DOCUMENT RESUME

ED 169 736 EC 114 658

AUTHOR Brainin, Paul A.; And Others
TITLE Impact Study on Driving by Special Populations. Final Report. Volume II: A Guide for the Evaluation of Handicapped Drivers.
INSTITUTION Dunlap and Associates, Inc., Darien, Conn.
SPONS AGENCY Bureau of Education for the Handicapped (DHEW/OE), Washington, D.C.; National Highway Traffic Safety Administration (DOT), Washington, D. C.
REPORT NO DOT-HS-802-330
PUB DATE Apr 77
CONTRACT DOT-HS-5-01206
NOTE 152p.; For related information, see EC 114 657
AVAILABLE FROM National Technical Information Service, Springfield, Virginia 22161

EDRS PRICE MF01/PC07 Plus Postage.
DESCRIPTORS Aurally Handicapped; Cerebral Palsy; Diseases; *Driver Education; Emotionally Disturbed; Epilepsy; *Evaluation Methods; *Handicapped; Mentally Handicapped; Neurologically Handicapped; Observation; Physically Handicapped; Special Health Problems; State Licensing Boards; *Traffic Safety

ABSTRACT

The second of a two-volume report on motor vehicle driving by handicapped persons presents an approach to the evaluation of drivers with 20 specific medical problems. The guide provides information on symptoms, treatment, guidelines for determining risk levels (risk increasing and risk moderating factors), questions for the applicant, and behavioral observations to be checked during the evaluation session for such conditions as cardiovascular diseases, cerebral palsy, diabetes, emotional disorders, epilepsy, hearing dysfunction, hemophilia, mental retardation, multiple sclerosis, myasthenia gravis, orthopedic impairments, Parkinson's disease, kidney disorders, stroke, and respiratory diseases. (CL)

DOT HS-802 330

IMPACT STUDY ON DRIVING BY SPECIAL POPULATIONS

Volume II - A Guide for the Evaluation of Handicapped Drivers

Contract No. DOT-HS-5-01206

April 1977

Final Report

PREPARED FOR:

U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
WASHINGTON, D.C. 20590

Document is available to the public through the National Technical Information Service, Springfield, Virginia 22161

Prepared for the Department of Transportation, National Highway Traffic Safety Administration under Contract No. DOT-HS-5-01206. The opinions, findings and conclusions expressed in this publication are those of the authors and not necessarily those of the National Highway Traffic Safety Administration.

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT HS 802 330		

4. Title and Subtitle
IMPACT STUDY ON DRIVING BY SPECIAL POPULATIONS, Final Report, Volume II - A Guide for the Evaluation of Handicapped Drivers

5. Report Date
April 1977

6. Performing Organization Code
--

7. Author(s) Paul A. Brainin, Robert M. Breedlove and Thomas J. Naughton

8. Performing Organization Report No.
ED76-10

9. Performing Organization Name and Address
Dunlap and Associates, Inc.
One Parkland Drive
Darien, Connecticut 06820

10. Work Unit No. (TRAIS)

11. Contract or Grant No.
DOT-HS-5-01206

12. Sponsoring Agency Name and Address
U.S. Dept. of Trans.
National Highway Traffic Safety Administration
Washington, D.C. 20590

U.S. Dept. of Health, Education and Welfare
Bureau of Education for the Handicapped
Washington, D.C. 20202

13. Type of Report and Period Covered
Final Report
June 1975 - November 1976

14. Sponsoring Agency Code

15. Supplementary Notes
This is Volume II of a two-volume report prepared under this contract.

16. Abstract

This project was conceived to study the impact of motor vehicle driving on the public roadways by "special populations." Major concerns were special populations' learning to drive, being licensed to drive, and driving behavior. Impact was considered from two perspectives: the impact on the handicapped driver and the impact on the welfare of the general public.

The project was divided into two phases. Phase I established a research data base of information directly relevant to special population motor vehicle driving. This information is summarized and presented in Volume I of the Final Report: Impact Study on Driving by Special Populations (Conduct of the Project and State of the Art). Volume II - Impact Study on Driving by Special Populations (A Guide for the Evaluation of Handicapped Drivers) draws upon information collected during Phase I and synthesizes these data into immediately usable products which will improve the circumstances under which special populations drive. The second volume presents an approach to the evaluation of the license applicant who is handicapped which is useful not only for licensing officials but also for driver education and other professionals involved in the rehabilitation of handicapped persons.

17. Key Words		18. Distribution Statement
Handicapped	Evaluation	Document is available to the U.S. Public through the National Technical Information Service, Springfield, Virginia 22161.
Driving	Special Populations	
Performance	Motor Vehicle	
Education	Operator	
Licensing	Driver Limitation	

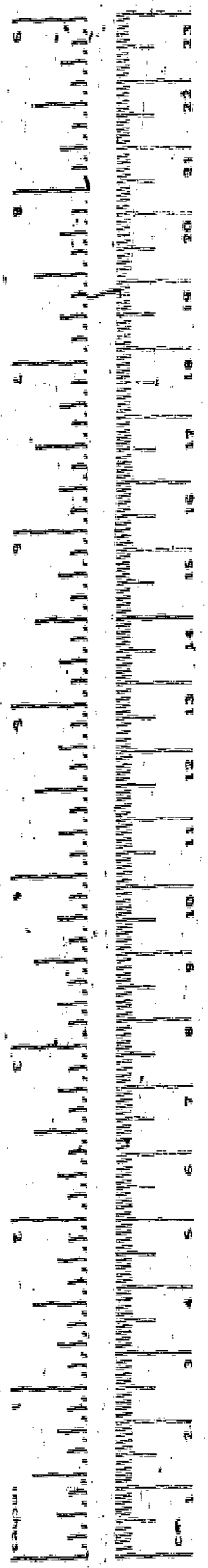
19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	150	

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

METRIC CONVERSION FACTORS

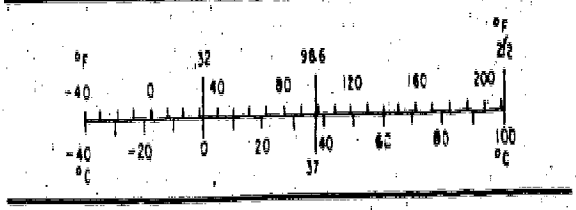
Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
LENGTH				
in	inches	2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
AREA				
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
MASS (weight)				
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
VOLUME				
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
TEMPERATURE (exact)				
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
LENGTH				
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
AREA				
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
MASS (weight)				
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
VOLUME				
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
TEMPERATURE (exact)				
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

TECHNICAL SUMMARY

CONTRACTOR	CONTRACT NUMBER
Dunlap and Associates, Inc.	DOT-HS-5-01206
REPORT TITLE Final Report, Volume II (Impact Study on Driving by Special Populations) A Guide for the Evaluation of Handicapped Drivers	REPORT DATE 30 November 1976
REPORT AUTHOR(S) Paul A. Brainin, Robert M. Breedlove, and Thomas M. Naughton	

This project was conceived to study the impact of motor vehicle driving on the public roadways by "special populations." The major concerns were special populations learning to drive, being licensed to drive, and driving behavior. Impact was considered from two perspectives: the impact on the handicapped driver and the impact on the welfare of the non-handicapped public. The impact on the handicapped focused on personal safety and mobility issues. The impact on the non-handicapped public focused on general public safety and on the benefits to a society with a mobile handicapped population.

The derivation of these perspectives can be found in the goals of the two agencies sponsoring the project. The National Highway Traffic Safety Administration of the U.S. Department of Transportation has the charter for saving lives on the country's highways. This includes the safety of speical population drivers themselves as well as the safety of other drivers, passengers, and pedestrians. The Bureau of Education for the Handicapped of the U.S. Department of Health, Education and Welfare has a responsibility for the training of handicapped persons, including driver training, to ensure the opportunity for lives and careers that are fruitful and worthwhile to themselves and to society.

The project was divided into two phases. The purpose of Phase I was to establish a data base of all directly relevant information. During Phase II, this information was utilized to develop products which are immediately usable and which improve the circumstances under which special populations drive. The two products produced by the project are distinctly different and constituted Volumes I and II of the Final Report. The first volume describes the wealth of information gathered in Phase I as well as the purpose and conduct of the total study. The second volume presents an approach to the evaluation of a license applicant or perspective applicant who is handicapped. This document, however, contains information useful not only to license officials but also to driver education and other professionals involved in the rehabilitation of handicapped drivers.

(Continue on additional pages)

"PREPARED FOR THE DEPARTMENT OF TRANSPORTATION, NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION UNDER CONTRACT NO.: DOT-HS-5-01206. THE OPINIONS, FINDINGS, AND CONCLUSIONS EXPRESSED IN THIS PUBLICATION ARE THOSE OF THE AUTHORS AND NOT NECESSARILY THOSE OF THE NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION."

FOREWORD

The National Highway Traffic Safety Administration (NHTSA) and the Bureau of Education for the Handicapped (BEH) sponsored the study on the impact of driving by special populations. The term "special populations" was broadly defined to include those people who have physical or mental handicaps which could affect their vehicle driving capabilities. The concern of both NHTSA and BEH was to study the complex issues of special populations' driving with the ultimate objectives of increasing public safety on the nation's highways and of increasing the mobility of all citizens. This present project addressed these complex issues and provided detailed information in advancing the state-of-the-art of knowledge in this field. This knowledge can be directly applied to the improvement of driver education and licensing of special populations.

Two official documents were produced as a result of the "Impact Study on Driving by Special Populations." Both of the documents are volumes of the Final Report. Volume I is a description of the project and a compilation of current thought on special populations' driving. The current information includes driver education, driver assessment, driving performance, and driver licensing. Volume II is a guide for the evaluation of handicapped individuals who are planning to drive.

Direction and guidance for the project was provided by Dr. Harold Booher, Contract Technical Manager, of the National Highway Traffic Safety Administration, and Dr. Max Mueller and Mr. Melville Appell of the Bureau of Education for the Handicapped. Thoughtful suggestions and comments were contributed throughout the project by Drs. John Eberhard, Jerry Tannahill, Michael Perel, Les Moore, and George McDonald of NHTSA. Discussions with Dr. Edward Pizer, Mr. Anthony Staros, Dr. Frank Schaffer, and Dr. William Holzberg of the Veterans Administration were also helpful.

The project was directed at Dunlap and Associates, Inc., of Darien, Connecticut, by Mr. Paul Brainin. Mr. Thomas Naughton and Mr. Robert Breedlove, members of the project staff, contributed greatly to the program's accomplishments. Mr. Joseph Fucigna, Executive Vice President, served as responsible corporate officer.

Dunlap and Associates, Inc., is especially indebted to the consultants to the project: Ms. E'lise Brown (aided by Ms. Mary Barber), Mr. Jiri Sipajlo, Mr. Joseph Reynolds, and Mr. Frank Gentile and Dr. Gerald Manus of Human Resources Center. We are also indebted to Marshall Franklin, M.D., for his assistance.

We are also grateful to all those individuals and organizations, too numerous to mention, who supplied us with valuable information. This information was assimilated and used as a resource for both volumes of the Final Report.

TABLE OF CONTENTS

		Page
I.	INTRODUCTION	1
II.	FORMAT OF THE GUIDE: HOW TO USE THIS DOCUMENT	5
III.	CONDITION GUIDELINES	9
	CARDIOVASCULAR DISEASES: A General Introduction	10
	Cardiac Syncope (Fainting)	14
	Heart Arrhythmias (Dysrhythmias)	18
	Heart Failure (Myocardial Failure; Congestive Heart Failure)	23
	Heart Inflammations	30
	Heart Structural Defects	36
	Ischemic Heart Disease (IHD)	39
	CEREBRAL PALSY	46
	DIABETES MELLITUS	50
	EMOTIONAL (MENTAL) DISORDERS	54
	EPILEPSY	58
	HEARING DYSFUNCTION	63
	HEMOPHILIA	68
	MENTAL DEFICIENCY OR RETARDATION	71
	MULTIPLE SCLEROSIS	74
	MYASTHENIA GRAVIS	78
	NARCOLEPSY	81
	NEOPLASTIC DISEASES	84
	ORTHOPAEDIC IMPAIRMENTS	90
	PARKINSON'S DISEASE (PARALYSIS AGITANS)	97
	PERIPHERAL VASCULAR DISORDERS	100
	PITUITARY AND ADRENAL DISORDERS	105
	RENAL DISORDERS (KIDNEY DISORDERS)	110

TABLE OF CONTENTS (continued)

	Page
RESPIRATORY DISEASES	115
STROKE	123
THYROID AND PARATHYROID DISORDERS	129
INDEX	135

I. INTRODUCTION

The following Guide for the Evaluation of Handicapped Drivers is the second of a two-volume set which together comprise the Final Report of an Impact Study on Driving by Special Populations. The study was performed under joint contract for the National Highway Traffic Safety Administration (NHTSA) and the Bureau of Education for the Handicapped (BEH). The Guide provides driver licensing personnel and personnel engaged in rehabilitative driver education with appropriate sets of guidelines to assist in their evaluation of drivers with most types of specific medical problems.

The driving license examiner's task is to determine what impact (if any) specific conditions or combinations of conditions may have upon an applicant's driving risk level. The Guide may be used as one input to this task. For each condition, the Guide provides a written account of its course, symptoms, and treatment in order to provide the examiner with a basic understanding. This is followed by guidelines for determining risk levels in the form of risk increasing or moderating factors. The remainder of each section is devoted to assisting the examiner in determining which of these factors are present. Questions are provided to assist in eliciting pertinent information concerning the applicant's experience with his condition, and an outline of behavioral observations is made available to translate aspects of applicant behavior that may appear during the examination process into risk increasing or moderating factors. Where further input from medical or other professional personnel is necessary, the risk increasing or moderating factors may serve as a basis for formulating questions. In cases where analysis of the condition is liable to be especially complex, the questions for medical or other professional personnel have been provided.

The driver educator may also profit from the general discussion of the specific conditions included in this volume, and this material may be useful in the training of driver educators. It is anticipated, however, that the Guide's most important feature for educators will be the risk increasing and moderating factors. These may serve as screening guidelines to assist in selecting potential drivers, and in assigning them to appropriate training programs. The risk factors may also be used as diagnostic categories to identify problem areas for special training. The questions to the applicant and the suggested behavioral observations should provide additional assistance to the educator in assigning appropriate priorities in the individual driver's training program.

In composing this Guide, it was realized that a detailed compendium of the most important medical conditions relevant to driving (in terms of their impact upon driving) would find a wide range of potential users. Every effort was made to make the text readable by non-medical personnel. The Guide has been written in as simple and straightforward a manner as possible, and technical terms and concepts have been defined when they are used. Sacrifices in completeness and technical sophistication have been kept to a minimum, however. The result is the most detailed guide of its type yet written, and a useful reference to possible driving impact of common physical handicaps and medical problems for use by the specialist. It may, therefore, be of material value in the work of law enforcement, judicial, and legislative bodies, or of concerned special interest group involved with driving, and in need of a suitable medical reference. Medical personnel (including private physicians and members of medical advisory boards) and other professionals should profit from the treatment of specific medical problems in terms of driving risk levels.

This document does not provide the driving license examiner with means to perform in-office medical diagnosis. Identification of medical problems is a skill that requires years of professional training and, frequently, specialized equipment. For purposes of licensing, it is assumed that the examiner has available advice and documentation from medical personnel or other appropriate sources. The Guide should enable the examiner to relate existing medical considerations, as obtained from such sources, to the applicant's driving situation. In circumstances of special difficulty, in which there are multiple, interacting conditions, conditions with a wide range of significant effects, or conditions which may produce driving-significant effects that are not observable by the examiner, it suggests that medical advice be sought. For reasons of space, it has not been possible to cover such situations in sufficient detail as to enable licensing personnel to perform such evaluations unaided. Nor has it been possible to treat every possible condition that might impact driving safety. In evaluating applicants with conditions not treated in this Guide, medical advice (from the applicant's physician, a medical advisory board, or other appropriate professionals) should likewise be obtained. The examiner should not hesitate to seek additional advice or documentation from medical personnel, or other professionals familiar with the applicant's condition, in any circumstances in which he feels that he does not have adequate information upon which to base his licensing decision.

The existing state statutes, driving research, and medical investigations do not permit establishment of specific pass-fail criteria. The statutes themselves are broadly worded, and require a great deal in the way of interpretative

application. Driving oriented medical research has, however, provided sufficient information that guidelines can be presented in terms of the presence or absence of factors which increase or moderate risk. It is up to the examiner's expert judgment to apply the guidelines to individual cases in a fashion that is consistent, fair, and that enhances both driving safety and the personal mobility of the handicapped. The Guide is intended to provide the basis for such judgment by the examiner. It is the examiner's responsiblity to determine that all factors are given due consideration, and that the handicapped driver shall not be needlessly deprived of his driving privilege. Where sufficient information is not available to the examiner for him to fulfill this responsibility, the Guide should allow the examiner to interact more knowledgeably with professionals, physicians, advisory boards, or other sources of information.

II. FORMAT OF THE GUIDE: HOW TO USE THIS DOCUMENT

For easy access and information use, the potentially handicapping conditions are grouped together in sections, and these are arranged in alphabetical order. The Table of Contents lists each of these classifications as they are treated in the Guide. Frequently, several related conditions will be treated in the same section, and highlighted at the beginning of the section under the group heading. These more specific conditions are not listed in the Contents, but may be found in the Index. In the case of cardiovascular diseases, a General Introduction to the subject (together with supporting Questions for Medical Personnel) was set off as a separate section. Specific categories of cardiovascular disorders have been set off in alphabetical order following the Introduction. Each of these sections has its own sets of Questions for the Applicant, risk factors, and behavioral or performance observations. This exception to the overall format was made in the case of cardiovascular diseases because of their complexity, the variety of their potentially serious effects, and the frequency with which they may be encountered.

The Index may be used to locate specific conditions, interrelate synonyms, identify complications, and to obtain definitions of medical conditions. Disease names and other technical terms are set off in capital letters the first time they appear in a section. A term will either be defined when first used, or the name of the section in which it is defined (and more completely discussed) will be provided. In the detailed discussion of a condition or other technical term, the most common synonyms for the term will be provided. Definitions of terms not used in this Guide may be obtained from a suitable medical dictionary, such as the most recent edition (currently, the 25th) of: Dorland's Illustrated Medical Dictionary, Philadelphia, W. B. Saunders Company, 1974.

There are, usually, four major parts to the treatment of a condition in this manual:

- A brief, background discussion of the possibly handicapping disorder.
- Risk Increasing or Risk Moderating Factors that may be associated with the condition as it occurs in the individual.

Questions for the Applicant, or for the physician or other professional familiar with the applicant's condition.

Behavioral Observations highlighting significant factors that may be observed in the applicant's performance.

The initial discussion is intended both to provide a general background discussion of the course and effects of the condition, and to underline the ways in which the condition may impact safe driving by the individual applicant. Cross references are liberally used in order to minimize duplication, and in order to highlight other conditions that complicate the condition currently under discussion when the complication is frequently seen, or may produce an especially great hazard. The background discussion is not intended, by itself, to provide a definitive analysis of the applicant's condition as it relates to driving risk levels. It is intended, primarily, to allow the examiner to use the other sections in an informed fashion.

Actual guidelines are suggested in the following sections: Risk Increasing Factors, and Risk Moderating Factors. These enumerate aspects of the condition, including significant complicating conditions, that may be present in the individual applicant. For all conditions treated in this Guide, the level of driving risk increase (over the level that could be expected of the driver who does not have such a condition) may range from none, to prohibitively high. The Risk Increasing Factors (when present) can be seen as moving the level of risk toward (but not necessarily to) this latter state. The Risk Moderating Factors consist of those factors which, when present, shift the level of expected driving risk back toward (and possibly to) levels that might be expected of the "average" driver. Both increasing and moderating factors have been derived from research, accident experience, driving records, and expert judgment. It should be recognized that they will require careful application, and that they are subject to modification in light of further research, technical advances, and additional experience.

When additional information is necessary in order to sensibly apply the material in this part of the section to an individual case, the examiner should use the risk factors as a basis for formulating questions to medical or other professional personnel, unless the appropriate questions have been provided.

The remaining parts, Questions (for the Applicant, Physician, or other professional) and the Behavioral Observations are intended to aid the user of this Guide in gathering information about a particular applicant. They are,

it must be emphasized, not intended to provide the basis for an in-office diagnosis. When a possible condition, such as heart disease, is discovered during the course of license screening, the examiner should bend every effort to obtain documentation on this condition from the applicant's physician or other medical personnel. The Questions for the Applicant and Behavioral Observations are intended to assist the examiner in evaluating the impact of a known, well documented condition upon the applicant's driving.

The Questions should not be asked in a perfunctory, roto manner, but the phrasing provided should be closely followed. For example: "dizziness" cannot be used in place of "dizziness, faintness, or loss of consciousness." The examiner should not hesitate to ask the applicant for clarification of vague, loosely worded answers. Precision is necessary, since slightly different answers may signify large differences in risk level.

The Behavioral Observations are not intended to be exhaustive procedures for observing applicant behavior in the office, or during the road test. They should be treated as highlighted items that may have an impact upon the examiner's interpretation of the risk factors. They are not intended to substitute for existing procedures and expert judgment, but only to supplement them, and to emphasize certain points. The examiner should also take care that he does not, through an overly brusque or skeptical manner, obscure the applicant's ability to cope with the stresses of driving in traffic. The examiner should be careful not to attempt to force the applicant to perform beyond his capability, as this may obscure his actual capabilities and limitations for safe driving performance. The applicant's responses to the questions provided may also suggest observations to be made during the road test. Applicant responses, documentation of the condition, and applicant performance, when considered in light of the risk factors outlined, should enable the user of this Guide to make an informed licensing judgment or referral.

