

# CRASH INJURIES

THE INTEGRATED MEDICAL ASPECTS OF  
AUTOMOBILE INJURIES AND DEATHS

By

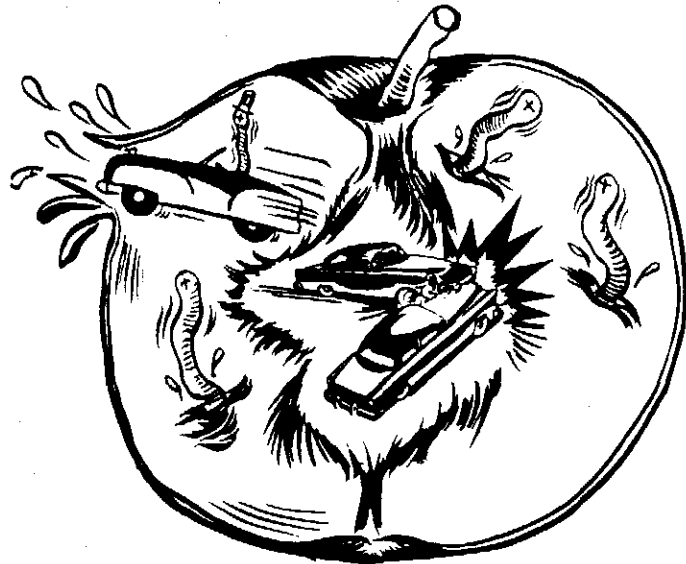
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*I heartily beg that what I have here done may be read  
with forbearance; and that my labors in a subject so  
difficult may be examined, not so much with the view  
to censure, as to remedy their defects.*

—NEWTON's Preface to the *Principia*, 1686

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To My Parents  
Lina A. Kulowski  
and  
Meyer Kulowski  
and my son, Gerald B. Kaye

(1) The Unknown Is Knowable (2) Advance by Trial and Error (3) Measurement and Theory Are Inseparable (4) Analogy Gives Insight (5) New Truth Connects With Old Truth (6) Complementarity Guards Against Contradiction (7) Great Consequences Spring From Lowly Sources.

(From Wheeler, J. A.: A Septet of Sibyls: Aids in the Search for Truth, *American Scientist*, 44:360, 1956.)

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## PREFACE

ACCORDING to Baldwin\* the first motor vehicle accident of which there is any record in the United States occurred in New York City in 1899. A passenger stepping off a trolley was struck by a passing motor vehicle and died in a hospital on the following day. Some 52 years later, in December, 1951, the millionth traffic victim died as a result of a motor vehicle traffic accident in the United States. By the end of 1954 another 100,000 people had been killed. From 1906, when traffic deaths had been estimated to be 400, deaths spiraled to a peak of almost 40,000 in 1941.

Stated another way† this means that 100 people in this country become accident vital statistics and another 6,000 receive injuries every day. The time during which the decelerations and forces generated in a collision are of sufficient magnitude to cause a fatality is very short. In fact, the total time consumed in a whole day involves less than 30 seconds to produce these deaths, and only about 30 minutes to inflict this multitude of injuries.

The individual automobile collision has been characterized, by D. M. Severy, "as an extremely complicated phenomenon of a very brief duration ending in destruction"\*\*\* (Fig. A).

The epidemic frequency of these accidental injuries and deaths is thought to derive from biomechanical and pathomechanical stress-strain patterns of behavior peculiar to the age of power and speed in which we live, work and play. This attribute, of course, is also shared by air traffic. Efforts to improve these situations are in progress along mass statistical, laboratory and full-scale crash lines of investigation (Figs. B, C). How does automotive ground

\* Baldwin, D. M.: Motor vehicle traffic accident facts, 1955, *Medical Aspects of Traffic Accidents* (Elliott), Sun Life Assurance Company of Canada, Montreal, p. 41.

† Haynes, A. L., et al.: *Automotive Collision Impact Phenomena*, Highway Research Board, National Academy of Sciences, N.R.C., Jan. 19, 1956.

\*\*\* Severy, D. M.: Photographic instrumentation for collision injury research, *Journal of the Society of Motion Picture and Television Engineers*, 67:69, 1958.

