vast data of the computer readout as he compares the dynamics of Flo Hyman's spike to that of Japan's best spiker, Yokoyama.

**RECOMMENDATION**

Results of the test and recommendations are given to the individual and coaches. Based on the results, additional questions may be raised by the performer or coaches for future analysis.



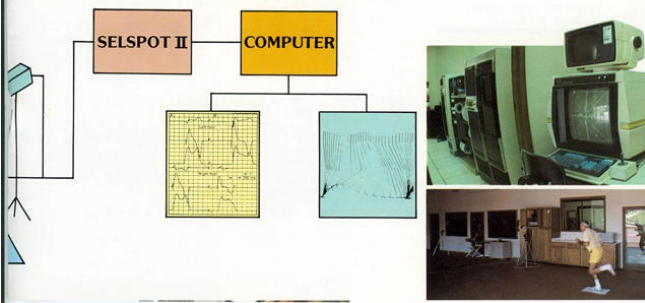
**COMPUTER ANALYSIS**

Above, Dr. Ariel calls upon computer to give him data as to displacements, accelerations and forces Hyman's body segments spikes the ball.



**APPROBATION**

President and Mrs. Carter congratulate Coach Arie Selinger on the remarkable achievement of the United States Womens Olympic Volleyball Team... achievement due in part to the extensive contributions by and usage of the Coto Research Center's systems.



"Space-age medicine and biomechanics are partners in progress. At Coto Research Center we work to lower the possibility of injury...to overcome degenerative locomotor patterns in neurological disease...to restore maximum mobility to the disabled with prosthetics and scientific exercise. It's work we enjoy."

Dr. Gideon Ariel

In a society increasingly concerned with physical fitness, statistics show an alarming rise in sports-related injury. In addition, human mobility is curtailed by trauma from accident and by degenerative disease such as muscular dystrophy. The Coto Research Center has pledged its facilities to the use of medical science, utilizing the most sophisticated technology of the computer age:

- to predict bodily stresses which lead to injury and to recommend preventative measures;
- to restore maximum usage to those who have suffered impaired bodily movement.

**MEDICINE AND SPORTS—An Ancient Tradition**

At the dawn of the Olympic Age in Greece, every phase of the ancient athletes' training was supervised by physicians known as gymnasts. Among the most famed was Herodicus, teacher of Hippocrates, the "father of medicine."

The founder of the Coto Research Center, Dr. Gideon Ariel, is an active participant of the Olympic Sports Medicine Committee. He is particularly concerned that competitors understand the findings of biomechanics.

To work with a modern athlete, the Coto Research team utilizes all of its expertise in evaluating reaction time, reflexes, engineering and physiology. The challenge is to prevent injury — to show the contender how to use movement properly to avoid undue stress on the body parts. For the smallest pain can change patterns of locomotion, and this...or any poor habit of posture or position can ultimately inhibit a chance for a record performance.

**Rehabilitation — One of Coto's Special Concerns:**

A person's performance is tied into a computer's memory which compiles data on every aspect of movement, velocity, center of gravity, strength, timing. Changes are calculated on a computer screen capable of displaying these aspects and then an analysis of possible improvements is made.

The Wilson Ariel 4000 Computerized Exercise Machine is particularly effective in rehabilitation. The computerized exerciser not only monitors progress, it can help in pinpointing how far the user remains from normality and how long before he can resume full use of the weakened area of the body.

In working to overcome the effect of injuries, the Wilson Ariel 4000 can, for example, build up a post-surgical knee by presenting it with the most appropriate amount of pressure each day. Meanwhile, it can keep the other leg from weakening by challenging it with

the full training weight. For amputees, the Research Center offers a new world of comfort and design in prosthetics. Working with the handicapped as well as manufacturers, the Center has been instrumental in the computerized testing of artificial limbs. It can strive for the perfect fit for optimum mobility.

**Executive Fitness — Exercise is the Key:**

Here again, the Wilson Ariel 4000 is a revolutionary aid to provide an executive with a computerized workout. The machine uses hydraulics to build muscles and a computer for monitoring and producing instant feedback on performance. In a short period of time — and in the most effective way — a sedentary individual can increase physical capacity without overexerting the muscles. A physical profile is created, relating the individual's strengths, weaknesses, body peculiarities, speed and duration by the Wilson Ariel 4000's programs.

The Wilson Ariel 4000 can be your friend...it will let you know if you're lazy, or if you should try harder. It will even remind you to pay your gym dues!

Coto Research Center will also design a dietary program for maximum health. We know that the better you feel, the better you will perform — both on the job and during leisure hours.



INDUSTRY

“Biomechanics offers much larger and more positive opportunities than just a consumer’s guide to sports and recreation equipment and techniques. Biomechanics can literally improve life from cradle to grave.”

Dr. Gideon Ariel

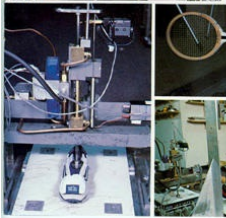
**COTO RESEARCH CENTER—HOME OF THE NEW INDUSTRIAL REVOLUTION**

Biomechanics and industry have already proven their natural affinity. The sophisticated software at Coto Research Center can:

- analyze methods of manufacture;
- analyze human performance;
- analyze the end product for safety and efficiency;
- analyze human-machine interaction; e.g., robotics.