The guideline material presented in the following sections is meant to supplement existing state licensing agency and medical advisory board guidelines. It is not expected that all material that could be useful in the licensing process is contained in this Guide. Other relevant information, such as previous driving record, reports of compensatory training personnel, and the like should also be carefully considered. Other, earlier sets of guidelines have been compiled, and may prove useful (see: Volume I of the Final Report).

Lastly, it should be emphasized again that no analysis of driving risk is possible without careful consideration of the individual driver. At the current state-of-the-art, hard criteria for conditions cannot be set. There is no adequate substitute for observation of the applicant's performance under a variety of traffic conditions.

III. CONDITION GUIDELINES

CARDIOVASCULAR DISEASES: A General Introduction

The impact of CARDIOVASCULAR DISEASES upon driving performance is a complex issue, and one that is not easily simplified. Several different sorts of disease process produce rather similar symptoms but have quite different driving risk factors associated with them. In every case, there are two basic issues:

> Is the heart's available pumping output (when considered in light of any extra load caused by circulatory problems) adequate to the work loads demanded by driving?
>
> Is the heart likely to suddenly fail to pump blood and maintain consciousness?

In general, risk is high if the effort required by driving is close to the maximum that the driver can tolerate without becoming overly fatigued, breathless, or having pain. Risk is lower if the driver can tolerate more exertion or if he is exposed to less physically demanding driving situations.

It is important to know whether the sudden failure can be effectively prevented, to what extent driving work loads tend to bring on the crises, whether medication can compensate or otherwise prevent collapse, and whether or not the medication (if any) produces dangerous side effects. It is clear that sudden failure of consciousness behind the wheel can easily cause accidents and injuries. Drivers who are prone to collapse with little warning run a very high risk. That risk is lessened with control of the crisis by medication and a physician's supervision, presence of warning symptoms that are not themselves disabling, or both.

To treat all of the possible complications of a single type of disorder in the same place would necessitate much repetition. Appropriate cross references are, therefore, included where necessary. The examiner is urged to use these cross references to obtain a complete picture of the relevant factors necessary for accurate evaluation of the applicant.

An Approach to Evaluation of the Applicant With Cardiovascular Disease:

When a license examiner encounters an individual with either a history of heart disease, or with a history of symptoms that suggest a possible heart condition (such as unexplained fainting, shortness of breath with very light exercise, or severe episodes of chest pain), he should proceed with thoroughness

and caution. Applicants with unexplained symptoms may run a range of possible increased risk from none to prohibitively high. The first step in the licensing process should be to obtain from the applicant a physician's diagnosis and evaluation of the condition. The license examiner may then use the materials in this section to determine driving risk level of the individual applicant for most commonly seen forms of cardiovascular disease.

Applicants with known or suspected heart disease should not be subjected to severe physical or mental stress. Anxiety produced by the licensing situation may produce symptoms of a severity out of all proportion to what would be produced by actual driving situations.

If the applicant experiences breathlessness, pain or faintness during the course of testing, the examiner must determine that this was not caused by the emotional stress of testing. If the symptoms were caused by the effort of driving, and not by the emotional stress of testing, he may determine that a condition of elevated risk exists. The risk is lessened if symptoms can be controlled or prevented by medication.

During testing, the examiner should also be alert for signs of adverse side effects of medication such as faintness, lightheadedness or dizziness, drowsiness, impaired alertness, severe headaches, or excitability. Occurrence of an attack during testing, particularly one involving faintness or loss of consciousness, means that the applicant's condition is not well controlled. On the other hand, absence of an overt attack does not indicate that the condition is well controlled. Very dangerous, uncontrolled conditions may be present without any symptoms being noticeable by the examiner. A physician's judgment must be relied upon in determining that any condition present is well controlled.

It is extremely important that the examiner not attempt in any manner to induce symptoms. If the applicant should have severe pain or collapse at any point during testing, medical help should be summoned <u>immediately</u>.

In some cases, accurate evaluation of driving risk levels will require additional consultation with trained medical personnel. The list of questions below are intended to be addressed to medical personnel (applicant's physician or medical advisory board) in order to obtain information on the relationship of the applicant's condition to his risk in driving. These questions are appropriate for any cardiovascular disorder treated in this section, and may be used whenever the examiner wishes to obtain further clarification. The list of questions should be used for any condition noted in the text as requiring medical advice. In addition, applicants with heart disease that produces symptoms

while they are resting, or after very light exercise (such as walking a short distance or climbing one flight of stairs) will require a physician's specific evaluation of their driving risk levels. The questions should also be used for any cardiovascular disorder not specifically discussed in the text of this section.

The examiner should bear in mind that diseases of the heart are often quite complex, and that presence of one class of heart disorder by no means eliminates the need to evaluate any others that may exist. Co-existing conditions may have cumulative effects and complex interactions that are not easily evaluated by persons lacking special training. In such cases, the examiner is encouraged to address these questions to medical personnel.

Questions to be Addressed to Medical Personnel:

1. Are you familiar with the history of this person's condition? Do you see this person regularly in connection with this condition?

2. Is there any type of driving (e.g., at night, or in heavy traffic) that would be especially hazardous for this person?

3. Should this person be re-evaluated at frequent intervals? Is the condition likely to deteriorate greatly over time?

4. Is this person likely to lose consciousness or collapse suddenly? Will there be a distinctive warning and, if so, how long before the attack? Can such attacks be prevented by medication or other therapy?

5. Is he liable to chronic impairment of consciousness or alertness because of this condition?

6. Is he liable to constant pain, weakness or other effects under the effort of driving? Can these effects be prevented by suitable medication?

7. Is the medication (if applicable) and dosage level required to treat this condition likely to impair alertness, cause severe headaches, or produce detrimental mood changes? Is it likely to cause faintness or dizziness, or to cause visual problems? Is it likely to cause a serious bleeding liability?

8. Consistent with good therapy, can the dosage level, specific medication, or scheduling be modified to allow for safe driving?

9. Is the physical effort or emotional stress of driving likely to precipitate an attack or to markedly worsen symptoms?

10. Does this person have an implanted cardiac pacemaker? Is it likely to continue to function normally? If so, does it control any tendencies he has toward attacks of faintness or loss of consciousness?

11. Does this person have any other surgically implanted prosthetic device? Is it likely to continue functioning normally?

Cardiac Syncope (Fainting)

STOKES-ADAMS SYNDROME
(Intermittent Atrio-Ventricular Block)
(Adams-Stokes Disease, Syncope or Syndrome)
(Morgagni-Adams-Stokes Disease)
CAROTID SINUS SYNCOPE
Other conditions characterized by loss of consciousness caused by heart dysfunction

Cardiac Syncope in General:

Cardiac fainting is caused by a sudden drop in the pumping output of the heart. It most commonly is associated with ARRHYTHMIAS (DYSRHYTHMIA, "palpitations") or CONDUCTION ABNORMALITIES such as HEART BLOCK (ATRIO-VENTRICULAR, or AV BLOCK--see: HEART ARRHYTHMIAS).

PARTIAL AV BLOCK is a condition in which the contraction wave induced by stimulation takes a longer-than-normal time to spread over the heart. It has no significance to driving. However, it may develop into INTERMITTENT COMPLETE AV BLOCK (STOKES-ADAMS SYNDROME). This is the most common form of cardiac fainting, in which the heart may at any time suddenly cease pumping. The Stokes-Adams attack typically occurs with only a momentary feeling of weakness, or with no warning at all. The victim suddenly loses consciousness. Attacks are not related to posture, activity or stress. The condition can be effectively controlled by a pacemaker. Persons with functioning pacemakers who are under a physician's care probably incur little increased risk. The disorder cannot presently be thoroughly controlled by medication.

Carotid Sinus Syncope (Hypersensitivity):

The CAROTID SINUS is a pressure sensing organ located in the neck on either side. If it is hypersensitive, slight pressure (such as from a tight collar or turning of the head) may cause a drastic loss in blood supply to the brain. Often, attacks of fainting occur with no traceable precipitating event. Carotid sinus syncope attacks are difficult to predict or control with certainty. The onset is sudden, often with falling, and there is little or no warning before loss of consciousness. Therefore, this disorder entails a high risk for driving.

Persons with a past history of this disorder should be evaluated carefully by trained medical personnel. There is no current, well established way of controlling carotid sinus hypersensitivity with medication. Radiation, surgery, and pacemakers have been used successfully, however. In evaluating the success of these measures, medical advice should be sought to determine the relationship between the individual's condition and his risk in driving. In screening for this disorder, the examiner should not attempt to reproduce the symptoms, as this procedure may cause stoppage of the heart.

Other Causes:

Cardiac fainting may occur following TACHYCARDIA (extremely rapid heart beat that is not caused by normal adjustment to stress or exertion) or FIBRILLATION (see: HEART ARRHYTHMIAS). In such disorders, there is usually some warning of the oncoming attack, and both conditions may be controlled by medication. Special attention should be given to possible side effects of medication given for these conditions. Drowsiness, irritability or nervousness, or visual problems frequently are present.

Cardiac fainting may also follow ARTERIOSCLEROTIC HEART DISEASE (MYOCARDIAL INFARCTION, CORONARY THROMBOSIS, CONGESTIVE HEART FAILURE--see: ISCHEMIC HEART DISEASE), or may follow stress or mild exertion in persons with AORTIC STENOSIS or AORTIC REGURGITATION (see: HEART STRUCTURAL DEFECTS). Any applicant with a history of heart attack, or disease of the aorta, or fainting from any unexplained cause should be screened for the conditions in this section.

Risk Increasing Factors:

1. Attacks of faintness or loss of consciousness with little or no warning. These indicate a very high risk.

2. Susceptibility to attacks of tachycardia or fibrillation that are not well controlled by therapy. The risk is further increased in driving situations, such as heavy traffic, from which the driver cannot quickly extricate himself.

3. Drowsiness, irritability or visual problems caused by medication.

4. A history of Stokes-Adams attacks that are not controlled by a pacemaker indicates a very high risk.

5. Persons who must drive daily in connection with their employment, and whose conditions are controlled by medication, experience some increase of risk if they do not have the option of not driving when they do not feel well.

6. Risk increases with a deteriorating condition if the condition becomes intractable to medication, or if the dosage must be increased to levels that produce undesirable side effects.

Risk Moderating Factors:

1. Risk of fainting in a dangerous situation is decreased if there is a distinct warning preceding attacks.

2. Persons whose daily employment does not strictly require driving, or persons with low driving exposure levels.

3. Attacks that are well controlled by medication at dosage levels that do not produce dangerous side effects.

4. Risk is minimal in persons whose conditions are controlled by a pacemaker and who are frequently seen by a physician.

5. Persons with stable, well controlled, or improving conditions are better risks for long-term licensure.

Questions for the Applicant:

1. Is the applicant under a physician's care for his condition? If so, how often does he see his physician?

2. How long has he had this condition?

3. Is his condition stable, getting better, or getting worse? (Have respondent explain)

4. Is the applicant taking medication for his condition? If so, how does it affect him?

5. Does his medication control the condition?

6. How much does the applicant drive, and what kind of driving does he do? (Only if the applicant is being re-licensed)

7. Has his medical condition ever been a factor in an accident or close call? If so, what happened?

8. Does he have any additional conditions? (If so, refer to the appropriate sections within this manual)

9. How often does the applicant have these attacks?

10. When did he last have an attack?

11. Before he has an attack, does he feel "palpitations" or other sensations in his chest, neck or arms?

12. When has has an attack, does he become faint or dizzy? Does he lose consciousness? If so, does it happen suddenly?

13. Does the applicant's medication (if applicable) ever make him drowsy? Does it make him excitable, nervous, or irritable? Does it make him depressed or affect his vision?

14. Does the applicant have a cardiac pacemaker?

Behavioral Observations:

Behavior during questioning: Absence of observable dizziness, faintness, lightheadedness, or fainting does not mean that the subject has a well controlled condition. Conversely, if these conditions are seen during the interview, the condition is not well controlled. If the subject loses consciousness during examination, medical help should be summoned immediately, since some of these attacks are life threatening.

Behavior during in-car performance testing: In the absence of an overt attack, little effect upon driving performance may be noted. The examiner should be alert for signs of faintness, lightheadedness, dizziness, excitability, reduced glare tolerance, other visual problems caused by medication, or drowsiness and generally low level of alertness. The examiner should watch for possible onset of attacks; sudden disorientation or giddiness, sudden profuse sweating with pallor or redness of the face, and any gasping for breath or clutching at the chest or throat are all significant signs.

Heart Arrhythmias (Dysrhythmias)

BRADYCARDIA –
CONDUCTION DISORDERS
FIBRILLATION
HEART BLOCK
"PALPITATION"
TACHYARRHYTHMIAS
TACHYCARDIA (PAROXYSMAL TACHYCARDIA)
VENTRICULAR or ATRIAL FLUTTER

Arrhythmias in General:

In general, ARRHYTHMIAS are disorders affecting the regularity or coordination of the heart beat. A large variety of separate conditions exist. No attempt will be made to list all of these conditions here, but broad classifications will be discussed. Cardiac arrhythmias are frequently the result of other types of heart disease, such as MYOCARDITIS (see: HEART INFLAMMATIONS), or MYOCARDIAL INFARCTION (see: ISCHEMIC HEART DISEASE). Arrhythmias associated with HYPOGLYCEMIA, or ELECTROLYTE IMBALANCE, as in kidney diseases, are particularly complex problems. Medical advisory help should be sought to determine if the disease is well controlled.

Paroxysmal Atrial Tachycardia:

PAROXYSMAL ATRIAL TACHYCARDIA is an intermittent disorder of rapid heart beat arising in the upper part of the heart. There is a sudden onset of strong palpitations (or flutter). Consciousness is not usually lost, however, and sudden collapse does not normally occur. By itself, this disorder does not make driving too risky. Lightheadedness may occur during the attack, and fainting may follow, but these developments do not take place suddenly. However, it may be caused by other, more serious conditions such as ATRIAL SEPTAL DEFECT (see: HEART STRUCTURAL DEFECTS), WOLFF-PARKINSON-WHITE or WPW SYNDROME (see: below), or MITRAL VALVE DISEASE (see: HEART STRUCTURAL DEFECTS). These should be evaluated separately.

Atrial Fibrillation or Flutter:

ATRIAL FIBRILLATION or ATRIAL FLUTTER are more serious disorders. They may be PAROXYSMAL (intermittent) or persistent. In either form, they do not typically produce sudden collapse. While the attack is going on, heart

pumping output drops and dizziness, lightheadedness, or breathlessness may appear. Heart failure may occur, especially in patients with ISCHEMIC HEART DISEASE. Persons with the persistent form have some risk of clot formation. They also have some risk of sudden stroke (see: STROKE), respiratory collapse, or heart attack unless the condition is controlled by medication. Medication, especially for the persistent form, may produce lightheadedness, fainting, ringing in the ears, or visual problems.

Ventricular Arrhythmia:

Rhythm disorders of the lower part of the heart (the VENTRICLES) are much more serious than are the conditions discussed above that involve the ATRIA only. VENTRICULAR TACHYCARDIA is a dangerous condition for driving. It frequently develops into VENTRICULAR FIBRILLATION in which all circulation ceases. The victim suffers complete collapse, and dies suddenly. Persons with ventricular tachycardia, therefore, run a high risk in driving unless the disorder has been controlled by medication. Dangerous side effects of medication include lightheadedness or fainting, visual blurring. and ringing in the ears. A history of ventricular tachycardia often results from an acute heart attack (see: ISCHEMIC HEART DISEASE), and corrects itself during the recovery period. Persons who have been free of this disorder after their recovery from a heart attack run a lower risk.

Atrio-Ventricular (AV) Block:

ATRIO-VENTRICULAR BLOCK has three degrees of severity. Partial (Type I) and INTERMITTENT COMPLETE AV BLOCK (Type II or STOKES-ADAMS SYNDROME) have been discussed elsewhere (see: CARDIAC SYNCOPE). COMPLETE, or Type III, Block may occur following myocardial infarction (see: ISCHEMIC HEART DISEASE) or inflammation (see: MYOCARDITIS). Type III heart block's major symptom is BRADYCARDIA (extremely slow heart beat) with low exercise tolerance, and frequent faintness. It may disappear with recovery from its causing condition, or it may be controlled with a pacemaker if it continues. If it has disappeared or is being controlled by a pacemaker, the risk is probably not great. If it is not controlled, evaluation of risk is difficult. Medical advisory help should be sought.

Bundle Branch Blocks:

BUNDLE BRANCH BLOCK DISORDER has little significance to driving by itself. RIGHT BUNDLE BRANCH BLOCK in persons under 40 with no other heart disease is insignificant for driving. LEFT BUNDLE BRANCH BLOCK, or right block with other heart disease, may indicate a severe degree of heart damage. Medical advisory help should be sought.

WPW Syndrome:

WOLFF-PARKINSON-WHITE (WPW) SYNDROME (ANOMALOUS ATRIO-VENTRICULAR EXCITATION) is a condition in which extra conduction pathways exist. These pathways produce attacks of extremely rapid heart beats (tachycardias). It produces some risk for driving because an attack may produce faintness or breathlessness. It may be controlled by medication or, in some cases, it may be completely cured by surgery. The medication itself may produce headache, ringing in the ears, visual distortion, and dizziness or faintness.

Risk Increasing Factors:

1. Ventricular atrio-ventricular arrhythmias are more dangerous than purely atrial ones.

2. Arrhythmias that result from cardiac damage, and persist after a recovery period of several weeks, are associated with higher risk than are arrhythmias that are not associated with damage, or that disappear during recovery.

3. Presence of drowsiness, faintness, visual problems, severe headache, or confusion caused by medication.

4. Use of tobacco, tea, coffee, or other stimulants (such as oral, caffeine-containing preparations, or possibly, alcoholic beverages).

5. Persons with complete heart block following cardiac disease run a very high risk if this condition is not controlled by a pacemaker.

6. Persons with tachycardias or fibrillations that are not well controlled by medication run an increased risk. The risk is further increased in driving situations, such as heavy traffic from which they cannot quickly remove themselves.

7. Persons who must drive daily in connection with their employment, and whose conditions are controlled by medication, experience increased risk if they do not have the option of not driving when they do not feel well.

8. Risk increases with a deteriorating condition if the condition becomes resistant to medication, or if the dosage must be increased to levels that produce dangerous side effects.

Risk Moderating Factors:

1. Purely atrial conditions have less associated risk than do those which involve the ventricles.

2. Persons with arrhythmias that are not connected with other heart disease.

3. Risk is decreased in individuals whose conditions are well-controlled by medication given at dosage levels that do not produce dangerous side effects.

4. Persons with stable, well-controlled or improving conditions are better risks for long-term licensure.

Questions for the Applicant:

1. Is the applicant under a physician's care for his condition? If so, how often does he see his physician?

2. How long has he had this condition?

3. Is his condition stable, getting better, or getting worse? (Have respondent explain)

4. Is the applicant taking medication for his condition? If so, how does it affect him?

5. Does his medication control the condition?

6. How much does the applicant drive, and what kind of driving does he do? (Only if the applicant is being re-licensed)

7. Has his medical condition ever been a factor in an accident or close call? If so, what happened?

8. Does he have any additional conditions? (If so, refer to the appropriate sections within this manual)

9. How often does the applicant have these attacks?

10. When did he last have an attack?

11. When he has an attack, does he become faint or dizzy, or lose consciousness? (If he does lose consciousness, see: CARDIAC SYNCOPE)

12. Does the applicant's medication (if applicable) ever make him drowsy? Does it make him nervous or excitable? Does it make him confused, give him headaches, or make him feel faint? Does he have any problems with his eyes?

13. Does the applicant have a cardiac pacemaker?

14. Has the applicant ever had a heart attack?

15. Does the applicant drink tea or coffee? Does he use any other form of caffeine contalning preparation (e.g., stay-awake tablets)? How often?

16. Does the applicant use tobacco in any form? How often?

17. Does the applicant drink alcoholic beverages? How often?

Behavioral Observations:

Behavior during questioning: Absence of observable dizziness, lightheadedness, or fainting does not mean that the applicant has a well controlled condition. On the other hand, if these conditions are seen during the interview, the condition is not well controlled. If the applicant has an attack at any time during the examination procedure, medical help should be summoned immediately.

Behavior during in-car performance testing: In the absence of an outright attack, little effect upon driving performance may be seen. The examiner should be alert for signs of lightheadedness, excitability, faintness, visual problems (especially squinting), drowsiness, or pallor (caused by medication-induced hypotension). All of these may be side effects of medication. Sudden disorientation or faintness, profuse sweating with flushing or pallor, or breathlessness may be signs of an attack.

Heart Failure
(Myocardial Failure, Congestive Heart Failure)

ACUTE HEART FAILURE
CHRONIC HEART FAILURE
LEFT HEART (VENTRICULAR) FAILURE
RIGHT HEART (VENTRICULAR) FAILURE
COR PULMONALE

Heart Failure in General:

HEART FAILURE refers to inadequate performance of the heart as a blood pump. This decrease in performance prevents adaptation of the heart's output to the demands of activity. When severe, output may even be inadequate at rest. Heart failure may be considered as having several degrees of severity ranging from appearance of breathlessness and other symptoms after moderate exercise, to constant difficulty even while at rest in severe cases. The degree of severity of heart failure will have a direct bearing upon risk levels in driving.