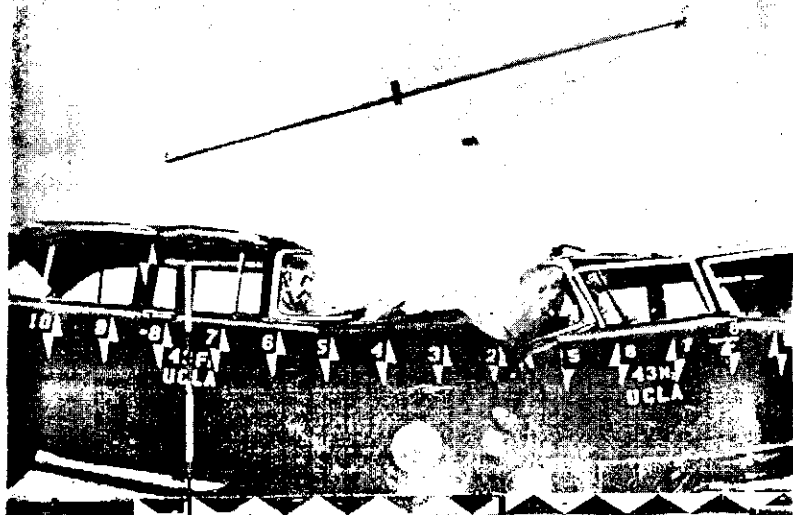


FIG. A. Head-on experimental collision at 50 miles per hour (mph). Photograph, courtesy of Derwyn M. Severy, Institute of Transportation and Traffic Engineering (ITTE), University of California at Los Angeles.

transport stack up with that of aviation in this respect? What are the reasons for differences, if any? There appear to be two reasons for the phenomenal advances in aviation and the apparent lag in comparable areas by automotive ground transport.

First of all, there has been simultaneity of progress in aviation with regard to medicine, biology, engineering, and adjacent fields of human endeavor. This kind of growth, until very recent times, has been lacking in regard to automotive ground transport. Another influence, impugns grave errors of perspective and judgment on the part of the public which has been "seeing one thing too large" and "something else too small." For example, whereas advances in aviation—now probing the fringes of outer space—have always been widely acclaimed and fostered by public opinion, those of automotive engineering have been accepted as a simple fact of life. However, in this one respect, the score is evened.

### STATISTICS SHOW - SINCE 1930

PASSENGER CAR AVERAGE HORSEPOWER INCREASED 65%  
TOTAL TRAFFIC FATALITY RATE DECREASED OVER 55%

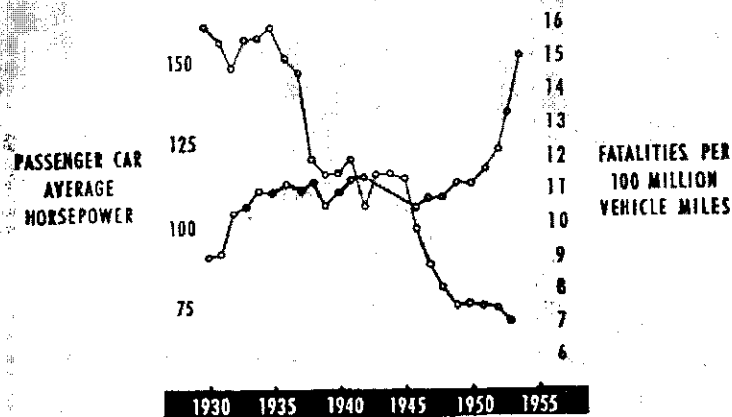


FIG. B. This is the statistical point of view.



FIG. C. This is the field and clinical story.

