

CHEMICAL HERITAGE FOUNDATION

MAX D. LISTON

BECKMAN HERITAGE PROJECT

Transcript of Interviews  
Conducted by

David C. Brock and Gerald E. Gallwas

in

Irvine, California and Fullerton, California

on

19 February 2002 and 22 January 2003

(With Subsequent Corrections and Additions)

CHEMICAL HERITAGE FOUNDATION  
Oral History Program  
FINAL RELEASE FORM

This document contains my understanding and agreement with Chemical Heritage Foundation with respect to my participation in a tape-recorded interview conducted by David C. Brock, Gerald E. Gallwas, on February 19, 2002 January 22, 2003.

I have read the transcript supplied by Chemical Heritage Foundation.

1. The tapes, corrected transcript, photographs, and memorabilia (collectively called the "Work") will be maintained by Chemical Heritage Foundation and made available in accordance with general policies for research and other scholarly purposes.
2. I hereby grant, assign, and transfer to Chemical Heritage Foundation all right, title, and interest in the Work, including the literary rights and the copyright, except that I shall retain the right to copy, use, and publish the Work in part or in full until my death, and that the interviewer shall retain the right to use the Work without the permission of Chemical Heritage Foundation.
3. The manuscript may be read and the tape(s) heard by scholars approved by Chemical Heritage Foundation subject to the restrictions listed below. The scholar pledges not to quote from, cite, or reproduce by any means this material except with the written permission of Chemical Heritage Foundation.
4. I wish to place the conditions that I have checked below upon the use of this interview. I understand that Chemical Heritage Foundation will enforce my wishes until the time of my death, when any restrictions will be removed.

**Please check one:**

a.  \_\_\_\_\_

**No restrictions for access.**

**NOTE:** Users citing this interview for purposes of publication are obliged under the terms of the Chemical Heritage Foundation Oral History Program to obtain permission from Chemical Heritage Foundation, Philadelphia, PA.

b. \_\_\_\_\_

**Semi-restricted access.** (May view the Work. My permission required to quote, cite, or reproduce.)

c. \_\_\_\_\_

**Restricted access.** (My permission required to view the Work, quote, cite, or reproduce.)

This constitutes my entire and complete understanding.

(Signature)

Max D. Liston  
Max D. Liston

(Date)

12/29/03

This interview has been designated as **Free Access**.

One may view, quote from, cite, or reproduce the oral history with the permission of CHF.

***Please note:*** Users citing this interview for purposes of publication are obliged under the terms of the Chemical Heritage Foundation Oral History Program to credit CHF using the format below:

Max D. Liston, interview by David C. Brock and Gerald E. Gallwas in Irvine, California and Fullerton, California, 19 February 2002 and 22 January 2003 (Philadelphia: Chemical Heritage Foundation, Oral History Transcript # 0252).



Chemical Heritage Foundation  
Oral History Program  
315 Chestnut Street  
Philadelphia, Pennsylvania 19106



## MAX D. LISTON

1918 Born in Oswego, Kansas on 16 March

### Education

1938 A.S., Fort Scott Jr. College  
1940 B.S., electrical engineering with communication option, University  
of  
Minnesota  
1941 M.S., mechanical engineering, Chrysler Institute

### Professional Experience

1940-1942 Chrysler Corporation  
  
General Motors Corporation  
1942-1946 Researcher  
  
Perkin Elmer, Inc.  
1946-1950 Chief Engineer  
  
Liston-Becker Corporation  
1950-1955 Founder  
  
Beckman Instruments, Inc.  
1955-1958 Manager, Liston Becker  
1958-1965 Director of Engineering  
  