**The Future Is Now!**

In recent years, computerized biomechanical analysis has resulted in the improved design of a variety of products.



Particularly in the area of athletic equipment, our tests have led to revolutionary changes. The flak jacket which protects football players was developed as a direct result of our research. Changes have been made affecting the velocity of tennis balls, the fit of athletic shoes, the balance of basketballs...and more.

The uses of biomechanics in industry are limitless...

- We have designed and constructed dental equipment.
- We have improved performance and safety features of bicycles.
- We have researched the injury potential in children’s toys and suggested modifications.

**And the work has only started.**

Coto Research Center has a special interest in the study of human performance on the job. Whenever a trained worker is immobilized by accident, a company loses one of its most valuable assets. To improve safety, we analyze the environment and the employees for fatigue factors; we check buildings to learn the slip-and-fall potential of various surfaces.

Our information is invaluable to insurance companies. Eventually we can affect the computation of actuarial tables! In the settlement of claims for disability,

biomechanical computerized analysis can provide revolutionary standards of measurement. It can pinpoint loss of function exactly... prescribe remedial exercise for maximum restoration of mobility. For the first time, there can be objective scientific quantification of disability.

**Meeting the Challenges of Tomorrow**

Leonardo da Vinci, the spiritual father of biomechanics, wrote: “Mechanical science is, above all others, the most useful, seeing that by means of it all animated bodies which have movement perform their actions.”

At Coto Research Center, we are proud of our “useful science.” It is the wave of the future.

- In our laboratories, we continuously explore the infinite applications of movement to the world in which we live. We are ready to create the questions as well as the answers.
- What is the best way of carrying equipment on the human body (backpacks, weaponry, etc.)?
- How do we best position people in planes, in tanks, in automobiles for maximum safety and comfort?
- How do we use the new science of robotics with the greatest efficiency in industry?

**An Invitation**

The staff of the Coto Research Center invites you to examine with us the uses of biomechanics for your firm or product. Join us in the New Industrial Revolution and discover the world of tomorrow...today.

FACILITIES

The facilities surrounding the Research Center at Coto de Caza



include a magnificent club house, restaurant, three swimming pools, gymnasium (complete with exercise rooms, saunas and jacuzzi), tennis and racquetball courts, bowling, a large Equestrian Center, and a hunt lodge with skeet and trap shooting.



The Computer Complex consists of 8 Data General Nova computers, 2 Megatek Graphics Systems,

The world famous Vic Braden Tennis College, adjacent to Coto Research Center, has the most sophisticated method of tennis instruction with Vic and his hand-picked teaching professionals. There’s a videotape system for



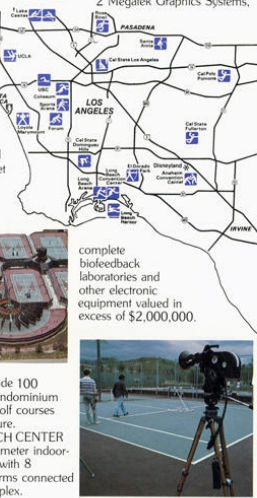
immediate playback analysis and unusual special equipment for the advanced as well as the beginner plus its own Conference Center. If it’s happening in tennis, it probably happened first at Vic Braden’s Tennis College.



Accommodations include 100 beautifully furnished condominium rooms. Two 18 hole golf courses are planned for the future.

COTO RESEARCH CENTER facilities include a 200 meter indoor-outdoor running track, with 8 imbedded Force Platforms connected to our Computer Complex.

complete biofeedback laboratories and other electronic equipment valued in excess of \$2,000,000.



We invite you to come to Coto Research Center located in Coto de Caza’s thousands of acres of lush rolling hills and valleys in Orange County, Southern California.

SAN DIEGO

Map not to scale

COTO RESEARCH CENTER

**STAFF**

- Dr. Gideon Ariel—President & Co-Founder
- Vic Braden—Chairman of the Board & Co-Founder
- Dr. M. Ann Penny—Vice President, Director of Research
- Dr. Arie Selinger—President Coto Coaches College & Director of Physiology
- Dr. Jeremy Wise—Director of Computer Science
- Alan Blitzblau—Director of System Development
- Justin Millium—Director of Micro-Systems Development
- Dr. Dany Saar—Director Fitness Systems

**MARKETING**

H. Bo Frieden, Director of Marketing

**ADVISORY BOARD**

- Dr. David L. Costill, Director, Human Performance Laboratory, Ball State University, Indiana
- Dr. Irving I. Dardik, Cardiovascular Surgery Chairman, U.S. Olympic Council on Sports Medicine
- Dr. Donald Hagan, Director, Exercise Physiology Division, Aerobics Center, Dallas, Texas
- Dr. Stephen Rerych, Department of Thoracic Surgery, Duke University Medical Center, Durham, North Carolina, Member, U.S. Olympic Council on Sports Medicine, Olympic Gold Medalist
- Dr. Arnold Starr, Chairman, Department of Neurology, University of California, Irvine
- Dr. John Sidney Shafer, Professor of Orthopedic Surgery, University of Illinois, Orthopedic Physician, Chicago White Sox Baseball Team
- Dr. Stanley Van den Noort, Dean, College of Medicine, University of California, Irvine
- Dr. Bertram Zarins, Orthopedic Surgery, Harvard Medical School, Massachusetts General Hospital, Boston, Member, U.S. Olympic Council on Sports Medicine



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