Heart failure is the possible end result of most other types of heart disease process. Therefore, it will be attended by liabilities to (for example) sudden collapse that are characteristic of the causing disease. These conditions should be evaluated separately. No attempt is made to cover them here. However, since MYOCARDIAL FAILURE is frequently the result of some disease process affecting the HEART CONDUCTION SYSTEM as well as the MYOCARDIUM, ARRHYTHMIAS or some degree of HEART BLOCK are often present. These conditions imply the possibility of sudden fainting, attacks of dizziness or faintness, and other dangerous problems. The examiner should probe for these, at a minimum, in applicants with CHRONIC HEART FAILURE.

Ventricular Enlargement:

One feature of the heart's physical condition that is very closely associated with the process of failure is VENTRICULAR ENLARGEMENT (DISTENSION, DILATATION). Related to (and usually occurring with) enlargement is HYPERTROPHY (increase in the muscle mass of the heart). For the purposes of this manual, differentiation of these two factors is not practical. The examiner should keep in mind, however, that when ventricular hypertrophy appears in a medical history, enlargement and potential or actual heart failure is sometimes implied. Presence of enlargement, without other signs of ventricular failure (such as breathlessness), in itself does not pose risks for driving.

However, enlargement regularly leads to ventricular failure if it is not corrected. Therefore, an applicant with enlargement should probably be re-examined frequently. An exception to this rule is the individual who is physically very active (e.g., the long-distance runner). Some degree of heart enlargement is entirely normal in these athletic individuals, and produces no effect upon their driving.

Acute Heart Failure:

In its ongoing phase, ACUTE HEART FAILURE is a very serious and debilitating disease. If its course is not arrested, it will end in death. The examiner is most unlikely to encounter it. Ongoing acute heart failure in applicants will usually have been caused by another known condition which may entail a high risk for driving. By the time acute heart failure appears, the underlying disease should be well advanced and its course may not be susceptible to prediction with accuracy. Therefore, the examiner should obtain medical advice to determine the relationship of the individual applicant's condition to his risk level in driving.

Applicants with a past history of acute heart failure that is now corrected may or may not be good driving risks. Their risk levels will depend primarily upon how well heart function has been restored, and upon the underlying condition which caused the failure in the first place. The examiner should direct his attention particularly to continuing arrhythmias (see: HEART ARRHYTHMIAS) or fainting (see: CARDIAC SYNCOPE) that may exist. Applicants whose heart failure was the result of a structural defect (see: HEART STRUCTURAL DEFECTS) that has been corrected by surgery may not run an increased risk in driving. In these cases, the examiner needs to know whether significant arrhythmias or sudden fainting are now present. These increase risk. It is also desirable to obtain medical advice as to whether or not the surgery was sufficiently successful in correcting the defect to prevent recurrence of heart failure. Medical advice should be obtained on this point in order to evaluate the relationship of the applicant's condition to his risk in driving. Since some surgical procedures may have only a temporary success, and relapse may occur after a period of time, licensure for limited periods followed by re-evaluation may be appropriate.

Chronic Heart Failure:

Chronic failure is failure of the heart to function adequately over a long period of time. It may be stable or progressive. It may be centered in the left ventricle or the right ventricle, or it may involve both. LEFT VENTRICULAR FAILURE usually appears first, and is followed by RIGHT

VENTRICULAR FAILURE when the disease is well advanced. Right ventricular failure seldom appears alone. When it does appear alone, it usually follows COR PULMONALE (enlargement of the right ventricle following lung disease) and the examiner should also be concerned with possible lung disease (see: RESPIRATORY DISEASES). Although each type of failure produces characteristic effects, they can be discussed together. Right failure can be considered a continuation of left failure for the purposes of this discussion. The examiner should not neglect to screen the applicant for other types of cardiovascular disease in order to determine the cause of heart failure. The underlying condition will play a major role in determining driving risk levels. When both sides display failure (acute or chronic), the term used is BILATERAL VENTRICULAR FAILURE.

As the pumping efficiency of the left ventricle declines, pressure in the pulmonary circulation (which drains oxygenated blood from the lungs into the left heart) begins to rise. Engorgement, distension, and rigidity of the lungs results directly from this increasing left ventricular filling pressure. Early chronic left ventricular failure will produce DYSPNEA (breathlessness) upon exertion, and the less the exertion required to produce dyspnea, the more advanced is the failure. Pulmonary congestion (blood engorgement) may produce wheezing and coughing as well, and these symptoms tend to worsen as the failure progresses. Breathlessness that appears while the individual is lying down, and that can be relieved by sitting up (ORTHOPNEA), is a sign of advanced disease. Another serious indication of advanced failure is an attack of severe breathlessness that may awaken the individual from a sound sleep. The victim of such an attack will choke and gasp until he has been sitting upright for a few minutes, after which the attack will subside. The appearance of this PAROXYSMAL NOCTURNAL DYSPNEA (CARDIAC ASTHMA) indicates a very advanced failure process. In its late stages, heart failure will produce breathlessness at rest or with only a little movement (such as walking across the room). PULMONARY EDEMA (collection of fluid in the lungs) that produces constant dyspnea is a likely occurrence. Either of these symptoms, if uncorrected, indicate a very high driving risk increase.

When right ventricular failure occurs as a result of the increased back pressure produced by lung engorgement, that side of the heart which normally pumps blood to the lungs to collect oxygen no longer functions effectively. A similar increase in lung circulatory back pressure may be produced by some respiratory diseases. Cor pulmonale will often result from this condition, and lead to right ventricular failure as well. The supply of oxygen to the muscles, internal organs, and brain may well become inadequate for normal functioning. In severe cases, bluish coloration of the skin (CYANOSIS) will

be quite noticeable. The veins of the neck often will be prominently visible, appearing swollen in more severe cases. Chronic brain oxygen starvation caused by chronic heart failure frequently produces neurological and mental performance impairment. Victims are frequently irritable, insomniac, have poor memory, and difficulty in concentrating. In severe cases, consciousness may become seriously impaired. Headache and generalized weakness of the limbs with impairment of coordination and weakness also occur frequently. The lower blood oxygen level may also tend to produce, or to worsen, existing ISCHEMIC HEART DISEASE.

It is often difficult to predict whether chronic heart failure will progress, or not, and if it does progress, it is also difficult to predict the rate of deterioration. Frequent re-examination of applicants with any form of chronic heart failure, and estpically of those with bilateral ventricular failure, is desirable. Applicants with a past history of acute heart failure that has improved following treatment may be relatively stable, and may not need frequent licensing review. Medical advice should be sought on this point to determine the relationship of the individual's condition to his risk level in driving.

Risk Increasing Factors:

1. The degree of CARDIAC INADEQUACY (circulatory impairment) is of primary importance in determining risk. Gasping breathlessness, or lightheadedness following moderate exercise increases risks. In general: The less exercise it takes to produce symptoms, the greater the risk. Symptoms produced by jogging or climbing several flights of stairs, but not produced by light exercise such as walking or daily activity, indicate small risk increase. Symptoms produced by walking a few feet indicate a more advanced condition. Note: The examiner should not attempt to induce symptoms by exercising the applicant.

2. Presence of VENTRICULAR TACHYCARDIA, heart block, CARDIAC SYNCOPE, or a tendency toVENTRICULAR FIBRILLATION all increase risk of sudden collapse.

3. Presence of mental impairment, difficulty in concentrating or other neurological problems caused by the inadequate brain circulation levels that may accompany heart failure.

4. Presence of bilateral failure that is severe enough to produce cyanosis decreases the amount of oxygen available to the brain. This may impair alertness and increase risk. "Cardiac asthma" (paroxysmal nocturnal dyspnea) indicates very severe failure.

5. The medications used to treat heart failure may, in large doses, produce nervousness, drowsiness, dizziness, or visual problems.

Risk Moderating Factors:

1. Absence of breathlessness, lightheadedness, or dizziness after light exercise.

2. Absence of neurological impairments, and of decreased alertness caused by brain circulation.

3. Presence of right ventricular failure (cor pulmonale) in absence of left ventricular failure may moderate driving risk if there is no marked decrease in mental performance. Risk is not decreased if PRIMARY PULMONARY HYPERTENSION is present (see: RESPIRATORY DISEASES). Medical advice should be sought on this point to determine the relationship of the individual's condition to his risk levels in driving.

4. Control or improvement of failure by medication if the dosage levels required do not produce drowsiness, dizziness, nervousness, or visual problems.

Questions for the Applicant:

1. Is the applicant under a physician's care for his condition? If so, how often does he see his physician?

2. How long has he had this condition?

3. Is his condition stable, getting better, or getting worse? (Have respondent explain)

4. Is the applicant taking medication for his condition? If so, how does it affect him?

5. Does his medication control the condition?

6. How much does the applicant drive, and what kind of driving does he do? (Only if the applicant is being re-licensed)

7. Has his medical condition ever been a factor in an accident or close call? If so, what happened?

8. Does he have any additional conditions? (If so, refer to the appropriate sections within this manual)

9. Does the applicant ever become breathless or lightheaded after climbing stairs? After walking about at home during normal activity? When was the last time?

10. Does the applicant ever feel faint? Does he lose consciousness? If so, does it happen suddenly? When was the last time?

11. Is the applicant awakened from sleep by breathlessness? When was the last time?

12. Does his medication (if applicable) ever make him nervous or irritable? Drowsy, faint or dizzy? Does it give him vision problems?

Behavioral Observations:

The examiner should be alert to signs of breathlessness, lightheadedness, or chest discomfort occurring during the examination. He should, however, try to differentiate between breathlessness caused by light exercise or driving (likely to occur first while walking out to the car, or in traffic) from that caused by emotional stress in the interview. The examiner should attempt to reassure the applicant and set him at his ease, in so far as this is possible, in order to make this differentiation simpler. Cyanosis (bluish coloration of the skin, especially visible under the fingernails) is highly significant. Distension (swelling) of the neck veins indicates some degree of right ventricular failure. The examiner may notice some swelling (edema) in the ankles, or in very serious cases, in the arms, wrists and face. This can be differentiated from simple obesity by gently pressing on the swollen site with the end of the finger. If an indentation remains briefly, edema is present. Edema may indicate either severe failure, or absence of a physician's close supervision. Either is significant.

The examiner should be especially alert for signs of neurological problems related to the disease. Inattention, difficulty in concentrating, irritability, decreased alertness, or lapses of memory are all highly significant. The examiner should be careful to differentiate impaired hearing from inattention or difficulty in comprehending instructions. Difficulty with hearing will appear frequently in elderly subjects. Adverse side effects of medication may be noted in the form of nervousness, squinting at glare, drowsiness, or signs of faintness, dizziness, or lightheadedness.

PERICARDITIS
ENDOCARDITIS
MYOCARDITIS, CARDIOMYOPATHY and MYOCARDOSIS
PANCARDITIS.

Heart Inflammation in General:

HEART INFLAMMATIONS are disorders of the heart that are caused by some underlying disease process. These causing conditions should be evaluated separately if they are known, and if they affect other organs. They may be produced by a wide variety of infectious diseases (viral, bacterial, or fungal), by malnutrition, by toxic reaction, or by cancerous or non-cancerous tumors (see: NEOPLASTIC DISEASES). The chief danger for driving lies in the possibility that the inflammation may attack the HEART CONDUCTION SYSTEM, a network of nerves that controls the heart beat. If this happens, a potentially very dangerous ARRHYTHMIA (see: HEART ARRHYTHMIAS) will result. This effect may produce sudden, unpreditable collapse. Therefore, presence of heart inflammation in an active form entails a high risk for driving.

Healed or inactive heart inflammation may have produced a wide variety of other cardiovascular problems. Among the more commonly occurring residual effects are damaged valves, ANEURYSMS or STENOSIS of the great vessels (see: HEART STRUCTURAL DEFECTS), CORONARY CIRCULATION OBSTRUCTION (see: ISCHEMIC HEART DISEASE), arrhythmias (see: HEART ARRHYTHMIAS) or MYOCARDIAL FAILURE (see: HEART FAILURE). The applicant should then be evaluated according to the materials in the appropriate section. Some types of heart inflammation may recur. The most likely type to reappear is inflammation caused by a cancerous tumor. If the applicant has a history of such an inflammation, medical advice should be sought concerning its activity and its likelihood of recurrence.

Heart inflammation may also be caused by a glandular dysfunction such as thyroid disorder. In these cases, the condition can usually be cured or completed controlled. Residual damage is not as likely to appear in such cases.

IDIOPATHIC or NON-SPECIFIC HEART INFLAMMATION may also occur. The terms "idiopathic" or "non-specific" mean that no specific infectious or invasive process can be discovered. Of these, inflammations that follow heart

surgery (POST CARDIOTOMY SYNDROME) or MYOCARDIAL INFARCTION (POST MI SYNDROME, DRESSLER'S SYNDROME) are particularly apt to recur. Occasionally, a NOSOCOMIAL (treatment-produced, infectious) inflammation will follow from some surgical or diagnostic procedure involving the heart. Possibility of recurrence is difficult to assess in such cases, and medical advice should be obtained.

Pericarditis:

PERICARDITIS refers to an inflammation of the tissue sack (PERICARDIUM) that surrounds and protects the heart. In some forms of the disease, invasion of the heart conduction system is not especially likely. These conditions include pericarditis that may accompany RHEUMATOID ARTHRITIS, and UREMIC PERICARDITIS. Uremic pericarditis is produced by chronic KIDNEY FAILURE that may be treated by HEMODIALYSIS. If treatment stabilizies and controls the condition, risk in driving may not be too great. However, if the disease remains active, risk is high due to the arrhythmias which accompany the disorder (see: RENAL DISORDERS).

Pericarditis also has several chronic forms, including: ADHESIVE PERICARDITIS, CHRONIC PERICARDIAL EFFUSION, and CONSTRICTIVE PERICARDITIS. Adhesive pericarditis refers to attachment of the pericardium to the heart. It is not important to driving if the disease which produced it is not active. Chronic pericardial effusion denotes slow accumulation of fluid between the pericardium and the heart wall. Some impairment of the applicant's ability to function without breathlessness (reduced exercise tolerance) usually occurs. Most importantly, chronic effusion generally indicates that the underlying disease is still active. Medical advice should be obtained on this point to determine the relationship of a specific person's condition to his risk level in driving. Constrictive pericarditis is a condition which often follows other forms of pericarditis. It refers to constriction of the heart by a thickened and scarred pericardium that interferes with its pumping efficiency. Symptoms are similar to those of chronic heart failure (see: HEART FAILURE), and victims become breathless either at rest (in the very severe forms), or after some degree of exertion. Constrictive pericarditis is probably not important to driving by itself unless breathlessness occurs at rest, or with the activity of driving. In such cases, risk may be moderately increased.

Myocarditis:

MYOCARDITIS or CARDIOMYOPATHY are group names for a wide variety of disorders that affect the muscle of the heart (MYOCARDIUM) itself. With all forms of active myocarditis, there is a strong possibility of an adverse

effect upon the nerve network that controls the heart beat. In all forms of active cardiomyopathy, here is a strong possibility of sudden collapse (see: CARDIAC SYNCOPE), and consequently a high risk for driving. Other forms of cardiomyopathy may be caused by poor nutrition, or by the long-term, toxic effects of alcoholism.

It is difficult to say for certain whether a particular form of myocarditis will produce lasting arrhythmias or heart failure after the active phase has passed. Medical advice should be sought in the case of individual persons with a past history of this disorder to determine the relationship of the specific applicant's condition to his risk level in driving. At a minimum, it should be determined whether or not the applicant has residual arrhythmias, any tendency to sudden fainting (see: CARDIAC SYNCOPE), or severe heart failure.

Endocarditis:

The inner surface lining of the heart is called the ENDOCARDIUM. Many types of disease process affect this tissue, producing a condition known as ENDOCARDITIS. The active form of the disease is divided into ACUTE and SUBACUTE forms. The acute form is unlikely to be seen in the active stage by the examiner with any frequency, as people who have it are very ill indeed. Applicants with a history of this disorder may have severely damaged heart valves (see: HEART STRUCTURAL DEFECTS), CORONARY INSUFFICIENCY (see: ISCHEMIC HEART DISEASE) or chronic heart failure. Evaluation of the applicant should be based upon these disorders as appropriate. There is also a distinct possibility that the disorder may recur. If the disease is in the active stage, the driver is prone to sudden collapse (see: CARDIAC SYNCOPE), sudden myocardial infarction (see: ISCHEMIC HEART DISEASE), or CEREBRAL EMBOLISM (see: STROKE).

The subacute form of endocarditis is a slower disease process than the acute form. It is none the less dangerous for driving in its active stage. Victims of the disease are prone to sudden collapse, sudden myocardial infarction, constant or intermittent breathlessness, fainting, or sudden cerebral embolism. Applicants with a past history of subacute endocarditis may have severe heart valve damage, arrhythmias with possible fainting, ISCHEMIC HEART DISEASE, or chronic heart failure. Evaluation of applicants should be based upon these conditions as appropriate.

Applicants with a surgically implanted artificial heart valve have an increased likelihood of developing some form of endocarditis, and should be screened for this condition by the examiner (see: HEART STRUCTURAL DEFECTS).

Pancarditis:

This term refers to a generalized inflammation of the heart which may include any or all of pericarditis, myocarditis, and endocarditis. In an active stage, it poses a high risk for driving. Victims of the disorder may be prone to sudden collapse, cerebral embolism, and other dangerous conditions. Applicants with a past history of this disorder frequently have a wide variety of resulting heart problems. Medical advice should be sought to aid in determining the relationship of a specific individual's condition to his risk level in driving.

Risk Increasing Factors:

1. Active forms of heart inflammation are much more dangerous for driving than inactive forms. Drivers are prone to sudden collapse from a variety of causes.

2. Presence of arrhythmias, and especially those types producing fainting (see: CARDIAC SYNCOPE).

3. Medication that produces dizziness or lightheadedness, visual problems, faintness, excitability, or drowsiness when given in the dose prescribed.

4. Nearness in time to the active phase of endocarditis (even after "cure"). The disease produces clots in the chambers of the heart or elsewhere which can move and lodge in the coronary arteries (producing a heart attack) or may cause sudden cerebral embolism. The victim may suddenly collapse.

5. Presence of severe heart failure or severe CARDIAC INSUFFICIENCY from heart valve damage increases risk for driving if the disorder is severe enough to cause the applicant to be breathless, mentally confused, or to experience pain at the level of exertion encountered in driving. The examiner should not attempt to produce symptoms by exercising the applicant.

Risk Moderating Factors:

1. Inactivity of the disease ("cure") that persists for long periods of time. In general, the longer the disease remains inactive, the lower the risk.

2. Absence of arrhythmia, fainting, severe heart failuare or other side effects in an applicant who does not have active disease. Absence of these factors in an applicant with active disease does not lower risk.

3. The longer it has been since an episode of active endocarditis, the lower is the risk of clot migration, and therefore the risk in driving is lower.

4. Control of any side effects of the disease by medication that does not produce undesirable reactions (such as dizziness or lightheadedness, drowsiness, nervousness, or visual problems).

Questions for the Applicant:

1. Is the applicant under a physician's care for his condition? If so, how often does he see his physician?

2. How long has he had this condition?

3. Is his condition stable, getting better, or getting worse? (Have respondent explain)

4. Is the applicant taking medication for his condition? If so, how does it affect him?

5. Does his medication control the condition?

6. How much does the applicant drive, and what kind of driving does he do? (Only if the applicant is being re-licensed)

7. Has his medical condition ever been a factor in an accident or close call? If so, what happened?

8. Does he have any additional conditions? (If so, refer to the appropriate sections within this manual)

9. Does the applicant ever have attacks of faintness or dizziness? If so, do they occur suddenly? Does he ever lose consciousness? (If so, see: CARDIAC SYNCOPE)

10. Is the applicant's condition currently active? If not, how long ago was it active?

11. Has he had this condition more than once?

12. Does the applicant's medication (if applicable) ever cause him to feel dizzy, lightheaded or faint? Does it ever make him nervous? Does it disturb his vision or make him drowsy?

13. Does the applicant ever feel breathless? If so, does it occur when he climbs a flight of stairs? Walks less than one block? When he is sitting still?

Behavioral Observations:

There are few signs specific to active heart inflammations that the examiner can detect. Gross symptoms such as fever, illness, chills, fainting, profuse sweating, mental confusion, or delirium indicate very severe disease. The examiner should also be watchful for signs of breathlessness, dizziness, or lightheadedness, sensitivity to glare, or mental confusion. If a collapse occurs at any point, medical assistance should be summoned immediately.

Heart Structural Defects

CONGENITAL HEART DISEASE
SEPTAL DEFECTS
HEART VALVE DISORDERS, CONGENITAL
HEART VALVE DISORDERS, ACQUIRED
AORTIC COARCTATION AND AORTIC STENOSIS
AORTIC REGURGITATION
ANEURYSMS, ARTERIAL
ANEURYSMS, HEART
CONGENITAL HEART BLOCK

Heart Structural Defects in General:

This is the most complex of the cardiovascular disease classes, both from the standpoint of distinctly different diseases, and from the standpoint of the wide range of possible severities that most of these disorders may display. The list given above is an abbreviated sample of the conditions which the examiner may encounter. Most of these conditions will have little effect on driving, or will require medical advice for proper evaluation.