Liston Scientific Corporation  
1975-present Founder and President

## ABSTRACT

Max D. Liston begins the interview with a discussion of his education. After graduating from high school in Fort Scott, Kansas, Liston attended the University of Minnesota. In 1940, he received a B.A. in electrical engineering with an option in communications. He was hired at the Chrysler Corporation that same year, and he participated in the Chrysler Institute; receiving his M.S. in mechanical engineering in 1941. After transferring to General Motors in 1942, Liston developed the breaker-type DC amplifier while modifying a submarine analyzer developed by Charles Kettering. With the assistance of Morris Reeder, Liston also developed an innovative vacuum thermocouple. In 1946, he was hired at Perkin-Elmer as the chief engineer. While there, he incorporated the breaker amplifier and vacuum thermocouple in to his designs for the Model 12 and Model 21 spectrophotometers. In 1950, Morris Folb and he formed the Liston-Folb company, which later became Liston-Becker. Together, they developed three atmospheric-analyzer models for the US Navy's submarines, and the Model 16 capnograph. Beckman Instruments acquired Liston-Becker in 1955. When Beckman Instruments consolidated their assets three years later, the Connecticut-based Liston-Becker plant was closed and Liston moved to California to become the corporate director of engineering. One of his most significant projects at Beckman Instruments was the development of automobile-emissions analyzers for smog tests in L.A. Liston is currently the president of Liston Scientific, a company he formed in 1975. His numerous accomplishments since its founding include the development of the Paramax, Digital-Alpha technology, and chemical-luminescence instrumentation. Liston concludes the interview with a brief discussion of his perceived influence on the field of spectrophotometry.

## INTERVIEWERS

David C. Brock is Program Manager for Educational and Historical Services at the Chemical Heritage Foundation in Philadelphia. He is currently a Ph.D. candidate in the History Department, Program in the History of Science at Princeton University. In 1995, Mr. Brock received his M.A. in the History of Science from Princeton University and in 1992, he earned a M.Sc. in the Sociology of Scientific Knowledge from the University of Edinburgh.

Gerald E. Gallwas was a member of the original team in the mid 1960s that founded and managed the growth of what became the clinical diagnostic business of Beckman Instruments. As the business grew, he served in many roles from new product development to directing clinical field trials in the United States, Europe, and Japan. This led to an extensive involvement with professional and trade organizations as well as regulatory agencies. He retired after thirty years of service as director of program management overseeing new product development programs.

## TABLE OF CONTENTS

- 1 Family Background and Education  
Parent's background. High school grades and experiences. Northwestern University. Interest in science. First radio. Undergraduate studies at the University of Minnesota. Writing of two undergraduate research papers. Sigma Psi honorary.
- 3 Early Career  
The "Chrysler Institute." Walter P. Chrysler. Paul Ackerman. The life-testing endurance department. General Motors. Debating Ackerman's job offer. Charles F. Kettering. Gifford G. Scott. Submarine Analyzer. Breaker-type DC amplifier. Triptane development. Professor Harrison Randall. University of Michigan spectrophotometry research. Firestone System. GM engine research. Dr. Ross Gunn. Military applications of the breaker amplifier.
- 8 General Motors and Perkin-Elmer  
DuPont's Experimental Research Station. Dr. David Frye. Dr. Downing. Dr. August Herman Pfund. Eppley vacuum thermocouples. Dr. E. J. Martin. Morris Reeder. Development of Reeder thermocouples. Problems of the Frigidaire division. GM stops production of the breaker amplifier. Howard Mogy. Richard S. Perkin. Formation of Perkin-Elmer. John U. White. GM's contracts with the Navy. Liston's move to Connecticut for Perkin-Elmer. Optically compacting tank prisms. Dick Perkin's money troubles. The Model 21. W. Brusky. Van Zandt Williams. John White leaves Perkin-Elmer. Dick Perkin's immorality.
- 12 Work After Perkin-Elmer  
Morris Folb. License for breaker amplifier. Dr. James Elam. Dr. George Saxton. Development of the Model 16 CO<sub>2</sub> analyzer. The Model 16 solves respirator problems. The Polio Foundation. The Iron Lung. Dr. John Severinghouse. Liston-Becker. Design description of the Model 16. Dr. Williams. Leeds and Northrup. The birth of non-dispersive IR. Perkin-Elmer's competition with Beckman Instruments. Arnold O. Beckman at Dr. Randall's lab. Liston-Folb. Albert Austin. Richard S. Becker. Liston's early relationship with Albert Austin. Development of CO analyzer. Instrument malfunctions. Liston-Becker's relationship with DuPont. Joseph Guilford.
- 17 The Navy and the *Nautilus*  
The Navy's awareness of Liston's gas-analysis work. The Mark III atmospheric analyzer. The Model P oxygen analyzer. The tilt test. The *USSN Nautilus*. Freon accident aboard the submarine. Mark II analyzer. Agricultural chemists and the CO<sub>2</sub> analyzer.