# HIGHWAY TRANSPORTATION

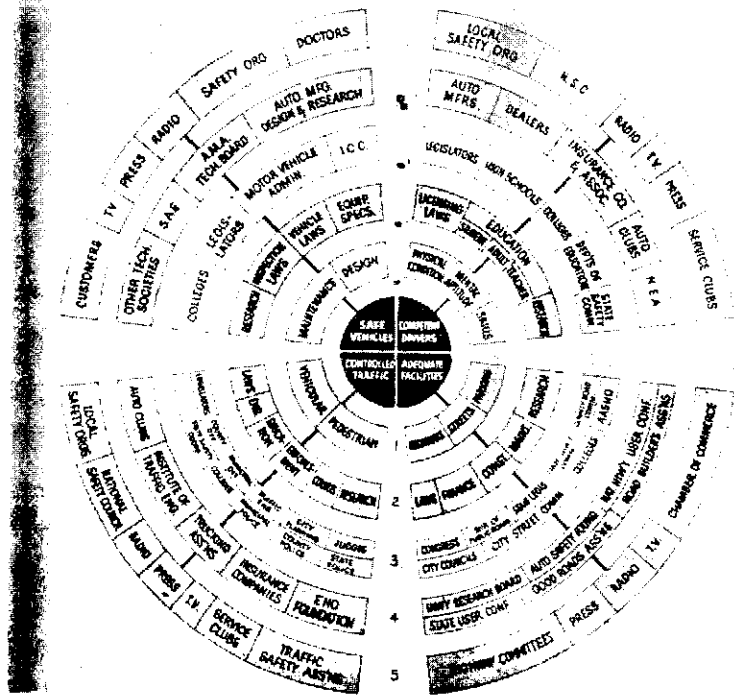


FIG. D. This complex representation of the interrelated problem of highway transportation has been developed around four basic targets (at center). Each concentric band has a functional relationship to these four major components: and, are numbered from center outward: (1) Major Components (2) Elements (3) Public Officials and Educators (4) Industry and Associates and (5) Public Support. (From Platt: *Traffic Quarterly*, Jan., 1957.)

Injuries and deaths have been accepted as inescapable facts of the "violence of history" and advances in both spheres of transportation.

This is a book about crash injuries. That is to say, it deals with the why of automobile accidents, the how of injuries, and methods of human salvage; from first aid through ultimate rehabilitation. It has been written primarily for physicians who wish to help their *crash* and *near-crash* patients (an even more frightening con-

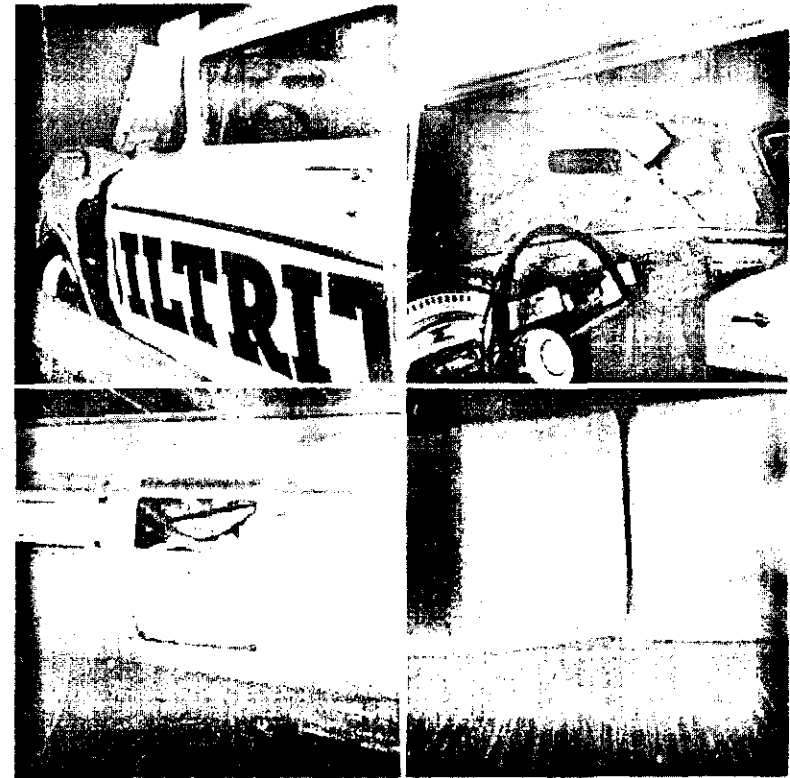


FIG. E. This vehicle, after involvement in a collision presents some fundamental elements of the automotive "hostile environment."

sideration)- through widening medical horizons, which are exploring adjacent domains of accident prevention and reduction of injuries through recently developed human-engineering and crash-impact engineering disciplines respectively.

The latter points of view have been derived during the last ten or twenty years by investigators from many fields of human endeavor (Fig. D). They, too, despite their diverse interests and approaches to a common problem, may find a common background of understanding, and benefit from the contributions of medical scientists and clinicians which are recorded in this book along with their own. It is my hope that the book will "promote effective

communication across the departmental walls which tend to isolate the professions and specialties from one another"; and, thus achieve a degree of sequential cross fertilization of ideas from these intersecting sources. For this reason the book aims at an audience "beyond the confines of specialization" in medicine and related fields.