A brief list of basic questions for the applicant is included within this section in the interest of obtaining some background information on the specific condition as it affects the individual applicant. The examiner should also use the Questions to be Addressed to Medical Personnel presented in the General Introduction to cardiovascular diseases. Risk Increasing and Risk Moderating Factors have been omitted. However, the examiner should be alert for obvious signs of heart trouble such as breathlessness, faintness, or chest discomfort. These probably indicate a condition of increased risk.

CONGENITAL (present at birth) heart disease is not likely to be seen as often as are ACQUIRED STRUCTURAL DEFECTS. Perhaps .4 to .8 percent of the driving age population will have some form of congenital abnormality of the heart. Of these, many will be quite harmless and will, therefore, not be called to the examiner's attention. Some will even correct themselves during the course of the applicant's life. The most likely to be seen will be people with defects that have been corrected by surgery. ATRIAL SEPTAL DEFECT is an exception in that victims may function quite well with the defect and elect not to have surgery. If the disease was completely corrected by surgery or by spontaneous correction, risk is not increased. In all cases of

acquired (through disease, injury or other cause) structural defects, or surgically implanted PROSTHESES (CARDIAC PACEMAKERS, ARTIFICIAL HEART VALVES, AORTIC PATCHES and the like), medical advice should likewise be obtained. A few conditions that deserve special mention because of their correctability or especially increased driving risk are listed below.

Heart Valve Disorders:

Applicants with surgically corrected MITRAL VALVE DISEASE whose conditions are stable may frequently drive without increased levels of risk. Applicants who have had implanted artificial heart valves, and who do not have other high-risk heart conditions (such as CARDIAC SYNCOPE or HEART ARRHYTHMIAS) may often function normally. A physician alone may determine the success of the surgery, however. Individuals who have one or more implanted artificial heart valves may be receiving medications that impair the clotting ability of the blood (anti-coagulants). While these medications do not create an increased risk of traffic accidents, they do produce a bleeding hazard to the driver in the event that he does become involved in a crash.

Aortic Stenosis, Coarctation, or Regurgitation:

If these disorders are not corrected by surgery, and if they are severe or deteriorating, the applicant may be prone to sudden loss of consciousness (see: CARDIAC SYNCOPE). Medical advice should be sought to determine the relationship of the individual applicant's condition to his risk level in driving.

Aneurysms of the Heart or Great Vessels:

ANEURYSMS are places in the wall of the heart or large blood vessel that are weakened and stretched. If these conditions are not corrected by surgery, there is always a possibility of their rupture. This would be followed by sudden collapse and death. The risk in driving by applicants with these conditions, unless they have been successfully corrected, is high. Risk is especially high for applicants who have DISSECTING ANEURYSMS.

Congenital Heart Block:

Unless this condition is well controlled by therapy or a surgically implanted cardiac pacemaker, applicants with this condition may be prone to sudden fainting (see: CARDIAC SYNCOPE), and so incur a high risk in driving. Medical advice should be sought to determine the relationship of the individual's condition to his risk in driving.

Questions for the Applicant:

1. Is the applicant under a physician's care for his condition? If so, how often does he see his physician?

2. How long has he had this condition?

3. Is his condition stable, getting better, or getting worse? (Have respondent explain)

4. Is the applicant taking medication for his condition? If so, how does it affect him?

5. Does his medication control the condition?

6. How much does the applicant drive, and what kind of driving does he do? (Only if the applicant is being re-licensed)

7. Has his medical condition ever been a factor in an accident or close call? If so, what happened?

8. Does he have any additional conditions? (If so, refer to the appropriate sections within this manual)

Behavioral Observations:

The examiner should be alert for obvious signs of heart disease such as breathlessness, faintness, distended blood vessels in the neck, bluish coloration of the skin (CYANOSIS), or chest discomfort. If present, these symptoms generally indicate a condition of elevated risk. Detailed evaluation of the relationship between the individual applicant's condition and his risk level in driving should depend upon medical advice, however.

If the applicant should experience severe pain, or should he collapse at any point in the examination procedure, medical help should be summoned immediately.

Ischemic Heart Disease (IHD)

CORONARY INSUFFICIENCY
CORONARY ATHEROSCLEROSIS
ARTERIOSCLEROTIC HEART DISEASE
ANGINA PECTORIS (A. P.)
UNSTABLE ANGINA
CRESCENDO ANGINA
MYOCARDIAL INFARCTION (M.I.)
HEART ATTACK
CORONARY OCCLUSION
CORONARY THROMBOSIS

Ischemic Heart Disease in General:

As with any other muscle in the body, there is a relationship of demand and supply between the amount of work the heart muscle (MYOCARDIUM) is called upon to perform, and the amount of blood-carried oxygen and other nutrients that it will need. When blood supply to the heart is restricted in the face of normal demand, or when the heart's work load is greatly increased by some circulatory abnormality, ISCHEMIC HEART DISEASE results. Most often, both factors (increased demand and impaired supply) are present. Narrowing of one or more of the three CORONARY ARTERIES that supply the myocardium is the most common direct cause of IHD. HYPERTENSION (high blood pressure) is a common complication that worsens the effect of this CORONARY INSUFFICIENCY.

IHD produces several different manifestations, the most common of which are discussed below. The most frequent result is an intermittent sensation of heaviness or tightness in the chest, which is usually accompanied by some degree of pain. Although a total blockage of some portion of the coronary circulation (a "heart attack") may appear suddenly, even without prior symptoms, the severity of the underlying IHD is related in a general way to the amount of exercise needed to produce symptoms. Symptoms of pain or heaviness that occur at rest or after very light exercise indicate severe IHD.

The disease process is highly complex and not always well understood. Therefore, it is often difficult to predict whether the disorder will remain stable, improve, or degenerate. If it degenerates, it is also often difficult to predict whether or not the victim will suddenly experience a "heart attack."

IHD that is attributable to CORONARY ATHEROSCLEROSIS (a narrowing of the arteries by fatty deposits) is often accompanied by hypertension, stroke, diabetes, ARRHYTHMIAS (see: HEART ARRHYTHMIAS) or heart valve disease (see: HEART STRUCTURAL DEFECTS). These other conditions greatly affect the progress of the disease and the overall risk in driving. Sudden collapse behind the wheel can be very dangerous when it occurs. But only about half of the drivers who die suddenly behind the wheel knew in advance that they had heart disease. In general, undetected disease is probably much more dangerous to the life of the patient, and for driving, than is detected and treated disease. Therefore, although millions of American drivers have IHD (and as many as 1 in 5 males will have last one heart attack before age 60), careful attention to the risk factors for driving by persons with IHD can still be very beneficial. Awareness of the disease does much to make the driver aware of danger signs in time to get out of traffic safely.

IHD may be caused by other factors, such as AORTIC STENOSIS, CONGENITAL ABNORMALITIES (see: HEART STRUCTURAL DEFECTS) or MYOCARDITIS (see: HEART INFLAMMATIONS), or severe lung disease. In these cases, evaluation should depend upon medical advisory assistance. IHD produced by ARTERIOSCLEROSIS or other causes may sometimes be treated by surgery. Risk evaluation in this case should be assisted by medical advice. The course of IHD can be affected to some degree by medication, surgery, and abstinence from cigarette smoking. The applicant should be questioned on these points.

Angina Pectoris:

ANGINA PECTORIS (AP) is a symptom of IHD that is most often found in the middle aged and the elderly, where it is quite common. Its major symptom is a discomfort in the front of the chest that is described as a sensation of weight or heaviness, and is accompanied by pain and sometimes labored breathing. The intensity of the anginal attack may vary from mild to an intensity severe enough to make the victim cease activity and seek immediate relief. An attack is usually brought on by physical activity, excitement, or stress. These factors, alone or in combination, may start an attack. The severity of the condition is considered to be related to the degree of stress, activity, or excitement necessary to provoke an attack. The less the activity needed to provoke AP, the worse the ailment. Persons who have Anginal attacks at rest in spite of medication have the disease in a severe form. Presence of hypertension or arrhythmia increases risk of sudden death very signficantly as well.

Angina pectoris alone has little signficance for driving except in its severe forms. The onset of pain is unlikely to be swift or crippling enough to prevent the driver from stopping safely. However, persons who experience constant or near constant pain at rest run a higher risk due to the distracting effect of the pain. Their chances of having a sudden heart attack are also greater. The same is true for individuals who experience AP following minimal emotional or physical stress. Severe angina pectoris is also more likely to be associated with arrhythmia (see: HEART ARRHYTHMIA) or fainting (see: CARDIAC SYNCOPE). Some medications may make the individual drowsy, excitable, or faint.

Myocardial Infarction: (CORONARY OCCLUSION, CORONARY THROMBOSIS)

MYOCARDIAL INFARCTION is a disorder that runs a brief course, but often leaves severe residual damage to the heart. It is caused by severe narrowing or blockage of the blood supply to some part of the heart muscle. It is the disease most commonly meant by the term "Heart Attack." An active infarct is not likely to be seen by the examiner unless it occurs during the examination. If this should happen, summon medical help immediately. After an infarct, most persons are able to resume work or other activity in 12 to 16 weeks. At this point, the condition is usually stabilized. Before this time, risk of a new attack, of FIBRILLATION with sudden collapse (see: HEART ARRHYTHMIA), or of other complications is greater.

Tranquilizing drugs are sometimes given to minimize work loads on the heart caused by emotional stress. These may make the applicant drowsy, inattentive, faint, lightheaded, or dizzy. Among the disorders produced by an attack are arrhythmia (see: HEART ARRHYTHMIA), fainting (see: CARDIAC SYNCOPE), some degree of HEART FAILURE (see: HEART FAILURE) or MITRAL VALVE disorders (see: HEART STRUCTURAL DEFECTS). Probability of another infarct is difficult to assess, but is higher in individuals who have experienced more than one attack. Medical advice should be sought on this point for determining the relationship of a specific person's condition to risk in driving.

When an attack occurs, its usual symptom is intense pain. There is usually time for the victim to get out of traffic safely. There is, however, some risk that the victim will collapse rapidly from VENTRICULAR FIBRILLATION and fainting. This possibility is probably greater in individuals who have arrhythmias already (see: HEART ARRHYTHMIA), but medical advice should be sought in determining the relationship of a specific person's condition to their risk in driving.

Acute Coronary Insufficiency: (CRESCENDO ANGINA, UNSTABLE ANGINA)

This disorder is midway between angina pectoris and myocardial infarction. It appears as chest pain similar to angina but does not abate with rest or medication. It is not likely to be seen by the examiner in active form. Evaluation should be based upon the degree of cardiac damage (if any) as indicated by other conditions (arrhythmias, heart failure, fainting, etc.).

Heart Failure:

This term is discussed in a separate section (see: HEART FAILURE)

Sudden Death:

Sudden collapse and quick demise of individuals with IHD is a recognized problem. Unfortunately, amost half of the persons who die suddenly from cardiac arrest associated wit IHD were previously unaware of their disease. This fact does much to limit the possible effectiveness of any license screening program. Furthermore, sudden death at the wheel has been identified as a causing factor in only a very small percentage of accidents.

Some important risk increasing factors in persons with known heart disease have been identified, however. The most important of these are arrhythmias (see: HEART ARRHYTHMIAS) of the ventricles. Presence of VENTRICULAR PREMATURE BEATS, VENTRICULAR EXTRASYSTOLES, or VENTRICULAR TACHYCARDIA has been reported to increase risk of sudden death from seven to ten times. Presence of BUNDLE BRANCH BLOCK (see: HEART ARRHYTHMIAS), VENTRICULAR ENLARGEMENT (see: HEART FAILURE), or a history of healed myocardial infarction (see: above) also increase risk of sudden death. The location and severity of the above abnormalities make a significant difference to risk levels. Medical advice should be sought for determining the relationship of a specific person's condition to their risk in driving.

Risk Increasing Factors:

1. Presence of uncontrolled hypertension or other diffuse vascular disease (see: PERIPHERAL VASCULAR DISORDERS).

2. Presence of arrhythmias, especially history of ventricular tachycardia or bundle branch block. Possibility of sudden collapse and death is especially increased.

3. Presence of the first two factors together further increases risk.

4. Cigarette smoking increases risk significantly. Risk is not increased if applicant no longer smokes.

5. Need to drive in heavy traffic, especially in nervous, easily excitable persons who experience symptoms of AP with mild emotional upset. Also, exposure to heavy concentrations of exhaust smoke may produce problems.

6. Presence of symptoms of CHRONIC HEART FAILURE (see: HEART FAILURE).

7. Presence of breathlessness, lightheadedness or angina pain at rest. The risk is higher in persons who have these symptoms in spite of medication than in persons who have them and are not receiving medication.

8. History of one or more myocardial infarctions may increase risk. Medical advice should be sought for determining risk levels.

9. Presence of diabetes (see: DIABETES). Medical advice should be obtained because there are several different types of this disorder.

10. Pain, breathlessness or lightheadedness following moderate exercise increases risk. In general, the less exercise it takes to produce symptoms, the greater the risk. Symptoms produced by jogging or climbing several flights of stairs but not produced by light exercise such as walking or daily activity indicate small risk increase. Symptoms produced by walking a few feet indicate a more advanced condition. Note: The examiner should not attempt to induce symptoms by exercising the applicant (see: HEART FAILURE).

11. Mental confusion resulting from inadequate blood supply to the brain from any of several causes is often seen in IHD. This increases risk.

12. Adverse side effects from medication such as dizziness, visual disturbances or severe headache may increase risk. However, persons with angina pectoris may take brief-acting medication to prevent or control pain. This medication may be needed in doses that produce risk-increasing side effects only rarely. Medical advice should be obtained in doubtful cases, as dizziness sometimes is a problem.

Risk Moderating Factors:

1. Absence of hypertension, or its control by medication.

2. Risk is decreased if the applicant does not currently smoke cigarettes.

3. Risk is decreased if the applicant does not drive in heavy traffic.

4. Absence of pain, lightheadedness or breathlessness after moderate exercise (such as climbing several flights of stairs). Note: The examiner should not attempt to exercise the applicant.

5. Absence of arrhythmias (see: HEART ARRHYTHMIAS).

6. Regular medical supervision, and close adherence to prescribed dietary, exercise, medication, alcohol consumption, and other requirements.

Questions for the Applicant:

1. Is the applicant under a physician's care for his condition? If so, how often does he see his physician?

2. How long has he had this condition?

3. Is his condition stable, getting better, or getting worse? (Have respondent explain)

4. Is the applicant taking medication for his condition? If so, how does it affect him?

5. Does his medication control the condition?

6. How much does the applicant drive, and what kind of driving does he do? (Only if the applicant is being re-licensed)

7. Has his medical condition ever been a factor in an accident or close call? If so, what happened?

8. Does he have any additional conditions? (If so, refer to the appropriate sections within this manual)

9. Does the applicant ever have attacks of pain, breathlessness of faintness? How often?

10. Does he have attacks after climbing several flights of stairs? One flight? While walking? While sitting at rest?

11. When did the applicant last have an attack?

12. Does the applicant smoke cigarettes?

13. Does he have high blood pressure?

14. Has the applicant ever had a heart attack? How long ago? Has he had more than one attack?

15. Does the applicant's medication (if applicable) ever make him dizzy, lightheaded or faint? Does it give him headaches? Does it bother his vision? Does it ever make him feel nervous or drowsy?

16. Does the applicant have diabetes? Does he have peripheral circulatory problems?

17. Is the applicant on a special diet? Does he follow it closely?

Behavioral Observations:

The examiner should be aware of symptoms of pain, breathlessness, or lightheadedness appearing during the course of the examination. Of all the symptoms related to IHD, angina pectoris is the most likely to occur in the examiner's presence. Appearance of symptoms while interviewing the applicant may be a reaction to stress of the interview. Appearance of symptoms while walking to the motor vehicle or during the road test generally indicates a fairly severe condition. The applicant may be observed to take medications during the examination. This may be a response to symptoms, or it may be a preventive measure on the applicant's part. The examiner should find out whether symptoms are actually present and, if so, whether the medication produces relief. Evidence of mental confusion is sometimes present. If it appears, it should be given close attention. It may be helpful to question the applicant about his recent activities to determine that this is not just a result of stress from the licensing procedure.

If the applicant appears to be having an attack, collapses, or complains of severe pain at any time, medical help should be summoned immediately.

CEREBRAL PALSY

CEREBRAL PALSY is a term used to describe a group of conditions caused by injury to the developing brain before birth, or during the first three years of life. The disorder is not progressive, but the injury may retard normal development, disrupt learning, and be the cause of sudden loss of consciousness or seizures. In all forms of cerebral palsy, brain damage impairs movement reflexes or motor control in at least one part of the body. The person's intelligence can be normal, but some mental deficiency or retardation is common. Speech is often strained and difficult to understand due to impairment of coordination in the facial muscles.

Three subdivisions of the condition have been identified, based upon the person's physical performance characteristics. SPASTIC CEREBRAL PALSY (LITTLE'S DISEASE) is the most common form. Persons with this disorder move stiffly, and may have asymmetrical (tilted to one side) posture. In this form of the disease, the legs are most clearly affected. The use of the hands may be normal, but upper limb complications are common.

The ATHETOID form is characterized by the individual's inability to hold groups of muscles in one position. These persons are constantly in a writhing or jerking motion. In some cases, the arms and legs may suddenly fly out from the body. It is not uncommon in athetoid cerebral palsy to find impaired hearing and high levels of anxiety which may lead to emotional instability.

The last form, ATAXIC CEREBRAL PALSY, is comparatively rare, but the individual can often learn to compensate for some motor impairments. There will usually be leg coordination problems, as well as difficulty in performing rapid, repetitive arm and hand movements.

Risk Increasing Factors:

The following symptoms may impact safe driving, but are not found in all persons afflicted with cerebral palsy. The degree of impairment usually remains stable unless other medical complications intervene.

1. Presence of muscular dysfunctions, including weakness with inability to control movement of the body (especially the head, arms, and legs), or sudden, uncontrolled movements of the arms or legs (athetoid form).

2. Presence of visual dysfunctions such as blind areas in the visual field (SCOTOMA), eye muscle weakness, or other visual perception deficits.

3. Presence of hearing dysfunctions, especially in those individuals with athetoid cerebral palsy (see: HEARING DYSFUNCTION).

4. Appearance of intellectual impairment or retardation (see: MENTAL RETARDATION). This may include subnormal reasoning power, contributing to easy distractability or short attention span and poor judgment, difficulty in learning new concepts, or difficulty in interpretation of signs (numbers, letters, symbols) or sounds, or possible seizures (see: EPILEPSY).

5. Presence of emotional instability in the form of sudden changes in mood produced by anxiety over inability to control muscular movement. These changes in mood are especially noticeable in the athetoid form.

6. Appearance of adverse reactions to the medications used to control seizures (when present), including drowsiness, lightheadedness or dizziness, or a general slowing of reaction time.

Risk Moderating Factors:

1. Successful completion by the applicant of a special driver training program.

2. In those cases where the person has been subject to seizures, risk decreases with longer periods of seizure-free time.

3. Use of adaptive controls to compensate for impaired function of one or more limbs.

4. Emotional stability, and a cautions, responsible attitude on the part of the applicant.

Questions for the Applicant:

1. Is the applicant under a physician's care for his condition? If so how often does he see his physician?

2. How long has he had this condition?

3. Is his condition stable, getting better, or getting worse? (Have respondent explain)

4. Is the applicant taking medication for his condition? If so, how does it affect him?

5. Does his medication control the condition?

6. How much does the applicant drive, and what kind of driving does he do? (Only if the applicant is being re-licensed)

7. Has his medical condition ever been a factor in an accident or close call? If so, what happened?

8. Does he have any additional conditions? (If so, refer to the appropriate sections within this manual)

9. Which form of cerebral palsy does the applicant have?

10. Does the applicant ever have seizures? If so, how often? When did the last seizure occur?

11. Has the applicant's hearing been affected by his condition?

12. Has the applicant completed a special driver education course?

13. Does the applicant use special adaptive controls in his vehicle? If so, ask him to explain.

Behavioral Observations:

Before going on the road, the examiner should check to see if the applicant is able to reach and use all of the required standard or adapted controls in his vehicle without looking. He should also observe whether the applicant can coordinate the quick movement of one foot from the accelerator pedal to the brake and back again several times without missing, or sliding off, either control. The examiner should determine that the applicant can maintain a good grip on the steering wheel, and that he has the strength to turn the steering wheel through its full range of movement. On the road, the examiner should check to make sure the applicant can perform rapid, repetitive motions (e.g., hand over hand steering) competently.

Completeness of the applicant's visual field may be checked by asking him to look straight ahead and, without moving his eyes or head, name objects which appear across the full field of vision. Perceptual difficulties may appear in the form of failing to maintain the appropriate distance between cars, weaving back and forth across lanes, consistently misjudging stopping distances, taking too long to pass, or failing to show adequate attention to possible traffic hazards (especially cars approaching from the rear on either side). The applicant's in-car attitude should be observed to determine that neither the medication, nor any brain dysfunction may be causing an emotional state which could cause an additional traffic risk.