- 20      Beckman Instrument's Acquisition of Liston-Becker  
Responsibilities at Liston-Becker. John F. Bishop. Dr. Beckman's interest in Liston-Becker. Negotiations for Liston-Becker. Ralph White. John Murray. The Beckman Instruments consolidation. The closing of the Connecticut plant. Liston becomes corporate director of engineering for Beckman Instruments. Robert Erickson. William Wright. Earl Jansen. Liston's relationship with Dr. Beckman. SPID's poorly designed instruments. Dr. Beckman's reluctance to deal with problems. William Shockley. The resignation of Shockley's staff.
- 25      Max Liston Leaves Beckman Instruments  
William F. Ballhaus. Automobile emissions tests in L.A. Dr. A. J. Hagen-Smith. The CRC. Charles Heinen. Dr. Beckman's interest in air pollution. Max' Liston's feelings of failure. Liston's work with oximeters. Moffitt Field contract. The special projects division. Liston's attempted purchase of the Beckman submarine business. Dr. Miles "Lowell" Edwards. Work with Forrest Bird. Hospital respirator problems. Invention of the Handi-Vent IPPB. Work for SmithKline. Larry Brown. Weston spectrophotometer. SGPT, SGOT, and CPK tests. SmithKline reagent tables. SmithKline's interest in Beckman Instruments. The Alpha spectrophotometer. The Escalab.
- 34      Developments at Liston Scientific  
Harold Dsenis. Gerald Frison. Ron Matheny. Edward Murphy. SmithKline warehouses the Liston respirator. Ohio Medical and Handi-Vent successes. The success of the Escalab. Digital-Alpha. Theodore Larsen. Description of the ABA-100. Contracts with Abbott Labs. Gene Browning. The Federation meeting in Chicago. Abbott Labs market study. Dr. Richard J. Henry. Abbott's poor quality reagents. Stanley Taylor. The Vickers instrument. The success of the ABA-100. Robert A. Scheollhorn. Abbott Labs tries to break its contract.
- 42      The Development of Microprocessor Technology  
North American Semiconductor. Incorporation of RAM in to the ABA-100. Chip programming. TI-380 computer. The VP clinical analyzer. The failure of the VP cost-reduction project. The VP's flaws. Liston's development of a multi-channel instrument. The growth of Liston Scientific. The disintegration of Abbott Labs relationship with Liston Scientific. Les Duryea. Description of the Paramax. Baxter's reagent tablets. The Dunes Project. The Spectrum plant. Baxter-Dade. Dade International purchases the Paramax. Applications development for the Paramax. PSA and TSA tests. ELISA tests. The Paddle instrument. The Nichols Institute. ELISA test description. Development of an electrolyte instrument. The new Escalab. Sales to India.

- 52     The Formation of Liston-Edwards  
       Reuniting with Lowell Edwards. Edwards steam engine. TRW. The measurement of hydrocarbons. Development of an emissions analyzer. Capnograph development. Dr. Osborne's theft. The current work at Liston Scientific. CEM's. The chemical-luminescence process. Work with the EPA.
- 57     A Review of Max Liston's Introduction to IR Spectrophotometry  
       Development of the breaker amplifier. Working with Triptane. Dr. Harrison M. Randall. Dr. David Frye. Perkin-Elmer Model 12. GM manufacturing of breaker amplifier. Bowling Barnes. Breaker amplifier in the Manhattan Project. Liston's work with Perkin-Elmer. Liston's thermopile development. Dr. Beckman's work with Dr. Randall. Perkin-Elmer Model 21. John U. White. Vincent J. Coates. Abe Offner.
- 62     Liston's Work After Perkin-Elmer  
       CO<sub>2</sub> analyzer. CO analyzer. Dr. Philip Drinker. Dr. Julius Comroe. Industrial analyzer development. Description of the gas analyzers. Flour. Li-Cor Biosciences. Creation and acquisition of Liston-Becker. Competition with MSA. Liston's move to California. The submarine analyzer contract.
- 70     Liston Leaves Beckman Instruments  
       Work with emissions analyzers. Formation of Liston-Edwards. The thousand car test in L.A. Description of emissions analyzer technology. Liston reflects on his achievements in the field of IR spectrophotometry.
- 74     Notes
- 75     Index