This book is also an attempt to stimulate further researches as well as improved understanding among scientists in medicine and allied disciplines. For this reason attention is drawn to broadening perspectives and changing attitudes in variously related phases of the life and death cycle of motoring. In order to project objectively some of these ideas it was necessary to overcome two major obstructions of my own, both in accordance with the wisdom of know it first, not to mention the emotional factor. The first was the difficulty of technical comprehension; the second was "in the resistance of human attitudes to change (for example, medical screening of drivers)." When the first obstacle had been hurdled—to a degree of course—the second loomed even larger, because it stems from an understandable resistance to compulsion in any form—even though every physician knows that "the doctrine of health by compulsion has been extraordinarily successful" in all other fields of public health.\*

The very success of health by compulsion and the convincing arguments for ranking highway safety high as a value should logically justify still further restrictions upon the individual as an operator of a motor vehicle. The line of health by compulsion may be extended to this point, where the driver's unfitness obviously threatens the safety and health of someone else. By the same token, "The automobile industry is like the maker of a very useful but potentially dangerous drug. The privilege of making and selling automobiles carries with it an obligation to be tireless to improve safety and to refrain from qualities which make them potentially dangerous to health"† (Fig. E).

It should be remembered in regard to this particular value—

\* Garland, T. O.: Health in perspective. *British Journal of Clinical Practice*, 12:396, 1958.

† Noves, Dorothy: America's No. 1 health problem: automobile accidents. *Connecticut State M. J.*, 22:183, 1958.



- |     |     |
|-----|-----|
| (1) | (4) |
| (2) | (5) |
| (3) | (6) |

FIG. F. Non-union of the tibia: showing the various steps in a sliding bone graft: (1) site of non-union has been cleared; (2) preparation of the proximal graft; (3) lifting it out; (4) the graft from the distal portion has been placed proximally and the proximal portion has been rotated 180 degrees and bridges the site of non-union; (5) securing the graft with metal screws; and (6) grafts secured.

the liberty of the individual versus the group—that this rather primitive, perpetual and universal conflict has been transposed into a "do-as-you-would-be-done-by ethic"—one of the major attainments of mankind.

Resistance to change, as in any stage of transition, is evidenced herein in the fact that current changes in ideas and in practices have not yet been crystallized; terminology is not well established; and, the extent of new methods is not well known.

In any case, once accepted, the wealth of data already accumulated in this book represent definitive assurances that automotive safety—i.e., including accident prevention, reduction of injury, and recovery—is ready to take its rightful place alongside of advances being made in the age of speed and power in which we live.

For the physician this book should fill an important need. It contains an account of the "available" scientific and empiric knowledge of our time which he needs to meet the challenges of patient "total" care engendered by injury-producing motor vehicle traffic accidents. It may also help him to decide what proportion of medical effort should be put into shaping attitudes to automotive safety alongside of human salvage (Fig. F).

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## GENERAL INTRODUCTION

*In our present age of rapid technological progress, the frightening discrepancy between our technical "know-how" and our philosophical incomprehension, in general, of basic scientific conceptions seriously endangers the integrity of our intellectual outlook.*

—MAX JAMMER

**T**HE magnitude of automotive injuries and deaths is generating new fraternal problems for medicine, engineering, and related sciences, disciplines, groups and individuals. Mass statistical, laboratory and full-scale crash investigators are asking for more medical data to direct these researches. One purpose of this book is to help close this gap between related clinical and extraclinical activities. This means compressing, channelling and integrating properly evaluated medical data with pre-impact, impact and post-impact factors which govern the life history of motoring as a whole.

The fact is that motor vehicle accidents present an opportunity for the study of trauma which is ordinarily afforded by combat as it occurs in war. Yet, this traffic scourge which has killed more people than have all the wars in which this republic has been involved and kills and injures more people off the job than occurs on the job has not given results of medical study comparable to war medicine and industrial medicine. Since these accidents strike down victims of all ages and both sexes, here indeed is a daily battleground for the study of trauma the results of which may better condition us to meet other imminent catastrophic threats (Figs. G, H, I).

Moreover, while much is being achieved by the experimental method of study in medicine by controlled experiments in animals with extrapolation to traumatic conditions observed in man, these methods can supplement but not supplant direct clinical, laboratory and autopsy examinations of crash victims, in a category separate from accidental injuries of mechanical origin in general.