DIABETES MELLITUS

DIABETES MELLITUS is a term used to describe a number of related medical conditions which affect the human body's ability to produce appropriate levels of INSULIN. Insulin, in turn, plays the major role in regulation of blood sugar levels. Blood sugar is the brain's chief nutrient, and it is highly sensitive to even minor fluctuation in sugar concentration. HYPOGLYCEMIA occurs when too little blood sugar is available to the brain. In this situation, the person may become very nervous, disoriented, or confused, and perhaps will not notice the early symptoms. When the blood sugar remains too low, hypoglycemia may lead to unconsciousness. When the level of blood sugar is too high, HYPERGLYCEMIA results. This situation (too much blood sugar) also may lead to unconsciousness or coma, but is less critical to safe driving since the condition develops over a longer period of time with sufficient forewarning.

In the United States, it is estimated that there are 4 million diabetics. The majority of these persons developed overt diabetes after the age of 45. In many of these cases, the disease progresses slowly, and control of the insulin/blood sugar balance is not too difficult. This balance can often be successfully maintained through dietary control. In more severe cases, oral medication or periodic injections of insulin are required.

In cases where the diabetes has been diagnosed during childhood or adolescence (EARLY ONSET DIABETES), the control of blood glucose level is much more difficult. Such cases are often described as "brittle." Persons with this condition must use some form of insulin in addition to dietary control. Whenever insulin is used, there is some danger of an insulin reaction (INSULIN SHOCK). In this situation, a temporary surplus of insulin in the system causes a large amount of blood sugar to be available to the brain, followed by a drastic drop in sugar level. The result is a hypoglycemic reaction with corresponding behavior changes, including nervousness, disorientation, confusion, or rapid loss of consciousness.

Diabetes alone can cause an increased traffic safety risk. However, diabetes also affects other body organs which, in concert, may further raise a person's traffic accident risk profile. Changes in the vascular or circulatory system are most important (see: PERIPHERAL VASCULAR DISORDERS). Diabetes in all ages is associated with accelerated ATHEROSCLEROSIS, or thickening (hardening) of the arteries. This arterial degeneration is the most frequent cause of death in the United States. Hardening of the arteries alone

can cause a decreased supply of blood to the brain and heart, and produce faintness or loss of consciousness as well as severe chest pains and liability to heart attack or stroke (see: ISCHEMIC HEART DISEASE, STROKE).

The longer a person has had diabetes, the more likely it is that the eyes will have been affected. Up to one-sixth of all acquired blindness is due to DIABETIC RETINOPATHY. This can cause temporary or permanent blindness in one or both eyes. The longer a person has had diabetes, the more likely it is that some degree of retinal damage will have occurred. In addition to this, the prolonged, higher concentration of glucose in the eye eventually causes blurring of vision, weakness in accommodation to changes in illumination, impaired ability to focus, and MYOPIA (nearsightedness).

Risk Increasing Factors:

1. Uncontrolled diabetes greatly increases risk in driving.
2. Occurrence of hypoglycemic attacks despite treatment with insulin.
3. It may be especially difficult to control hypoglycemia in the young driver whose day-to-day diet and activity patterns may vary.
4. Any smoking, or alcoholic beverage intake, or obesity (overweight) will complicate insulin/blood sugar balance and increase risk.
5. Presence of ISCHEMIC HEART DISEASE, especially if the applicant has a history of one or more heart attacks, or has diffuse circulatory disease (see: ISCHEMIC HEART DISEASE, PERIPHERAL VASCULAR DISORDERS).
6. Presence of serious visual problems.
7. History of one or more strokes.

Risk Moderating Factors:

1. In general, the diet-controlled diabetic probably does not present an increased traffic risk.

2. The awareness of the disease, and of its symptoms, may in itself be a positive traffic safety factor.

3. Absence of a history of altered consciousness within the past year.

Questions for the Applicant:

1. Is the applicant under a physician's care for his condition? If so, how often does he see his physician?

2. How long has he had this condition?

3. Is his condition stable, getting better, or getting worse? (Have respondent explain)

4. Is the applicant taking medication for his condition? If so, how does it affect him?

5. Does his medication control the condition?

6. How much does the applicant drive, and what kind of driving does he do? (Only if the applicant is being re-licensed)

7. Has his medical condition ever been a factor in an accident or close call? If so, what happened?

8. Does he have any additional conditions? (If so, refer to the approprate sections within this manual)

9. How old was the applicant when his diabetes was first diagnosed?

10. Does he use insulin to control his diabetes?

11. Is the applicant overweight? By how much?

12. Does the applicant smoke? How much?

13. How often (if at all) does the applicant drink alcoholic beverages?

14. Does the applicant ever feel lightheaded or dizzy, or lose consciousness as a result of his diabetes? When was the last time?

15. Does the applicant normally carry some sugar or candy in case he has an insulin or hypoglycemic attack?

16. Has the applicant ever had a stroke? Has he ever had a heart attack or other cardiovascular disease?

Behavioral Observations:

The in-car performance test is capable of producing high anxiety, and possibly a mild or full hypoglycemic attack. In the case of the older driver who has a long history of diabetes, the examiner should be particularly mindful of any circulatory or visual impairment.

Check to see if the applicant becomes disoriented or confused in driving situations, or becomes easily fatigued, or shows any chest pain as a result of handling the automobile in traffic. The examiner should also observe whether the applicant shows any difficulty in focusing his eyes (squinting), or in dealing with glare, or if he has difficulty in perceiving normal traffic hazards (especially those at greater distances).

EMOTIONAL (MENTAL) DISORDERS

AFFECTIVE DISORDERS
ANTISOCIAL PERSONALITY DISORDERS
ANXIETY NEUROSIS
CATATONIC SCHIZOPHRENIA
CYCLOTHYMIC PERSONALITY DISORDER
DEPRESSIVE NEUROSIS
HEBEPHRENIC SCHIZOPHRENIA
HYPOCHONDRIACAL NEUROSIS
HYSTERICAL NEUROSIS
INVOLUTIONAL MELANCHOLIA
MANIC-DEPRESSIVE ILLNESS
NEUROSIS
OBSESSIVE COMPULSIVE NEUROSIS
OBSESSIVE COMPULSIVE PERSONALITY DISORDER
PARANOIA
PARANOID PERSONALITY DISORDER
PARANOID SCHIZOPHRENIA
PHOBIC NEUROSIS
PSYCHOPHYSIOLOGIC DISORDERS
PSYCHOSIS
SCHIZOID PERSONALITY DISORDER
SCHIZOPHRENIA
SENILE DEMENTIA
SEXUAL DEVIATION

The list of conditions above are presented as examples of the major types of emotional disorders that the examiner might encounter. As such, these conditions describe disorders of various levels of severity, with a full range of effects upon driving capability. Some of the disorders listed are relatively minor, and others are more severe. Some individuals with emotional disorders can drive as safely and competently as a normal driver. Other individuals can cause a great risk if they are allowed to drive. Some emotional disorders have obvious effects upon the individual's personality, and such people may exhibit bizarre behavior. Other disorders are more subtle, and people with these conditions can, at times, appear perfectly normal. The relationship between abnormal behavior and driving is complex, and general rules about this relationship are difficult to establish. Emotional disorders can often be treated, and can sometimes be controlled or cured. Medication is often used as part of the treatment and, depending on the medication and dosage levels, can sometimes

adversely affect driving performance. In general, if an applicant has a history of emotional disorders, and has not yet been restored to normal status, professional advice should be sought to determine the relationship between the individual's condition and his risk levels in driving.

If an applicant, because of a mental disorder, is presently residing in an institution or hospital, this would indicate that his condition has not been cured. Depending upon the specific condition of the individual, and upon the course of his treatment, he is probably a high-risk driver. Halfway houses and out-patient clinics represent a transition from, or an alternative to, complete institutionalization for some people. These individuals live part-time at the institution, or only come in for treatment. They, too, have not been completely cured, but generally are suffering from a less severe form of emotional disorder. They are more likely to be able to drive safely than are those who are institutionalized on a full-time basis. Professional advice should also be sought in determining their risk levels in driving, however.

Risk Increasing Factors:

1. Current, full-time institutionalization indicates an active, relatively severe condition. In general, the longer the history of institutionalization, the more severe the condition is likely to be.

2. Medication or other treatment (surgery or ELECTROCONVULSIVE THERAPY) which creates severe mental confusion or disorientation, drowsiness, nervousness, irritability, dizziness, faintness, muscular weakness, or impairment of muscular control.

3. Current inclination by the applicant (in the opinion of a professional therapist) to use a motor vehicle to commit suicide and/or homicide, especially when there is also a past history of such an inclination.

4. Emotional disorders combined with continuing high levels of stress in the applicant's personal life (e.g., problems in his work or in his family situation).

5. Lack of treatment for the condition when such treatment is required.

6. Mental disorders that involve problems with muscle coordination or other motor difficulties (e.g., paralysis of the legs), or disorders that produce perceptual impairments.

7. Presence of emotional disorders that have produced antisocial, aggressive, impulsive behavior in an applicant who has not been pronounced cured.

Risk Moderating Factors:

1. In general, the milder the condition, the lower driving risk level.

2. Disorders that have been relatively well controlled by active treatment or therapy.

3. Medication or other treatment that does not create severe mental confusion, disorientation, nervousness, irritability, dizziness, faintness, muscular weakness, or problems in muscle control.

4. Absence (in the opinion of a professional therapist) of tendencies to use a vehicle to commit suicide or homicide.

5. Absence of disorders that produce muscle control or coordination difficulties, or that create perceptual difficulties.

6. Absence of disorders that cause the applicant to be antisocial, abnormally aggressive, or impulsive.

Questions for the Applicant:

1. Is the applicant under a professional's care for his condition? If so, how often does he see his therapist?

2. How long has he had this condition?

3. Does he take medication for this condition?

4. How much does the applicant drive, and what kind of driving does he do?

5. Does he have any additional medical conditions? (If so, refer to the appropriate section within this manual)

Questions for the Therapist:

1. Is the applicant under your professional care for this condition? If so, how often do you see the applicant?

2. How long has he had this condition?

3. Does he take medication for this condition?

4. How much does the applicant drive, and what kind of driving does he do?

5. Is the applicant taking medication for his condition? If so, how does it affect him?

6. Does his medication control the condition?

7. Does he now have (or does he have a past history of) suicidal or homicidal tendencies while using a motor vehicle?

8. Is his emotional disorder characterized by antisocial, aggressive, or impulsive manifestations which have produced, or might well produce, unsafe driving behavior?

9. Are there any other factors which might affect his driving safety?

Behavioral Observations:

Even though an applicant does not exhibit "strange" behavior during license testing, this does not necessarily mean that he does not have an emotional disorder. On the other hand, evidence of strange or bizarre behavior does not necessarily mean that his driving is unsafe. If his behavior is bizarre, he should be referred for professional advice. The examiner should be alert for signs of dizziness, faintness, mental confusion or disorientation, muscular weakness, or other difficulty. During the in-car performance testing, the examiner should check for normal concentration on driving. The examiner should also check for exaggerated aggressiveness, irresponsibility, and impulsiveness while driving in traffic.

EPILEPSY

GRAND MAL EPILEPSY
PETIT MAL EPILEPSY
FOCAL or PARTIAL (JACKSONIAN) SEIZURES
PSYCHOMOTOR EPILEPSY

Epilepsy in General:

The actual number of Americans who have EPILEPSY is unknown. As many as one to four million people may have some form of the disease. In many instances, the epileptic suffers only very mild effects, and the disease is not diagnosed by a physician. Epilepsy is a disease which affects the brain and causes SEIZURES or "fits." Epilepsy may cause sudden loss of consciousness, muscular convulsions or spasms, or it may cause only a slight, temporary change in a person's conscious awareness. Uncontrolled, severe epilepsy can be unpredictable and incapacitating. A person who has a serious, uncontrollable case is certainly a very high risk driver. He could lose control of his vehicle at almost any time by falling into unconsciousness, or through gross, uncontrolled muscle spasms, or both. On the other hand, an individual with a medical history of a minor, controlled case of epilepsy is probably not a high risk driver.

Epilepsy is sometimes controlled by certain medications which, if they are taken regularly, can often prevent the occurrence of seizures. The medication itself can sometimes cause drowsiness, confusion, dizziness or faintness, or irritability. Occurrence of adverse side effects is determined by type of medication, dosage level and scheduling, and individual susceptibility to the medication's effects. There are several types of epilepsy, each with its own characteristic form and severity of seizures. The most common types are GRAND MAL EPILEPSY, PETIT MAL EPILEPSY, PSYCHOMOTOR EPILEPSY, and FOCAL or PARTIAL (JACKSONIAN) SEIZURES. One individual may have more than one type of seizure. Each of these types is described below.

Grand Mal Epilepsy:

Generalized, or grand mal, seizures are usually characterized by loss of consciousness and initial rigidity of the body, followed by large-scale, jerking movements. After some minutes, the body spasms subside and

consciousness gradually returns. The attack may be followed by general mental confusion and fatigue, plus, at times, paralysis in some limbs. It is not unusual for the onset of symptoms to be preceded by an "aura." The aura may take the form of unusual mental sensations, including hallucinations, or may be felt as strange bodily sensations. The aura can provide the individual with a forewarning of an impending attack. Grand mal seizures vary in intensity and in frequency of occurrence from individual to individual, and attacks may vary in frequency from several per day to once per year or less. In addition, some individuals experience attacks only at night. According to some estimates, as many as one fifth of all individuals with grand mal epilepsy have this freedom from seizures during daylight hours.

Petit Mal Epilepsy:

This form of epilepsy is quite rare for drivers over the age of thirty. It first appears in childhood, and sometimes disappears after puberty. The condition appears as a brief loss of conscious awareness lasting for 5 to 10 seconds. Loss of consciousness can sometimes last for up to 30 seconds. The seizure begins suddenly, and the victim exhibits a blank stare and total immobility. The attack ends as suddenly as it begins. The victim may sometimes not be aware that he has had an attack. The number of seizures varies widely from a few seizures over a period of several days to over one hundred in a single day.

Focal or Partial (Jacksonian) Seizures:

Focal or partial seizures begin with uncontrolled muscular movement in one part of the body. This may appear as a twitching in the corner of the mouth, with associated speech difficulties, or it may involve large, uncontrollable movements of an arm or leg. There is usually some disturbance in the person's awareness, but he will usually not lose consciousness unless the uncontrolled muscle movement spreads to additional muscles. When the uncontrollable movements spread, or "march," to additional areas of the body, this process is called JACKSONIAN MARCH. If the entire body becomes involved in the march and consciousness is lost, then the seizure is essentially a grand mal attack. The individual may have focal seizures alone, or in alternation with grand mal attacks, or preceding grand mal attacks.

Psychomotor Epilepsy:

Psychomotor epilepsy is characterized by attacks that are in some ways similar to petit mal. It is more closely related to focal (Jacksonian) seizures, however. The individual will not remain motionless, but will continue to perform

automatic, purposeless movements. Psychomotor attacks may occur at any age, and are frequently seen in alternation with, or preceding, grand mal or focal seizures. Psychomotor epilepsy is frequently associated with structural brain damage, and is also less likely to be controllable by medication than are most other forms of epilepsy.

Risk Increasing Factors:

1. Risk increases with higher frequency of seizures.
2. Absence of a warning "aura" which might allow the driver to park his vehicle safely.
3. Seizures that may occur at any time.
4. Paralysis that persists after a seizure has passed.
5. For petit mal, risk increases with seizures of longer duration.
6. For focal seizures, involvement of parts of the body used in driving (e.g., arms, legs).
7. Presence of Jacksonian march in focal seizures, or focal seizures that affect conscious awareness.
8. Adverse effects of medication, including: drowsiness, faintness or dizziness, confusion, or irritability.

Risk Moderating Factors:

1. Risk decreases with longer periods of seizure-free time.
2. Control of seizures by medication, provided that such medication does not produce serious adverse effects.
3. Limitation of seizures to focal involvement of areas that do not affect driving (e.g., a mouth twitch), that do not march to other areas of the body, and that do not alter consciousness.

4. Seizures that are always preceded by an "aura," provided that the aura itself is not debilitating, and provided that the aura allows sufficient time for the driver to park his vehicle safely.

5. Seizures that only occur at night, allowing a restriction to daytime driving.

Questions for the Applicant:

1. Is the applicant under a physician's care for his condition? If so, how often does he see his physician?

2. How long has he had this condition?

3. Is his condition stable, getting better, or getting worse? (Have respondent explain)

4. Is the applicant taking medication for his condition? If so, how does it affect him?

5. Does his medication control the condition?

6. How much does the applicant drive, and what kind of driving does he do?, (Only if the applicant is being re-licensed)

7. Has his medical condition ever been a factor in an accident or close call? If so, what happened?

8. Does he have any additional conditions? (If so, refer to the appropriate sections within this manual)

9. How frequent are the applicant's seizures? When was the last occurrence?

10. Are seizures limited to nighttime?

11. Does the applicant have a warning "aura" before a seizure occurs? How often? What are they like? How long before the seizure occurs does the aura appear?

12. How long do the seizures last?

13. Does the applicant ever lose consciousness during a seizure? How often?

14. Does the applicant lose awareness of his surroundings during seizures? How often?

15. If the applicant has only focal seizures, what muscles are affected?

16. Does the applicant's medication ever make him drowsy, faint or dizzy, confused, or irritable?

Behavioral Observations:

Absence during testing of the types of seizures described above does not necessarily indicate that the applicant's condition is under control. However, appearance of a seizure, even a brief lapse of awareness lasting for more than a second or two, indicates a condition that is not well controlled. Seek emergency medical help if an applicant has a large seizure.

HEARING DYSFUNCTION

TINNITUS
OTOSCLEROSIS
MENIERE'S SYNDROME
CENTRAL DYSACUSIS (APHASIA)
LABYRINTHITIS
OTITIS MEDIA

The level of hearing function required for safe driving has not yet been accurately defined. On the one hand, people with degrees of hearing impairment, varying up to total deafness, may drive safely, provided they have received compensatory training or have had time to adapt to their condition. Even normal individuals driving under noisy conditions may be functioning in a situation that simulates hearing loss. Surrounding noise tends to mask audible signals. On the other hand, uncompensated hearing loss does produce a potential driving risk increase. Hearing losses that occur very early in life produce additional problems that also accentuate need for, and complicate, compensatory training.

The sensitivity of the human ear to sound is a function of both the loudness level (volume) and the frequency (pitch) composition of the sound. Loss of sensitivity, even in normal individuals, begins as early as age 16 and continues throughout life. This hearing loss is most noticeable in the higher frequency ranges. In the United States, the prevalence of significant hearing loss is high. It is estimated that at least 10 million persons are afflicted with CONGENITAL (either hereditary or as a result of PRENATAL damage) deafness. Congenital deafness accounts for about half of the childhood cases, and for about one third of the adult cases. ACQUIRED deafness (deafness occurring after birth, usually as a result of infectious disease or traumatic injury) accounts for most other cases.

There are three general classifications of hearing impairment, and these are typed according to the anatomical site (bodily location) of the disorder. The first of these are SOUND CONDUCTION disorders in which there is physical interference with conduction of sounds through the ACOUSTIC APPARATUS. Examples of this condition include blockage of the external ear canal, restricted movement of the TYMPANIC MEMBRANE (ear drum) or AUDITORY OSSICLES (small bones of the inner ear), or possibly congenital absence of these structures. A second classification is SENSORY-NEURAL TRANSMISSION DISORDERS. These can include impaired function or absence

of signal-receiving nerve endings in the ORGAN OF CORTI (or COCHLEA) or dysfunction of the nerve pathways leading through the ACOUSTIC NERVE to the brain. Lastly, there may be problems with CENTRAL NERVOUS SYSTEM (CNS, i.e., the brain and spinal cord) INTEGRATION. In such cases, the individual cannot integrate (interpret) the neural signals he receives into intelligible sounds.

More important than either the cause or the type of dysfunction is the age at which significant hearing loss is first apparent. The earlier the loss appears, the more severe are the consequent difficulties in social and intellectual development, and in many other categories of human performance, including driving. Severe hearing loss that is manifest before three years of age is particularly likely to be severely damaging.

TINNITUS or "ringing in the ears" is a condition affecting most persons to a limited degree. In more severe cases, the ringing is pronounced, and therefore masks sounds that could otherwise be heard. This exaggerated ringing usually comes and goes unpredictably. It commonly occurs after exposure to loud noise, however.

OTOSCLEROSIS is a common sound conduction impairment affecting the small bones of the middle ear (the auditory ossicles). Otosclerosis progressively limits the movement of these bones and, in turn, dampens the sound vibrations that they transmit. Hearing loss due to this condition may be noticed as early as adolescence. Over the course of this condition, which may run for 30 years or more, increasingly louder sounds are required to overcome the ossicles' resistance to movement. As long as the hearing loss is only conductive in nature, a hearing aid can restore hearing function to near-normal levels.

MENIERE'S SYNDROME is a condition that affects both the hearing and balance (VESTIBULAR REFLEX) functions of the ear. This disease most often affects people in their fifties, although other age groups may be attacked as well. Its symptoms most often include: intermittent hearing loss (usually worsening with residual impairment after each attack), a "ringing" or roaring in the ears (tinnitus), nausea, attacks of sensations of rotating or to-and-fro movement (PAROXYSMAL VERTIGO), and occasional loss of consciousness. The condition usually has attacks that begin suddenly and last for a short time, although attacks may last for several days. The period between attacks ranges from several years to a day or so. Medication may be valuable in preventing or limiting the severity of attacks. Surgical treatment may also be used to cure the vertigo aspects of the disease, although this procedure may leave the applicant without a sense of balance if it is performed on both ears. A single,

massive dose of an agent that destroys the organ of balance (LABYRINTH), and leaves hearing ability at whatever level existed before treatment, is often performed instead of surgery. If Meniere's syndrome is present in active form, a great driving risk increase is produced. Medical advice should be sought to determine the relationship between the applicant's condition and his risk level in driving. If the disorder has been treated, and difficulties with balance remain, the examiner should also obtain medical advice.