## NOTES

1. John Bertrand Johnson, "Thermal agitation of electricity in conductors," *Phys. Rev.* 32, (1928): 97-109.
2. Richard Joseph Henry, *Clinical Chemistry: Principles and Techniques* (New York: Harper and Row, 1964).

## INDEX

### A

Abbot Laboratories, Inc., 38-42, 46  
  ABA-100, 36-44, 70  
  ABA-200, 46  
  Dade division, 47  
  VP clinical analyzer, 43-46  
  Xerox chemists, 39-40  
Ackerman, Paul, 3  
Air Reduction Company, 35  
Air Force, United States, 3, 10  
American Automotive Society [AAS], 3  
American Cyanamid Company, 11  
American Hospital Supply Corporation, 38, 46, 52  
American Optical Lens Company, 10  
American Wheelabrator Corporation, 15  
Anglo-American Enterprise Corporation, 37  
Arizona, University of, 19  
Army, United States, 10, 14, 28  
Austin, Albert, 15, 19-20

### B

Baird Associates, Inc., 11  
Ballhaus, William, 25, 28  
Barnes, Bowling, 9, 58-59  
Bausch & Lomb, Inc., 6, 10, 16  
Baxter International, Inc., 46, 48  
  Dade division, 46-49, 51  
Baxter-Dade, 48  
Becker, Richard [Dick], 15, 20  
Beckman Instruments, 13-18, 20, 24-26, 29, 33-35, 38, 44, 46, 49  
  Model DB, 23  
  Model DK, 23  
  Model DU, 23  
  Model P [Pauling] oxygen meter, 18  
  pH meter, 13, 23, 66  
  Scientific Products Instrument Division [SPID], 13, 27  
  Special Projects Division, 28  
  Specialized Instruments Corporation [Spinco], 13  
  STAT Lab, 38  
Beckman, Dr. Arnold O., 18, 24, 26-27  
Beebe, Cedric, 20  
Beer's Law, 32  
Bell Aircraft, Inc., 15

Bell Laboratories, Lucent Technologies, Inc. [Bell Labs], 2, 3, 7  
Berkeley, California, University of, 43  
Bird, Forrest M., 29-30  
Bishop, John [Jack] F., 20-21, 28, 65-66, 72  
Branson Instruments Company, 33  
Branson, Norman, 33  
Breaker amplifier, 4, 6, 8-10, 15  
Breer, Carl, 3  
Brown Instruments, 11  
Brown, Larry, 31  
Browning, Gene, 38-39  
Bruskey, W., 11  
BUN [blood urea nitrogen], 51  
Bureau of Mines, 53

## C

Calbiochem. See EMD Biosciences, Inc.  
CEM [Continuous Emissions Monitoring], 54  
Chapman, Robert [Bob], 20  
Chemical Construction Corporation, 17  
Chicago, Illinois, 38  
Chrysler Corporation, 3-4, 23, 25-27, 53, 71  
    Chrysler Institute, 3  
Chrysler, Walter P., 3  
Clark, Dr. Leland, 8  
CLEA [California Law Enforcement Association], 51  
Comroe, Dr. Julius, 8, 62  
Cooper, William [Bill], 35  
Coordinated Research Council [CRC], 25  
Corbin-Farnsworth Company, 34  
Creatine Phosphokinase Test [CPK Test], 31, 36

## D

Datascope Corporation, 53-54  
Denver, Colorado, 30  
Detroit, Michigan, 4, 26  
Digital-Alpha, 36  
Dow Chemical Company, 38  
Downing, Dr., 7  
Drinker, Dr. Philip, 12, 16, 62  
Dsenis, Harold, 34  
DuPont, E. I. de Nemours and Co., Inc., 7-8, 16-17, 41, 48-49, 55  
    Experimental Station, 8, 57  
Duryea, Les, 46

## **E**

Eastern Laboratory, 48  
Eastman Chemical Products, Inc., 41, 49  
Edwards Lifesciences Corporation [Edwards Laboratories], 29  
Edwards, Dr. Miles, 30  
Edwards, Dr. Miles "Lowell", 30-31, 46, 52, 54  
Elam, Dr. James, 8, 12, 54  
Enzyme Linked Immunosorbant Assay Test [ELISA Test], 49, 50  
EMD Biosciences, Inc., Calbiochem, 31  
Environmental Protection Agency [EPA], 56  
Eppley Laboratory, Inc., 8  
Erickson, Robert, 22, 24  
Escalab [new version], 51  
Escalab System, 34, 36-39, 47, 70

## **F**

Fairchild Camera and Instrument Corporation, 10, 25  
Fairchild Semiconductor, 25  
Farmer, Louis, 39  
Farrand Optical Company, Inc., 10  
Food and Drug Administration [FDA], 51  
Firestone System, 5, 7  
Fluor Corporation, 17  
Folb, Morris, 12, 16  
Ford Motor Company, 25  
Foxboro Invensys Systms, Inc., 17, 33  
Frison, Gerry, 30, 34  
Frye, Dr. David, 7-8, 57  
Fullerton, California, 21, 57

## **G**

General Electric Company, 3  
General Motors Corporation [GM], 3-6, 8-10, 16, 25, 27, 33, 52-53, 58-59, 60, 62, 71  
Glaxo SmithKline, Inc., 31, 33, 35-38, 40-41, 51  
Glide bombs, 58  
Guantanamo Bay, Cuba, 18, 69  
Guilford, Joseph, 17, 37  
Guliano, Patrick, 20  
    Master Craftsman Program, 20  
Gunn, Dr. Ross, 6

## **H**

Hagen-Smith, Dr. A. J., 25, 27, 71  
Handi-Vent, 30-31, 35, 70  
Harbor-UCLA Medical Center, 40  
Harding, Dennis, 2  
Harvard University, 12  
Heinen, Charles, 26, 71

## **I**

IC [integrated circuit] computer chip, 30  
Industrial Society of Chemists [ISC], 13  
Institute of Electronic and Electrical Engineers, Inc. [IEEE], 2  
Intel Corporation, 25, 42, 45  
Iron Lung, 12-13

## **J**

Jackson, William, 53  
Jansen, Earl, 22  
Johns Hopkins University, 16, 54  
Johnson & Johnson Consumer Companies, Inc., 36, 53  
Johnson, J. B., 7

## **K**

Kelvin, Lord William Thompson, 14, 55  
Kettering, Dr. Charles F., 4, 7, 16  
Klett photometer, 41

## **L**

Larson, Theodore, 40  
Latham, Barry, 40  
Leeds & Northrop, 11, 14, 17  
Lewis, Joseph, 29  
Liston-Becker Company, 13, 15-21, 25-26, 35, 63-67, 72  
    CO analyzer, 16-17  
    Mark II, 19, 68-69  
    Mark III, 18-19  
    Mark IV, 27, 70  
    Model 16 [CO<sub>2</sub> analyzer, capnograph], 12-13, 16-17, 19, 63, 65  
Liston-Edwards Corporation, 52, 54  
Liston-Folb Company, 15  
Liston Scientific Corporation, 45  
    Alpha spectrophotometer, 34  
    Chemical-luminescence instrument, 54

Digital-Alpha [*See* ABA-100], 34

Paddle Instrument, 49

Paramax, 46-47, 49, 51

Liston, Max D.