LABYRINTHITIS and OTITIS MEDIA are descriptive terms indicating, respectively, inflammation of the structures of the inner ear and of the middle ear. Otitis media is most often caused by an infectious organism, and may, therefore, spread to affect the organs of balance or other structures. Medical advice should be sought to determine the relationship between active otitis media in an individual applicant and risk levels in driving. Labyrinthitis refers to inflammation of the organs of balance in the inner ear. Its causes may range from ALLERGY to LEUKEMIA. Therefore, its course and severity vary widely. Medical advice should be sought to determine the relationship between the applicant's condition and his risk levels in driving.

CENTRAL DYSACUSIS (PARTIAL or TOTAL APHASIA) is a term used to describe a difficulty in understanding complex sound patterns. With this condition, there is little measurable damage to the ear itself, and simple sounds are detected normally. It is the individual's slow perception, confusion in attempting to integrate audible signals, and poor general understanding that leads specialists to conclude that the difficulty is seated in the brain. CEREBRAL ARTERIOSCLEROSIS that affects those portions of the brain that are concerned with processing of sounds (see: PERIPHERAL VASCULAR DISEASE) is probably the most common cause of central dysacusis. STROKE (see: STROKE) and traumatic injury to the head may cause similar problems.

Risk Increasing Factors:

1. Persons suffering from Meniere's syndrome who have attacks of vertigo or fainting present a high risk situation. The more frequent the attacks, the greater is the risk for driving.

2. Apparent intellectual impairment as demonstrated by slowness in thinking (inattention or distractibility), or problems in comprehension of spoken or written language (central dysacusis, aphasia).

3. Marked emotional stress or frustration caused by reduced or confused auditory perceptions.

4. Distractibility, drowsiness, or slow reactions caused by medications used to treat vertigo of Meniere's syndrome or labyrinthitis.

Risk Moderating Factors:

1. Totally deaf drivers can usually compensate for their hearing loss and drive safely. This is particularly true if they have participated in a special driver training program.

Questions for the Applicant:

1. Is the applicant under a physician's care for his condition? If so, how often does he see his physician?

2. How long has he had this condition?

3. Is his condition stable, getting better, or getting worse? (Have respondent explain)

4. Is the applicant taking medication for his condition? If so, how does it affect him?

5. Does his medication control the condition?

6. How much does the applicant drive, and what kind of driving does he do? (Only if the applicant is being re-licensed)

7. Has his medical condition ever been a factor in an accident or close call? If so, what happened?

8. Does he have any additional conditions? (If so, refer to the appropriate sections within this manual)

9. At what age did he first notice hearing loss?

10. Has the applicant's condition been intermittent? Has it been stable or progressive?

11. (If intermittent) What are the attacks like? How frequently does he have them? When was the last time?

12. (If the condition is progressive) How has the applicant's hearing changed during the past year?

13. Does the applicant have ringing in the ears (tinnitus)? Is it loud enough to interfere with his understanding of speech?

14. Does the applicant ever have attacks of dizziness or a "spinning" sensation? If so, how quickly does the attack come on? Has he ever fallen down or lost consciousness during an attack?

Behavioral Observations:

The examiner should be alert for evidence of confused thinking or impairment of consciousness. However, the examiner should bear in mind that communication with hearing-impaired persons may present difficulties. He should, therefore, speak slowly and enunciate clearly. Examination of totally deaf persons may best be performed by personnel who have been trained in special communications techniques.

During in-car performance testing, the examiner should:

1. Check to see that the applicant pays adequate attention to possible traffic hazards.

2. Check to make sure that the applicant maintains a responsible attitude, and does not become confused or markedly frustrated, especially in heavy traffic situations.

HEMOPHILIA

HEMOPHILIA is a term used to describe several hereditary disorders affecting blood clotting or coagulation. The most dramatic symptom is life-threatening hemorrhaging that may follow even minor traumatic injury. Far more common, however, is a chronic, internal hemorrhaging into the bone joints (HEMARTHROSIS). Hemarthrosis leads to swelling around the joint which produces muscle spasms, limitation of motion in the joint, and pain. The knee, elbow and ankle areas are most often involved, although other joints can be affected. The joint may regain normal functioning following early episodes of hemarthrosis, but repeated attacks cause permanent joint stiffening, and eventual crippling. Severe pain is often present, and may be distracting. Control of such may require use of medications that can cause drowsiness, inattention, mental confusion or mood changes.

Most people are not able to receive HUMAN CLOTTING FACTOR which could control the disease. Therefore, most persons with hemophilia are urged to avoid activities which may expose them to the hazard of injury. Depending upon the level of clotting factor deficiency involved in the individual's case, it may be necessary to avoid even minor bumps. This avoidance of activity can produce frustration and anxiety which may lead to psychological difficulties.

There is a wide range of severity in the bleeding disorders displayed by persons with hemophilia. Some individuals may be so little affected that they can live virtually normal lives. In the worst case, a person can die from a very minor injury, or be severely physically and emotionally crippled.

Risk Increasing Factors:

1. Limited range of motion in one or more joints sufficient to affect observed driving performance adversely.

2. Severe pain of hemarthrosis, or control of such pain by medications that produce drowsiness, inattention, mental confusion, or adverse mood changes (such as inappropriate euphoria).

3. Evidence of severe frustration or emotional instability sufficient to cause a traffic safety hazard.

Risk Moderating Factors:

1. Mild hemophilia with no evidence of limited range of motion in the extremities, or control of the disease through receipt of clotting factor.

2. Evidence of emotional stability, and a responsible attitude in the applicant.

3. Use of adaptive controls to compensate for limited range of motion (see: ORTHOPAEDIC IMPAIRMENTS).

Questions for the Applicant:

1. Is the applicant under a physician's care for his condition? If so, how often does he see his physician?

2. How long has he had this condition?

3. Is his condition stable, getting better, or getting worse? (Have respondent explain)

4. Is the applicant taking medication for his condition? If so, how does it affect him?

5. Does his medication control the condition?

6. How much does the applicant drive, and what kind of driving does he do? (Only if the applicant is being re-licensed)

7. Has his medical condition ever been a factor in an accident or close call? If so, what happened?

8. Does he have any additional conditions? (If so, refer to the appropriate sections within this manual)

9. Has the applicant ever had swollen joints (hemarthrosis) as a result of this condition?

10. How often and for how long have these joints been affected?

11. Is the applicant receiving human clotting factor treatments?

12. Does the applicant have adaptive control equipment in his vehicle? If so, ask him to explain.

Behavioral Observations:

The examiner should observe the applicant closely to gauge the extent to which the joints have been affected, or if they have been affected at all. The

examiner should greet the applicant with a firm handshake (remembering that not all people shake hands) [illegible] to see if there is any obvious limitation to range of motion in the wrist, elbow, or shoulder. He should also closely observe the applicant while he is walking, and note any marked stiffness or rigidity in the knee or ankle joints.

Before beginning the road test, the examiner should check to see if the applicant can reach and use all of the required controls. During the road test, the examiner should check whether or not the applicant has any difficulty in range of motion for affected joints during hand-over-hand turns (wrist, elbow, and shoulder), or during operation of the accelerator or brake (knee or ankle joints). If adaptive controls are used, the examiner should observe whether or not the applicant can use them skillfully and efficiently. The examiner will also want to evaluate any unusual behavior (such as an antagonistic or careless attitude) or emotional instability that may be manifest by the applicant during the road test. Adverse reactions to medication such as drowsiness, inattention, or mental confusion should also be noted.

MENTAL DEFICIENCY OR RETARDATION

MENTAL RETARDATION is a term used to destribe a great variety of different disabilities and a large number of people. Several million Americans can be considered mentally retarded. Estimates as high as 6 or 7 million affected individuals have been made. Retardation may be caused by any of several diseases, by head injuries, or it can be inherited. A person who is mentally retarded is less intelligent than the average person, but his lack of normal intelligence may or may not affect his driving ability. This is dependent upon the severity and type of retardation. A list of Questions for the Professional is included for use in obtaining additional information about the applicant's condition. It should be addressed to psychologists, psychiatrists, educators, or other personnel familiar with the individual applicant. In addition, some mentally retarded individuals have other neurological or musculoskeletal handicaps as well as lower intelligence These conditions may also affect driving. In evaluating a driver applicant with these added conditions, refer to the other appropriate sections of this manual (if musculoskeletal handicaps are present, see: ORTHOPAEDIC IMPAIRMENTS).

In general, level of intelligence is not directly related to driving ability, unless the applicant's intelligence is very low. People with IQ's below 50 (as measured by a well regarded intelligence test) rarely are able to drive safely. Unfortunately, IQ is a complex concept, and it cannot be said, for example, that a person with an IQ of 70 will always be a better driver than one who has an IQ of 60. Each person should be evaluated according to his own abilities. Successful completion of a specialized driver training program for the mentally retarded can be of major benefit in making the applicant a safer driver. An inability to write or read well (with the exception of ability to read traffic signs) does not make an applicant an unsafe driver.

Risk Increasing Factors:

1. The risk increases the lower the IQ is below 70 (on a well regarded IQ test, e.g., Wechsler Adult Intelligence Scale or Stanford-Binet).

2. Presence of additional musculoskeletal or neurological disabilities that affect driving.

3. Inability to recognize and interpret common highway signs and signals.

Risk Moderating Factors:

1. The higher the IQ above 70, generally, the lower the driving risk.

2. Absence of additional musculoskeletal or neurological handicaps.

3. Recent, successful completion of a driver training program that is extensive and especially designed for the retarded.

Questions for the Applicant:

1. Are you under a physician's care (or any professional help)? If so, how often do you see your physician?

2. Are you taking medication? If so, how does it affect you?

3. How were you taught to drive? (Ask about the extensiveness of the driver program, if he has attended one)

Questions for the Professional:

1. Is the applicant under your care for his condition?

2. How long has he had this condition?

3. Is his condition stable, getting better, or getting worse?

4. Is the applicant taking medication for his condition? If so, how does it affect him?

5. In what way is his medication helpful?

6. How much does the applicant drive, and what kind of driving does he do? (Only if the applicant is being re-licensed)

7. Has his medical condition ever been a factor in an accident or close call? If so, what happened?

8. Does the applicant have any additional musculoskeletal or neurological impairments?

9. Does the applicant have any perceptual difficulties? If so, what are they?

10. Does the applicant have emotional disorders that might affect his driving? If so, what are they?

11. Has the applicant successfully completed a special driver training program? Does he still have any particular difficulties with driving?

Behavioral Observations:

During questioning the examiner should look for obvious musculoskeletal or neurological conditions. The applicant should be observed while walking to see if his gait is abnormal. His arm movements, the way he holds his head, and his manner of writing should also be observed. If the applicant's movements are unusual, he may have additional handicaps that could affect his driving. Refer to other sections of this manual for additional information (for musculoskeletal impairments, see: ORTHOPAEDIC IMPAIRMENTS; for neurological disorders, see: MULTIPLE SCLEROSIS, CEREBRAL PALSY, or STROKE, as appropriate).

The applicant should also be observed for mobility limitations during the road test. He should be able to move the steering wheel, operate the pedals, and actuate all other control quickly. If he has difficulties, he may have additional handicaps.

Special attention should be paid to traffic situations that require judgments and decisions. Particular attention may be directed to the following:

- Proper distance behind cars ahead when moving.
- Consistent speed regulation.
- Correct judgment of road position while cornering.
- Correct and quick decisions in response to changing traffic situations.
- Correct judgment of stopping distance.
- Ability to understand traffic signs and signals.

MULTIPLE SCLEROSIS

MULTIPLE SCLEROSIS (MS) is one of the most common, long-term, degenerative diseases affecting the human nervous system. The cause of the condition has not been determined, but it is known that the disease process causes a degeneration in the nerve pathways of the CENTRAL NERVOUS SYSTEM (brain and spinal cord), causing poor or uneven neural transmission. Depending upon the particular nerve pathway affected, uneven neural transmission can cause poor MOTOR COORDINATION, impaired vision, impaired perception, or changes in emotion.

The disease strikes women slightly more often than it does men. In the United States, it is estimated that there are several hundred thousand persons suffering from multiple sclerosis. It is a disease in which 70% of all cases diagnosed are first noted in persons between the ages of 20 and 40. Generally, the fewer the symptoms noted at onset, the more likely it is that the disease will be slow in progressing.

The disease is characterized by episodes of worsening which occur from time to time over a period of 20 to 30 or more years. An actual attack usually, but not always, comes on over a period of several hours or several days. In the case of a person whose optic nerve (nerve of the eye) is affected, partial or total blindness in one eye may appear in as little as two days. The blindness, or symptoms of the nervous system attack itself, may be gone in as little as two weeks. Much longer periods are required for the improvement of the affected nerve pathway. Eventually, the cumulative effect of these attacks on the nervous system can be seen in deteriorated sensory systems. The systems affected will be those whose particular neural pathways have been damaged by the disease. Motor (coordination) impairment also accumulates progressively over the course of the disease. Weakness or paralysis of the legs is often noted, although the upper extremities may also be involved. After an attack, weakness may be minimal, but repeated attacks leave permanent, increasing weakness. Tremor and spasticity also appear in the course of the disease, and contribute to the increasing impairment of motor coordination. Advanced multiple sclerosis may require the use of adaptive control mechanisms in order to allow for safe driving. Special training in the use of these devices, and in specialized, compensatory driving techniques, may be very beneficial in control of driving risks associated with the progressive motor impairment of multiple sclerosis (see: ORTHOPAEDIC IMPAIRMENT).

There are several mental and emotional changes which may occur as a result of the effects of multiple sclerosis. Depending upon which portions of the central nervous system are affected, individuals may demonstrate either an inappropriate, general lack of concern, or a depressed, irritable attitude. A decrease in general mental capability may also occur, and may be manifest as confusion, poor memory, and disorientation. The type and amount of medication used to treat multiple sclerosis can also have an impact upon the person's mental state, and may often produce depression, nervousness, or EUPHORIA.

It is very unlikely that a person with multiple sclerosis will have a sudden, acute attack while driving. Almost all attacks will occur with sufficient warning that an individual will be able to remove himself safely from traffic or, usually, avoid driving altogether. Since multiple sclerosis is a slowly degenerative disease, with long periods of stability between worsening attacks, the individual's driving performance will usually remain stable until the next attack. Sometimes, improvement in driving performance, due to an improvement in the condition, or to increasingly skilled adaptation by the driver, may occur between attacks.

Risk Increasing Factors:

1. Permanent, residual motor impairment in those parts of the body needed in driving, unless such impairment is well compensated by adaptive equipment, special training, or both.

2. Serious visual impairment that cannot be corrected, especially double vision (DIPLOPIA) or uncontrollable, involuntary eye movements (NYSTAGMUS), or other visual-motor impairment.

3. Mental or emotional difficulties occurring as a result either of the disease, or of medication used to treat its effects.

4. A history of many attacks, especially if they occur close together, producing cumulative, major impairments for which compensation is difficult. Medical advice should be sought to determine the relationship of such individuals' conditions to their risk in driving.

5. A very recent attack that has produced a major motor impairment to which the driver has not yet successfully adapted. Such risks can be expected to lessen with time, however.

Risk Moderating Factors:

1. Successful compensation for motor impairment through adaptive control equipment, special training, or driver experience.
2. Absence of serious visual impairment.
3. Absence of serious mental or emotional impairment. Presence of an alert, appropriately cautious attitude.
4. A history of attacks that are few in number, widely spaced, or both.
5. No very recent attack, or a recent attack which has left little residual impairment.

Questions for the Applicant:

1. Is the applicant under a physician's care for his condition? If so, how often does he see his physician?
2. How long [illegible] this condition?
3. Is his condition stable, getting better, or getting worse? (Have respondent explain)
4. Is the applicant taking medication for his condition? If so, how does it affect him?
5. Does his medication control the condition?
6. How much does the applicant drive, and what kind of driving does he do? (Only if the applicant is being re-licensed)
7. Has his medical condition ever been a factor in an accident or close call? If so, what happened?
8. Does he have any additional conditions? (If so, refer to the appropriate sections within this manual)
9. If major residual motor impairment exists, does the applicant have adaptive control equipment in his vehicle? Has he had special training? Ask him to explain.

10. What was the applicant's first attack like?

11. What was his last attack like? When did it occur? How long did it take in coming on?

12. How many attacks has the applicant had all together?

Behavioral Observations:

In the car, the examiner should pay special attention to those sensory or motor areas the applicant has described as having been affected in his most recent attack. He should determine whether the applicant has experienced any residual difficulties in these areas and, if so, how well he has been able to compensate for them. The examiner should check to see whether or not the applicant has sufficient leg and/or upper body strength and coordination to safely maneuver the vehicle. If adaptive controls are present, check to see that the applicant is able to use them skillfully and effectively. The examiner should be alert for any visual problems.

The examiner should also watch the applicant's behavior and in-car attitude to make sure that neither the medication, nor any effect of the disease, is producing a mental or emotional state that could cause an additional driving risk.

MYASTHENIA GRAVIS

MYASTHENIA GRAVIS is a condition that produces temporary but recurring attacks of extreme muscular weakness. These attacks may affect most parts of the body, but are particularly likely to involve the muscles of the head and neck. Although during an acute attack the weakness is markedly worse, some degree of muscle weakness is constantly present. In severe cases, there is often continuing weakness of the arms, shoulders and chest muscles. Chest and abdominal muscular weakness may progress to partial respiratory paralysis. This condition may produce a condition of low blood oxygen (O_2) or high blood carbon dioxide (CO_2) content with mental confusion, headaches, insomnia and irritability (see: RESPIRATORY DISEASES). Myasthenia gravis has a highly variable rate of progression. Some cases remain at the same level of severity for 10 years or more, and other cases end in death or total invalid status within the first year. Some degree of REMISSION (disappearance of symptoms) occurs in about half of all cases, and remission is complete in about 25% of all those diagnosed.

Medication may be used for partial control of symptoms. Total reversal of muscular weakness is very seldom achieved, but very worthwhile improvements, from the standpoint of driving risks, can usually be achieved in cases that are not severe. The development of an attack is gradual, and the driver with myasthenia gravis will be able to get out of traffic and park his vehicle safely before the attack becomes severe.

Virtually all cases of myasthenia gravis result in visual problems at some time. The most common of these are DIPLOPIA (double vision), and inability to keep the eyelids from drooping and covering the visual field (PTOSIS). Uncorrected, these symptoms produce large driving risk increases. Weakness of the neck muscles will result in inability to hold the head erect. This can be partially compensated by use of a neck brace. However, inability to turn the neck may still require modifications to the vehicle's mirror system.

The severity of myasthenia gravis symptoms varies from day-to-day, and on a "bad" day, driving may not be advisable. Symptoms are also frequently more severe at the end of the day. If the applicant has the option of not driving at such times, overall risk increase is minimized.

Myasthenia gravis is also sometimes seen in connection with diseases of the thyroid gland. When this occurs, separate evaluation of the thyroid disorder is necessary, and medical advice should be sought to determine the

relationship of the applicant's condition to risk levels in driving if the thyroid disorder is not well controlled (see: THYROID DISEASES).

Risk Increasing Factors:

1. Visual disturbances (diplopia or ptosis) that are not controlled by medication.

2. Paralysis of the neck muscles, unless the applicant is able to compensate for this impairment through the use of a neck brace and modified mirror system.

3. Respiratory function impairment.

4. Weakness in the arm, chest, and shoulder muscles, or in the legs, sufficient to cause an inability to effectively control the vehicle. Adaptive equipment may sometimes be useful in compensating for these impairments (see: ORTHOPAEDIC IMPAIRMENTS).

5. Presence of uncorrected thyroid disorders.

Risk Moderating Factors:

1. Absence of visual disturbances, or their control by medication.

2. Absence of persistent neck muscle paralysis, or effective compensation by the applicant (neck brace and modified mirror system).

3. Absence of respiratory impairment.

4. Sufficient strength in the chest, shoulders, and extremities to control the vehicle efficiently.

5. The option of not driving on "bad" days or during periods of severe symptoms.

Questions for the Applicant:

1. Is the applicant under a physician's care for his condition? If so, how often does he see his physician?

2. How long has he had this condition?

3. Is his condition stable, getting better, or getting worse? (Have respondent explain)

4. Is the applicant taking medication for his condition? If so, how does it affect him?

5. Does his medication control the condition?

6. How much does the applicant drive, and what kind of driving does he do? (Only if the applicant is being re-licensed)

7. Has his medical condition ever been a factor in an accident or close call? If so, what happened?

8. Does he have any additional conditions? (If so, refer to the appropriate sections within this manual)

9. Which muscles are usually involved in an attack? Are there other muscles which are sometimes involved?

10. How often do the applicant's attacks occur? (e.g., Hourly? Daily?) Do they occur while the applicant is active? While he is at rest?

11. Does the applicant use any adaptive devices on his vehicle? If so, ask him to explain.

Behavioral Observations:

The examiner should check to see if there are any visual problems, especially problems involving eye movement. These will appear as difficulty in recognizing objects in traffic, or in reading road signs some distance away while the car is moving. If the applicant is using a neck brace (or has neck paralysis but is not using a brace), check to see that he has sufficient ability to scan the traffic environment to the rear and sides of his vehicle. If a moderate amount of eyelid droop is present, the examiner should determine whether or not the applicant can see adequately to allow for safe driving. If adaptive devices (control or mirror systems) are present, the examiner should determine whether the applicant can use them skillfully and efficiently.

NARCOLEPSY

NARCOLEPSY is characterized by attacks of overpowering sleepiness which may occur at any time, including while driving. The number of NARCOLEPTICS in the United States is subject to dispute, and estimates of their frequency range from the fairly rare to numbers in the millions. The disease also varies greatly in severity, that is, in frequency and severity of attacks of drowsiness. Therefore, most people who have this condition, unless it is present in a fairly severe form, are never diagnosed. It should be emphasized that narcolepsy and EPILEPSY are not related disorders.

Narcolepsy includes four major manifestations or symptoms, called the NARCOLEPTIC TETRAD:

1. NARCOLEPSY PROPER--excessive, often overpowering sleepiness.

2. CATAPLEXY--brief, transient episodes of muscular weakness, lasting up to one minute, that are produced by sudden changes in emotional state (for example, laughter, surprise, or anger). A characteristic drooping of the head and slackness of the jaw may often be observed during these attacks.

3. SLEEP PARALYSIS--brief, transient inability to move extremities just prior to, or just after sleep.

4. HYPNAGOGIC HALLUCINATIONS--vivid dreamlike experiences that occur while in a drowsy state.

Any of these major symptoms could affect safe driving. These manifestations may occur at any time, but they appear more frequently after a substantial meal or after consuming alcoholic beverages. A controlled diet may have a beneficial effect upon the course of the disease and upon the frequency and severity of symptoms. However, effective control usually requires medication.

Risk Increasing Factors:

1. Uncontrolled narcolepsy can create a very great risk for driving.

2. Frequent symptom attacks that occur without prior warning.

3. Over-indulgence in alcoholic beverages.

4. Eating habits which routinely include heavy meals.

5. Use of any additional medication (medication not intended to control narcolepsy) that tends to produce drowsiness (such as sedatives, tranquilizers, anti-nausea drugs, or antihistamines) or that increases frequency or severity of narcoleptic attacks.

Risk Moderating Factors:

1. Complete control of narcoleptic symptoms by medication, provided that such medication does not itself produce effects that increase risk.

2. Risk levels decrease with increasing length of time since last appearance of symptoms.

3. Adherence to a properly formulated diet that decreases the possibility of attacks.

4. Sufficient warning of an oncoming narcoleptic attack to permit the driver to park his vehicle in a safe location.

Questions for the Applicant:

1. Is the applicant under a physician's care for his condition? If so, how often does he see his physician?

2. How long has he had this condition?

3. Is his condition stable, getting better, or getting worse? (Have respondent explain)

4. Is the applicant taking medication for his condition? If so, how does it affect him?

5. Does his medication control the condition?

6. How much does the applicant drive, and what kind of driving does he do? (Only if the applicant is being re-licensed)

7. Has his medical condition ever been a factor in an accident or close call? If so, what happened?

8. Does he have any additional conditions? (If so, refer to the appropriate sections within this manual)

9. How does his condition affect him?

10. How often does the applicant experience attacks of symptoms? When was the last time?

11. Does he take medication for a purpose other than the control of this condition? If so, does it make him drowsy?

12. Does the applicant drink alcoholic beverages? If so, how often?

13. Does the applicant have a diet prescribed by his physician? Is he following it?

Behavioral Observations:

The examiner should look for obvious signs or symptoms. However, the appearance of fatigue or mild drowsiness in an applicant should not be taken to indicate that his narcolepsy is uncontrolled. Conversely, "nodding" or falling asleep during the interview or during the road test probably indicates that the condition is not well controlled. As a matter of caution, if the applicant has exhibited marked narcoleptic symptoms during the interview, the examiner may wish to reconsider conducting the driving performance test. An uncontrolled narcoleptic may place himself, the examiner, and others in jeopardy in the course of the road test.

An obese narcoleptic applicant may have poor dietary habits including frequent overeating. Such indulgence may provoke symptoms if the disorder is not well controlled.

NEOPLASTIC DISEASES

CARCINOMAS
FIBROMAS
SARCOMAS
OTHER SOLID TUMORS
LEUKEMIAS or LYMPHOMAS
LYMPHORETICULAR NEOPLASMS

General Introduction to NEOPLASTIC Diseases:

NEOPLASMS are defined as "new" growth of tissue which is abnormal in that is displaces (infiltrates, crowds out, or destroys) healthy tissue and does not serve the purpose of the tissue it displaces. In addition, the neoplastic growth is not limited by the conformation of surrounding tissues. Therefore, neoplasms will usually develop until medical intervention (surgery, radiation, CHEMOTHERAPY, or some combination of these treatments) although SPONTANEOUS REMISSIONS (disappearance of symptoms) do sometimes occur. In addition, TUMOR MASSES (neoplasms) may be categorized as BENIGN or MALIGNANT. Benign tumors are those which grow in an isolated area and do not invade adjacent healthy tissue or spread to remote sites (METASTASIZE). Malignant neoplasms (CANCERS) are INVASIVE, prone to metastasize, or both.

Applicants with a past history of [illegible] tumors usually incur no additional risk in driving on that account. If, however, the tumor was located in the CENTRAL NERVOUS SYSTEM (or in the eyes or auditory organs), there may be residual (left over) disability with risk increase. Such disabilities should be evaluated separately, and medical advice should be sought to determine the relationship of the individual's condition to his risk levels in driving. Benign tumors may also recur in the same location or elsewhere from one to several times without increasing driving risk levels.

Malignant neoplasms present a vastly different picture for driving hazards. Malignant neoplasms may occur in virtually any part of the body, and may (whether through effect of the PRIMARY growth or through the effects of the distant metastases) compromise or impair any body function. The disease may produce marked degradation of some function necessary to safe driving, or it may produce general weakness and wasting (CACHEXIA) of sufficient severity to prohibit safe operation of a motor vehicle. It is usually the case

that either the applicant with malignant neoplastic disease is capable of driving normally, or that he is obviously too ill to drive and so he does not. A majority of those effects of the disease that would prohibit safe driving (such as liability to sudden collapse) occur at a stage where driving is physically impossible.

There are some exceptions to this general rule, however. Even very advanced disease can sometimes be forced into complete remission (disappearance of symptoms) by therapy. Remissions may last for years or may be very brief. This is particularly true of the LEUKEMIAS and of the LYMPHORETICULAR NEOPLASMS (LYMPHOBLASTOMA, HODGKIN'S DISEASE, LYMPHOSARCOMA, and the other LYMPHOMAS). During remission, the driver may usually operate a motor vehicle safely unless the medication (chemotherapy) used to induce or maintain remission produces serious side effects. These side effects can be brief bouts of dizziness, severe malaise, serious GASTROINTESTINAL BLEEDING or NAUSEA, or marked proneness to bleeding (THROMBOCYTOPENIA) or very severe ANEMIA (caused by BONE MARROW DEPRESSION).

Radiation therapy of neoplastic disease can produce symptoms similar to those seen with chemotherapy. In addition, AZOTEMIA (HYPERURICEMIA and/or UREMIA) may be present with either mode of treatment. Azotemia may produce nausea, headaches, weakness, malaise, and cardiovascular problems (see: KIDNEY DISEASES).

Active metastases or primary tumor in the central nervous system may produce serious hazards for driving, including violent headaches, EPILEPTIFORM SEIZURES, VISUAL DISTURBANCES, or difficulties with coordination or balance. These symptoms may sometimes be alleviated by surgery or radiation therapy. However, a physician's evaluation of residual damage and likelihood of recurrence should be obtained to determine the applicant's driving risk level.

Cancers which have spread to the heart or surrounding large blood vessels may produce risk of collapse or sudden death from EXSANGUINATION (loss of blood), or produce dangerous ARRHYTHMIAS (if present, see: HEART ARRHYTHMIA). Medical advice should be sought to determine the relationship of the individual's condition to risk levels in driving. It should be noted that this event, although very much a hazard if it does occur, is a comparatively rare event. It does not occur unless there is an ACTIVE SITE in the heart or central blood vessels. Collapse due to sudden HEMORRHAGE from

these structures would occur most often in cancers of the ESOPHAGUS (ESOPHAGEAL CARCINOMA) or stomach (GASTRIC CARCINOMA). Sudden exsanguination may occur with many other types of neoplasm. However, it usually does not appear unless the disease is sufficiently far advanced as to make driving unlikely.

Applicants with neoplastic disease may undergo one or several courses of chemotherapy, one or several courses of RADIOTHERAPY, and may possibly receive REMISSION MAINTENANCE CHEMOTHERAPY. Maintenance chemotherapy is sometimes given over periods of up to several years. The same adverse reactions as occur with short-term chemotherapy may also occur here, but in a lesser degree of severity. Certain, CHRONIC, side-effects may occur either with intense, short-term chemotherapy or with maintenance level dosages. These include PULMONARY FIBROSIS, a form of CHRONIC OBSTRUCTIVE PULMONARY DISEASE (C.O.P.D., see: RESPIRATORY DISEASE); GASTROINTESTINAL IRRITATION with nausea, vomiting, bleeding and ulceration; and CYSTITIS, NEPHRITIS or KIDNEY FAILURE. Any of these may produce some increase in risk, depending upon their severity.

Finally, it should be noted that cancers, unless cured, tend to be progressive disorders. The rate of progression varies from disease to disease, from individual to individual, and along the course of one individual's condition. The rate at which the disease advances, in very general terms, tends to accelerate although there may be periods of regression or remission. Unless cured, cancers follow a "three steps forward, two steps back" kind of course. Toward the end, there is usually a period of rapid decline. Over the course of the disease, adverse effects from therapy tend to accumulate as well. Frequent re-assessment, at periods set according to the rate of progression of the disease, is advisable. Cancers may run courses of from several months to a year or two, as in most LUNG CANCERS, to ten years or more of essentially normal life, as in some cases of CHRONIC LEUKEMIA.

The questions given below are intended to be addressed to medical personnel (applicant's physician or medical advisory board) in order to obtain information relating the applicant's condition to his risk level in driving. These questions are appropriate for any neoplastic disease, and may be used whenever the examiner wishes to obtain further clarification. The list of questions should be used for any MALIGNANT NEOPLASM or other condition noted in the text as requiring medical advice.

Questions to be Addressed to Medical Personnel:

1. Are you familiar with the history of this person's condition? Do you see this person regularly in connection with this condition?

2. Is there any type of driving (e.g., in heavy traffic) that would be especially hazardous for this person?

3. Does this person have active lesions in the central nervous system, the heart or central vessels? Are such lesions typical of the course of this person's condition?

4. Is this individual liable to chronic or transient impairment of conscious alertness or to attacks of faintness or dizziness? Is such impairment likely to develop while he is still ambulatory?

5. While still ambulatory, will this individual be liable to sudden collapse? If so, will he have a distinctive warning?

6. Is the medication (if applicable) that will be used in ambulatory therapy of this condition likely to impair alertness, cause severe headaches or nausea, or cause problems with coordination? Is it likely to cause faintness or dizziness, or to produce visual disturbances? Is is likely to cause a serious bleeding liability?

7. Consistent with good therapy, can the dosage level, specific supportive medication, or scheduling be modified to allow for safe driving?

8. Is this individual currently in remission or otherwise free of clinical disease? If so, do you anticipate a lengthy symptom-free period?

9. At what interval (if any) would you recommend re-evaluation or re-examination? Should this interval be changed over time?

Risk Increasing Factors:

1. Primary or metastatic lesion in the central nervous system.

2. Primary of metastatic lesion in the heart or great blood vessels.

3. Faintness, dizziness, or seizures caused by medication or the disease itself; impairment of alertness from either cause.

4. Attacks of [illegible] cough, severe pain or nausea unless these are well controlled by medication and provided such medication does not produce adverse effects.

5. Liability to sudden collapse.

6. Cachexia or severe malaise.

7. Rapidly developing disease.

Risk Moderating Factors:

1. Remission or other symptom-free status.

2. Benign neoplasm.

3. Slowly developing disease.

4. Freedom from severe pain, coughing, or nausea or control of these symptoms by medication provided that such medication does not produce headaches, seizures, impair consciousness, or cause visual disturbances.

5. Freedom from liability to sudden collapse.

6. General appearance of good health (freedom from cachexia) and general alertness.

Questions for the Applicant:

1. Is the applicant under a physician's care for his condition? If so, how often does he see his physician?

2. How long has he had this condition?

3. Is his condition stable, getting better, or getting worse? (Have respondent explain).

4. Is the applicant taking medication for his condition? If so, how does it affect him?

5. Does his medication control the condition?

6. How much does the applicant drive, and what kind of driving does he do? (Only if the applicant is being re-licensed)

7. Has his medical condition ever been a factor in an accident or close call? If so, what happened?

8. Does he have any additional conditions? (If so, refer to the appropriate sections within this manual)

Behavioral Observations:

The examiner should be alert for signs of impaired alertness, severe pain or nausea, weakness and emaciation, or dizziness. Coughing or serious shortness of breath should also be noted. The examiner is unlikely to be able to accurately assess the stage of the disease beyond these gross observations without advice from medical personnel. If the applicant should collapse at any time during the course of the examination procedure, medical assistance should be summoned immediately.

ORTHOPAEDIC IMPAIRMENTS

AMPUTATIONS
HEMIPLEGIA
MONOPLEGIA
NEUROMUSCULAR DISORDERS
PARAPLEGIA
QUADRIPLEGIA
TRIPLEGIA

The term ORTHOPAEDIC IMPAIRMENT relates to limited functioning in, or loss of, the LOCOMOTOR (moving) parts of the body. Active locomotion (movement) is accomplished through interaction of the brain, motor nerves, skeletal muscles, tendons, ligaments or FASCIA, and the bones. Collectively, these parts constitute the neuro-musculo-skeletal system. Injury or disease of these parts may result in restricted movement. Limited skeletal movement may result from a very wide variety of underlying disorders or mishaps, including: birth defects, traumatic injury (such as accident resulting in spinal cord injury or limb amputation), growth disorders such as brittle bones or some types of dwarfism (see: PITUITARY AND ADRENAL DISORDERS), normal aging (e.g., humped back), joint inflammations (such as arthritis or HEMARTHROSIS--see: HEMOPHILIA), or neuromuscular and neurological disorders (such as POLIOMYELITIS, CEREBRAL PALSY, STROKE, MULTIPLE SCLEROSIS, MYASTHENIA GRAVIS, PARKINSON'S DISEASE, and many others). Some degree of crippling or even amputation may also occur following some types of circulatory disorders (see: PERIPHERAL VASCULAR DISEASES).

With many conditions underlying orthopaedic impairment, additional risk factors quite unrelated to limited body movement may exist. These underlying conditions should, therefore, be given close attention in evaluating the applicant's overall risk in driving. In particular, with neurological or neuromuscular disorders, there may be complications in the form of perceptual or intellectual impairment. Cerebral palsy is one example of a condition with a strong possibility of some degree of mental retardation, EPILEPSY-like seizures, hearing, and visual dysfunctions (see: CEREBRAL PALSY).

Orthopaedic impairment may cause pain, irritability, and emotional stress. Range of motion and strength of the limbs may vary from day to day, as with arthritis, or remain stable, as with spinal cord injuries or amputations.

Spasms, cramps, and involuntary trembling or jerking movements (ATHETOSIS) may produce a momentary loss of control, and create an increased driving risk level. In addition, medications which may be contraindicated for driving (causing drowsiness, lightheadedness, inattention, or mood changes) may be prescribed to relieve the plan that often accompanies orthopaedic impairments.

Partial or complete paralysis of body parts may result from injury (lesion) to the spinal cord which carries motor nerve impulses from the brain and controls body movement. There is a direct relationship between the location of the spinal cord lesion and the functional capabilities of the individual. There is also a relationship between the extent of the damage to the cord and the degree of sensation remaining intact in the affected limb. Feedback sensations can be important to the driving task (for example, in judging the amount of force being applied to the brakes). The following terms are used to classify paralysis of the limbs:

MONOPLEGIA--Partial or total paralysis of one limb

PARAPLEGIA--Partial or total paralysis of both legs

TRIPLEGIA--Partial or total paralysis of three limbs

QUADRIPLEGIA--Partial or total paralysis of both arms and both legs

HEMIPLEGIA--Partial or total paralysis of one arm and one leg on the same side of the body

The above classifications identify functional limitations by type, and indicate which mechancial, adaptive driving equipment should be used (see: chart below). It is critical to remember that assessments of driving capability must be made for each and every person individually. Considerations such as special training, severity of movement impairment in affected limbs, and driver attitude and motivation, will produce large differences in driving capabilities among individuals within a given type category (e.g., quadriplegia). Physical, orthopaedic impairment cannot be directly translated into driving impairment. Assessment must emphasize ability of the applicant to drive in a safe manner regardless of the adaptive equipment used.

Orthopaedic impairments may produce driver limitations, but experience has shown that some loss of movement is compatible with safe operation of a motor vehicle that is equipped to compensate for such limitations. Compensation

for orthopaedic impairment may require high energy expenditures by the driver, and this may result in fatigue and increased driving risk. Spinal cord injuries may also make it difficult for the driver to maintain proper body temperature. Overheating or chill may distract attention from driving, and increase risk as well. Given the proper adaptive equipment, or PROSTHETIC DEVICES (such as artificial limbs), and appropriate training, disabled drivers can often effectively compensate for their limitations.

Special Automotive Driving Aids
Required for Loss or Paralysis of Limb

Special Automotive Driving Aids Required	Right Leg	Left Leg	Both Legs	Right Arm	Left Arm	Both Arms
A. Brake and Accelerator			X			
B. Dimmer Switch	X	X	X			
C. Left Foot Accelerator	X					
D. Parking Brake		X	X	X	X	
E. Steering Assists[1]				X	X	
F. Foot Operated Steering[2]						X
G. Turn Lever, Right Hand Operated					X	
H. Shift Lever, Left Hand Operated				X		

[1] Steering assists are add-on devices for use with standard automotive steering wheels, e.g., Spinner Knob, Quad Grip.

[2] Foot operated steering is used where the legs are unimpaired, and both arms are severely paralyzed, or have been amputated.

Risk Increasing Factors:

1. Severe inability to control body posture while driving, unless this can be compensated by a special system of driver restraints.

2. Presence of athetosis (severe trembling or large-scale, involuntary jerking movements), particularly if limbs that are needed in driving are affected.

3. Restriction of head or neck movement, unless the driver is able to compensate through the use of special mirrors.

4. Muscle weakness or paralysis of the limbs, unless appropriate adaptive controls are used.

5. Loss of sensation or position sense (being able to determine the location of the limb without looking) in one or more limbs that are required for driving.

6. Pronounced distractability and inattention while driving whether produced by pain, medication, or other impairments.

7. Presence of adverse effects of medication, including: drowsiness, irritability, visual problems, marked mood changes, or faintness.

8. Presence of seizures (see: EPILEPSY), mental retardation (see: MENTAL RETARDATION), or some forms of APHASIA (see: STROKE).

9. In applicants who have crippling or amputations caused by circulatory disease, and symptoms of heart disease (see: ISCHEMIC HEART DISEASE), a history of PULMONARY INFARCTION (see: RESPIRATORY DISEASES), or a history of stroke, driving risk is very high (see: PERIPHERAL VASCULAR DISORDERS).

10. Lack of knowledge about, or denial of, the applicant's motor or sensory performance problems.

Risk Moderating Factors:

1. Successful completion by the applicant of a special driver training program.

2. Compensation for limb movement limitations, or impairment of head or neck movement, through use of appropriate adaptive controls or special mirror systems, or other equipment.

3. Absence of adverse effects from medication.

4. Absence of seizures, mental retardation, or aphasia.

5. Absence of athetosis.

6. Attentive, responsible attitude on the part of the applicant, and evidence of composure under the stresses encountered in traffic.

Questions for the Applicant:

1. Is the applicant under a physician's care for his condition? If so, how often does he see his physician?

2. How long has he had this condition?

3. Is his condition stable, getting better, or getting worse? (Have respondent explain)

4. Is the applicant taking medication for his condition? If so, how does it affect him?

5. Does his medication control the condition?

6. How much does the applicant drive, and what kind of driving does he do? (Only if the applicant is being re-licensed?

7. Has his medical condition ever been a factor in an accident or close call? If so, what happened?

8. Does he have any additional conditions? (If so, refer to the appropriate sections within this manual)

9. Was the applicant ever a regularly licensed driver before he was impaired? When, and for how long?

10. What, if anything, most disturbs the applicant about driving (in his present condition)?

11. Does the applicant have pain in his arms, legs, or neck when he turns his head while driving?

12. Does he have pain at other times? When?

13. Is his pain worse on some days than it is on others? How is it today?

14. Do the applicant's limbs move when he does not wish them to? When he becomes nervous do they move more than usual?

15. Does the applicant sometimes lean over too far? How does he straighten up?

16. Does the applicant reach through the steering wheel to operate any of his vehicle's controls?

17. What special adaptive equipment, if any, does the applicant have on his vehicle?

18. Has the applicant completed a special driver training course?

Behavioral Observations:

Positioning of an orthopaedically impaired body is critical for balance. The examiner should note whether all extremities are supported, as support reduces fatigue and helps to stabilize the body. Position of paralyzed lower extremities should be such as to not interfere with driving controls (e.g., a foot under a brake or resting on an accelerator). Paralyzed extremities or prostheses may change position during a turn and interfere with driver control. The use of a prosthesis, such as an artifical hand, may require the driver to take his eyes off the road to operate the prosthesis since it has no sensation. A limb without sensation may be used in awkward manner, as there is no feedback.