director of engineering, Beckman Instruments, 22

father, 1-2

Fort Scott High School, 1

grandfather, 2

mother, 1

pulse oximeter, 8, 27-28

sister, 1

Sigma Psi honorary, 3

wife, 25

Los Angeles [LA], California, 26-27, 56

Los Angeles County Hospital, 46

Los Angeles, California, University of [UCLA], 40, 49

Lowe, Dr., 39

Luft, Karl F., 14, 68

## **M**

Manhattan Project, 59

Martin, E. J., 8, 16

Mexico University, 11

Michigan, University of, 3, 5-7, 16, 57, 59-60

Minnesota, University of, 2-3

Minute Man program, 42

Moffitt Field, 27

Mogey, Howard, 9-10

Monsanto Corporation, 17

Motorola, Inc., 42

Murphy, Edward, 34-35

Murray, John, 21

## **N**

National Semiconductor Corporation, 25

Navy, United States, 9-10, 17-18, 20

Naval Research Labs, 14

USSN Nautilus, 18-19, 69

New London, Connecticut, 18, 69

Nichols, Dr. Albert, 49-50

Nichols Institute, 49-50

North American Semiconductor, 42, 45

Northwestern University, 1

## **O**

Ohio Medical Products, 31, 35  
Oxaloacetic transaminase enzyme [OT], 32  
Oximeter, 8, 27  
    pulse oximeter, 8, 27-28

## **P**

Pacific Atoll atomic tests, 10  
Palo Alto, California, 34  
Pennsylvania, University of, 54  
Perkin, Richard S. [Dick], 9-12  
    Gladys [wife of], 12  
Perkin-Elmer, Inc., 9-11, 15, 27, 35  
    Model 12, 8-9, 11, 58, 60-61  
    Model 21, 9, 11-12, 14, 60-62  
Pfund, August Herman, 8, 14  
Philips Corporation, 42  
Philosophical Society of London, 14  
*Plastics Magazine*, 37  
Polio Foundation, 12  
Prostate Specific Antigen Test [PSA Test], 49, 50  
Pyruvic transaminase enzyme [PT], 32  
Pullman Company, 3

## **Q**

Q-circuit, 12

## **R**

Randall, Dr. Harrison, 5, 7  
Reeder, Morris, 9  
Riverside, California, 26  
Rube Goldberg, 33, 47

## **S**

Saxton, Dr. George, 8, 12  
Schoellhorn, Robert A., 41  
Scott, Dr. Gifford G., 4, 7, 9  
Seraseal, 44  
Seva, 49  
Severinghaus, Dr. John W., 8, 13, 16  
SGOT [serum glutamic oxaloacetic transaminase], 31  
Shockley, Dr. William [Bill], 24  
    four-layer diode, 24

"traitorous eight", 25  
Signetics, 42  
Solburg, Arnie, 52  
Springdale, Connecticut, 20  
Stanford University, 53  
Starr, Dr. Albert, 29-30  
    Starr-Edwards heart valve, 29

## **T**

Taylor, Stanley, 40  
Technicon Corporation, 39, 41  
Thompson, Inc. [RCA], 3  
Thompson, Ramo, Woodridge, Inc. [TRW], 52  
Thompson, William, 14  
TI [Texas Instruments]-380, 43  
Tilt test, 18  
Triptane, 5-6, 57  
Thyriod Stimulating Antibody Test [TSA Test], 49-50  
Turner, Edward, 28

## **U**

Union Carbide Corporation, 38

## **V**

Vacutainers, 44  
Venturi pump, 30  
Vickers, Inc., 41

## **W**

Weston Instrument Company, 31  
White Sands Atomic tests, 10  
White, John U., 8-12, 60-62  
White, Ralph, 21  
Whittenberger, Dr. James, 8, 12, 16  
Williams, Van Zandt, 11  
World War II, 4, 8-9, 14, 73  
    submarine menace, 4  
Wright, Norman, 60  
Wright, William [Bill], 22

## **X**

Xerox Corporation, 38-40  
    Xerox chemists, 39-40

## **Y**

Yale Lock Manufacturing Company, 20

**Z**

Zeder, Fred M., 3

Zeder, James, 3