The driver licensing examiner should test for maximum braking and high speed acceleration to be sure the adaptive equipment does not interfere with other equipment, or with the driver's body. An undesirable change in posture during the road test may result in movements too slow for conditions, such as turning too slowly, or in loss of control. Changes in posture may be inappropriately corrected by pushing on hand controls.

Excessive blinking may be a sign of inattention, and excessive perspiring may be due to anxiety. Performance during a road test may deteriorate due to fatigue, and inability to be attentive may be due to pain or anxiety about a request to perform beyond limits. The examiner should note whether the applicant avoids checking blind spots to the side of the body which is paralyzed. Restricted head and neck movements may require additional mirrors. The examiner should be sure to test the driver in circumstances which require these visual checks. Spasms (athetosis) of a paralyzed limb may cause interference with normal operation (e.g., a leg flaring up and hitting the brake pedal), and possible loss of control.

Emphasis should be placed on the ability of the driver to perform the driving task accurately. The driver must have sufficient strength to turn the steering wheel, apply the brakes, and maintain good, general control of the vehicle. He must be able to reach and operate all of the controls, whether by mechanical attachments on the vehicle, or by suitable prosthetic devices. The evaluation of each driver is a highly individualized process.

PARKINSON'S DISEASE (PARALYSIS AGITANS)

PARKINSON'S DISEASE is a progressive neurological condition whose major symptom is a rhythmic tremor. The tremor is usually first noticed in one hand, and it is less noticeable or absent during voluntary movement. As the disease progresses, the tremor usually spreads to the trunk of the body and one of the legs. The disease causes difficulty in coordination of movement in the affected limb. As the disease progresses, movement becomes slower and more difficult. In parkinsonism's advanced form, the person is usually bedridden. The disease is relatively common, usually beginning between the ages of 40 and 70. The rate of progress of the disease is highly variable, and simple hand tremor is often the only impairment for 10 to 15 years. In another person, the disease may cause immobility and helplessness within a few years.

The course of the disease is slowly progressive, and there are no sudden, acute attacks which could cause an unpredictable traffic hazard. It is usually possible, therefore, for the driver to compensate gradually for his condition as it develops. Persons affected by parkinsonism in its very advanced stages, however, will demonstrate an obvious rigidity in attempting to coordinate muscular activity. This would make it extremely difficult for them to drive safely. Involuntary muscular spasms, for example, a leg flailing about and striking a brake pedal, may also appear. These also produce some degree of driving risk increase unless they are controlled by medication or, perhaps, adaptive equipment (see: ORTHOPAEDIC IMPAIRMENTS).

As the individual experiences increasing difficulty in quickly and accurately performing complex motor actions, he may experience extreme frustration and emotional stress. This may produce an increased traffic risk, especially if the applicant loses composure under such stress. The medications used to control the effects of Parkinson's disease frequently produce visual blurring, and difficulty with bright sunlight or glare. When these visual problems occur, they can usually be helped considerably by special glasses.

Risk Increasing Factors:

1. Large-scale muscular rigidity or involuntary shaking that persists during attempts at voluntary movement, and is not controllable by medication.

2. Sensitivity to glare or other visual problems, unless these are corrected by special eyeglasses.

3. Evidence of severe frustration or emotional stress in traffic situations.

Risk Moderating Factors:

1. Small-scale tremors of the extremities that disappear during voluntary movement.

2. Absence of visual blurring and sensitivity to glare, or the control of these problems by special eyeglasses.

3. Ability to control frustration and maintain composure in heavy traffic.

Questions for the Applicant:

1. Is the applicant under a physician's care for his condition? If so, how often does he see his physician?

2. How long has he had this condition?

3. Is his condition stable, getting better, or getting worse? (Have respondent explain)

4. Is the applicant taking medication for his condition? If so, how does it affect him?

5. Does his medication control the condition?

6. How much does the applicant drive, and what kind of driving does he do? (Only if the applicant is being re-licensed)

7. Has his medical condition even been a factor in an accident or close call? If so, what happened?

8. Does he have any additional conditions? (If so, refer to the appropriate sections within this manual)

9. When did the applicant first notice his tremor?

10. Does the tremor disappear when the applicant performs voluntary movement? (For example: disappearance of a hand tremor when the applicant reaches to pick up an object on a table)

11. Does the applicant make use of any adaptive controls in his vehicle? If so, have the applicant explain.

Behavioral Observations:

The examiner should observe whether or not the applicant is able to control his vehicle efficiently and well, and whether or not his motor impairments create serious problems in his maneuvering of the vehicle (see: ORTHOPAEDIC IMPAIRMENTS). The examiner should also watch closely for evidence of stress. However, the examiner should limit his stress testing to that level of stress which results from driving in heavy traffic. Demanding of the applicant that he perform more quickly, or beyond his limits, may produce frustration which could mask the applicant's emotional capabilities in real driving situations. The examiner should also be alert for signs of visual problems. If adaptive controls are used, the examiner should determine that the applicant can use them skillfully and efficiently.

PERIPHERAL VASCULAR DISORDERS

THROMBOPHLEBITIS (PHLEBOTHROMBOSIS)
THROMBOANGIITIS OBLITERANS (BUERGER'S DISEASE)
ARTERIOSCLEROSIS OBLITERANS
PERIPHERAL ARTERIAL EMBOLISMS
ARTERIOVENOUS FISTULA
PERIPHERAL ANEURYSMS
POSTPHLEBOTIC SYNDROME and VARICOSE VEINS

Peripheral Vascular Diseases in General:

PERIPHERAL VASCULAR DISEASES are disorders of the circulatory system that occur in locations other than the heart, lungs, brain, or other internal organs (for example, in the legs). Most of the same disease processes that occur in disorders of coronary circulation also occur in peripheral circulation. Here, however, they are unlikely to produce sudden collapse of the driver. Vital functions are unlikely to fail even if a peripheral vessel should fail suddenly. However, sudden driver collapse may occur if a sufficiently large ANEURYSM (a stretched, thin location in the wall of an artery) should rupture. This would cause a sudden drop in blood pressure, and a rapid loss of consciousness. Collapse may also occur if a moving clot (EMBOLISM) produced in the peripheral circulation should lodge in the vessels of the heart, lung, or brain. Diseases such as THROMBOPHLEBITIS which produce dislodgeable clots on the walls of major vessels may produce a significant risk for driving.

Thrombophlebitis and Phlebothrombosis:

Thrombophlebitis is a frequently occurring medical problem. An estimated 250,000 new cases are diagnosed annually in the United States, and the rate of mortality from PULMONARY INFARCTION, its most frequent complication, is also quite high. The disease is often produced by injury to the legs (particularly by fractures), but also may result from other traumas, from heart disease, or simply from long periods of sitting. It may be superficial, or may involve the deep veins. If the disease has spread to the deep veins, likelihood of moving EMBOLUS formation, and therefore risk in driving, is greater. A past history of thrombophlebitis may not indicate an increased risk, although an extensive case may have produced crippling disability. If the disease is well controlled and not currently active, IHD is not present (see: ISCHEMIC HEART DISEASE), and if the applicant can operate the vehicle's foot controls adequately (see: ORTHOPAEDIC IMPAIRMENTS), no risk increase for driving is implied.

If the disease is active, there is a strong possibility of pulmonary infarction and sudden collapse (see: RESPIRATORY DISEASES). Driving risk, in this case, is greatly increased. Treatment of thrombophlebitis by medications that prevent clot formation (anti-coagulants) increases the hazard of serious bleeding. Although this does not produce a direct risk for driving, the bleeding hazard can be a serious danger to the driver in the event of an accident.

Thromboangiitis Obliterans (Buerger's Disease) and Arteriosclerosis Obliterans:

Both of these disorders produce complete blockage (obliteration) of peripheral arteries and veins. Their course is chronic, running over periods of several years. The causes of the two diseases are different, and are not well understood in either case. Control of the progress of the disease is difficult, although some well-defined factors increase the rate at which the disease extends. One of the most important of these factors is cigarette smoking. These disorders usually involve pain, sometimes very severe, in the lower extremities, and sometimes pain occurs in the hips or back as well. The pain may be related to exercise or it may continue at rest. With ARTERIOSCLEROSIS OBLITERANS, if the pain persists at rest, the risk is particularly high. There will likely be difficulties in operating the foot controls of the vehicle, and GANGRENE may develop. With arteriosclerosis obliterans, surgery may alleviate the symptoms and lower risk. However, this disease is often only one manifestation of a general arteriosclerotic disease process. MYOCARDIAL INFARCTION (see: MYOCARDIAL INFARCTION and ISCHEMIC HEART DISEASE) and CEREBROVASCULAR ACCIDENT (see: STROKE) often occur. These always should be evaluated separately. They are especially likely to occur if diabetes (see: DIABETES MELLITUS) is present. In such cases, medical advice should be sought to determine the relationship of the applicant's condition to his risk level in driving.

Peripheral Arterial Embolisms:

These are extremely serious because they are peripheral manifestations of serious cardiovascular disease (see: HEART INFLAMMATIONS). Risk of additional embolisms and of sudden collapse may be quite high. Medical advice should be sought to determine the relationship of the applicant's condition to risk levels in driving.

Arteriovenous Fistula and Peripheral Aneurysms:

These are structural abnormalities of the peripheral circulation. An ARTERIOVENOUS FISTULA is an abnormal connection between an artery and

a vein. It generally produces some loss of function in the limb supplied by the artery affected. If there is no apparent loss in ability to operate the vehicle's controls, risk is not increased. Risk is increased if there is difficulty in operating the controls. This disorder can usually be completely corrected by surgery.

PERIPHERAL ANEURYSMS may cause sudden collapse if they rupture without warning, and a large aneurysm may produce some increase in risk for driving. The aneurysm will usually give severe pain if it is about to rupture, however. Therefore, the driving risk increase is not prohibitive, and it is lower in individuals who do not have to sit for long periods in the vehicle, or who do not have to drive in heavy traffic. Peripheral aneurysms can frequently be corrected by surgery. If surgery has been performed, a physician's advice should be obtained to determine the success of the surgery.

Postphlebotic Syndrome and Varicose Veins:

These conditions, by themselves, are insignificant to driving unless they are severe enough to be crippling (see: ORTHOPAEDIC IMPAIRMENTS). Individuals with these conditions should be screened for the other conditions in this section, however. Recurring thrombophlebitis is particularly significant for driving.

Risk Increasing Factors:

1. Cigarette smoking.
2. Presence of diabetes mellitus.
3. Severe pain at rest, or following very moderate exercise.
4. Medication with anti-coagulant drugs.
5. Presence of severe mental confusion, ischemic heart disease, or uncontrolled hypertension.
6. Presence of active thrombophlebitis, or of active peripheral arterial embolism.
7. Applicants who have advanced peripheral vascular disease (arteriosclerosis obliterans), especially if they have had one or more amputations as a result, and who also have cardiovascular disease, run a very high risk in driving.

Risk Moderating Factors:

1. Absence of severe pain following exercise.

2. Surgical correction or surgical relief of symptoms.

Questions for the Applicant:

1. Is the applicant under a physician's care for his condition? If so, how often does he see his physician?

2. How long has he had this condition?

3. Is his condition stable, getting better, or getting worse? (Have respondent explain)

4. Is the applicant taking medication for his condition? If so, how does it affect him?

5. Does his medication control the condition?

6. How much does the applicant drive, and what kind of driving does he do? (Only if the applicant is being re-licensed)

7. Has his medical condition ever been a factor in an accident or close call? If so, what happened?

8. Does he have any additional conditions? (If so, refer to the appropriate sections within this manual)

9. Does the applicant have diabetes? If so, is his condition controlled by diet? Is he receiving insulin injections?

10. Does the applicant have active thrombophlebitis?

11. Has he ever had an episode of thrombophlebitis? If so, how many times? When was the last time?

12. Does the applicant have any form of heart disease?

13. Has he ever had a stroke?

14. Does the applicant have chest pain? If so, does it ever occur while resting? After walking a few feet?

Behavioral Observations:

The examiner should be concerned with possible cardiovascular disease symptoms, such as chest pain with moderate exercise, lightheadedness or faintness, breathlessness, or distended neck veins (see: CARDIOVASCULAR DISEASES: ISCHEMIC HEART DISEASE). The examiner should also be alert for other signs of advanced arteriosclerotic disease, such as mental confusion, or evidence of cerebrovascular problems. These might include, sagging of the muscles of one side of the face, one-sided difficulties with muscular coordination, or a slurring of speech. Any of these conditions can produce an increase in risk, and medical advice should be sought to determine the relationship of the applicant's condition to his risk in driving.

The examiner should also be alert for evidence of pain, such as limping (CLAUDICATION) that appears after rest or with very little exercise. This is suggestive of some driving risk increase. If the pain is sufficient to markedly interfere with operation of the vehicle's controls, the risk level is considerably increased.

PITUITARY AND ADRENAL DISORDERS

ANTERIOR PITUITARY DISORDERS
- ACROMEGALY
- GIGANTISM
- CUSHING'S SYNDROME (BILATERIAL ADRENOCORTICAL HYPERPLASIA)
- HYPERPITUITARISM
- HYPOPITUITARISM (SIMMOND'S DISEASE)
- PITUITARY DWARFISM
- PITUITARY MYXEDEMA
- HYPOADRENOCORTICISM (PITUITARY)
- SHEEHAN'S SYNDROME
- MULTIPLE ENDOCRINE ADENOMATOSIS

POSTERIOR PITUITARY DISORDERS
- DIABETES INSIDIDUS
- HAND-SCHUELLER-CHRISTIAN DISEASE

ADRENAL DISORDERS
- ADDISON'S DISEASE (ADRENAL CORTICAL INSUFFICIENCY
- CUSHING'S SYNDROME
- PRIMARY ALDOSTERONISM

Pituitary Disorders in General:

The above list is only a partial catalog of the many possible disorders of the PITUITARY gland. This small gland, located just above the roof of the mouth, controls normal human growth and development, and regulates the functions of many other glands within the body. A complete list of all pituitary disorders that may have an impact upon driving risk levels is not feasible here. In most cases, medical advice will be needed to determine the relationship between an individual applicant's condition and his risk levels in driving. Disorders of the ADRENAL glands are also discussed in this section. Pituitary disorders may present a bewildering variety of symptoms, and only a few of the most significant are treated here. It is important to remember that serious psychological disturbances, including severe emotional disorders, may follow HYPOPITUITARISM, PITUITARY MYXEDEMA, CUSHING'S SYNDROME, HYPOGLYCEMIA (including hypoglycemia of pituitary or adrenal disease), or ADDISON'S DISEASE if these are not well controlled.

Gigantism and Acromegaly:

These two disorders are caused by over-production of HUMAN GROWTH HORMOME (HGH) at different times in the individual's life. Excess HGH during

growth will result in GIGANTISM. The individual's height may run from 6-1/2 feet to over 8 feet. There may be some degree of muscular weakness or coordination impairment, and other body metabolic function may be abnormal as well. The applicant will frequently need to be evaluated as to presence and severity of ORTHOPAEDIC IMPAIRMENT (see: ORTHOPAEDIC IMPAIRMENTS), and medical advice should be sought concerning any additional problems. ACROMEGALY is produced when excess HGH secretion appears after maturity. It is generally accompanied by other disorders such as DIABETES MELLITUS (see: DIABETES MELLITUS), HYPERTENSION, orthopaedic impairments and, late in its course, mental disturbances and HEART FAILURE (see: HEART FAILURE). The disease may run a course of several decades; however, and safe driving is generally possible for most of this period if the accompanying conditions are well controlled. Medical advice should be sought on this point to determine the relationship of the individual applicant's condition to his risk levels in driving.

Cushing's Syndrome (Pituitary Basophilism):

CUSHING'S SYNDROME is the result of hyperactivity of the ADRENAL CORTEX produced either by excess secretion of ADRENAL CORTICOTROPHIC HORMOME (ACTH) by the pituitary, or by disease of the adrenal gland. This disorder produces very significant risk increases for driving. Its symptoms usually include severe muscular weakness, high blood pressure (HYPERTENSION), and severe spinal deformities caused by collapse of the bones of the spine. Psychological disturbances are common, and diabetes mellitus is also frequent. Serious cardiovascular disease also usually appears if the disease is not brought under control. Cushing's disease may be controlled by irradiation of the pituitary, or by surgical removel of the adrenal cortex. Surgery leaves the individual with treatable ADDISON'S DISEASE (see: below), and driving risk may not be too high if the resulting disease has been brought under control. Medical advice should be sought concerning any residual heart disease, bone deformities, or other residual effects of Cushing's disease, however.

Pituitary Dwarfism:

This condition is produced by inadequate pituitary HGH secretion during infancy or childhood. If other hormone abnormalities are not present, the pituitary dwarf can be treated primarily as having a possible orthopaedic impairment. His small stature may make it difficult for him to reach the vehicle's controls. However, if he has adaptive equipment to facilitate control of the vehicle, he can usually drive safely (see: ORTHOPAEDIC IMPAIRMENTS). Pituitary dwarfs, unlike people with HYPOTHYROID

DWARFISM, usually have normal intelligence. There may be some tendency toward drowsiness, however, and this could increase risk levels.

Pituitary Disorders Affecting Specific Target Glands:

A large variety of separate pituitary conditions exist in which the primary affect of the disease is dysfunction of another ("target") gland that the pituitary regulates. Pituitary myxedema (HYPOTHYROIDISM) (see: THYROID AND PARATHYROID DISORDERS) and PITUITARY HYPOADRENOCORTICISM (causing hypoglycemia, psychological disturbances, and fatigue) are two examples of this type of condition. These disorders present all of the driving risk factors associated with primary dysfunctions of the target gland, and they may be more difficult to control. Medical advice should be sought to determine the relationship of the individual applicant's condition to his risk level in driving in all such cases.

Panhypopituitarism (Simmond's Disease) and Hyperpituitarism:

These terms indicate a generalized under or over secretion of pituitary hormones affecting more than one "target" gland. Psychological dysfunction is very common, and driving risk levels from this and other factors may be very high. Medical advice should be obtained in all such cases to determine the relationship of the individual's condition to his risk levels in driving.

Addison's Disease:

Addison's disease (CHRONIC ADRENAL CORTICAL INSUFFICIENCY) is a disorder caused by insufficient production of HYDROCORTISONE (CORTISOL) and ALDOSTERONE by the adrenal cortex. Its effects include low blood pressure, hypoglycemia (see: DIABETES MELLITUS), weakness, lowered heart output, small heart size, and often psychological disturbances with mental instability, and attacks of fainting. Its course may be marked by recurring ADRENAL CRISIS with profound weakness, severe pain, and eventual death from cessation of kidney function. It may be seen in company with diabetes (see: DIABETES MELLITUS), hypothyroidism, or HYPOPARATHYROIDISM (see: THYROID AND PARATHYROID DISORDERS). Even without sudden collapse, driving risk increase in untreated Addison's disease can be very high due to neuromuscular weakness and severe mental disturbances.

Addison's disease can usually be completely controlled by medications that replace adrenal cortex secretions, however. If the prescribed schedule of medications is strictly adhered to by the applicant, and if the applicant in under close medical supervision, there is probably no driving risk increase.

Risk Increasing Factors:

1. Presence of severe mental or emotional disturbances.

2. Presence of severe muscular, neuromuscular, or skeletal abnormalities, unless these can be compensated for by use of special adaptive equipment in the vehicle.

3. Presence of severe cardiovascular disease.

4. In general, an uncontrolled or uncontrollable condition will usually produce some amount of risk increase. The appearance of risk increase may be delayed, however, as in acromegaly. Medical advice should be sought on this point to determine the relationship of the applicant's condition to his risk level in driving.

5. Evidence of carelessness on the part of the applicant in following prescribed courses of medication, or absence of close medical supervision.

Risk Moderating Factors:

1. Absence of severe orthopaedic impairments, or compensation for such impairments through the use of special adaptive equipment in the applicant's vehicle (see: ORTHOPAEDIC IMPAIRMENTS).

2. Absence of severe cardiovascular disease.

3. Absence of mental or emotional disturbances.

4. Control of the applicant's condition by hormonal replacement or other medication, by surgery, or other effective means. Risk is not reduced if the applicant is careless in following his schedule of medication, or if he is not under medical supervision.

Questions for the Applicant:

1. Is the applicant under a physician's care for his condition? If so, how often does he see his physician?

2. How long has he had this condition?

3. Is his condition stable, getting better, or getting worse? (Have respondent explain)

4. Is the applicant taking medication for his condition? If so, how does it affect him?

5. Does his medication control the condition?

6. How much does the applicant drive, and what kind of driving does he do? (Only if the applicant is being re-licensed)

7. Has his medical condition ever been a factor in an accident or close call? If so, what happened?

8. Does he have any additional conditions? (If so, refer to the appropriate sections within this manual)

9. Does the applicant follow his scheduled medication (if applicable) closely?

10. Has the applicant ever had an episode of faintness or dizziness as a result of his condition? Has he ever lost consciousness? If so, when was the last time?

11. Does the applicant use adaptive controls in his vehicle? If so, ask him to explain.

Behavioral Observations:

Musculoskeletal or neuromuscular abnormalities secondary to pituitary or adrenal disorders should be evaluated as orthopaedic impairments (see: ORTHOPAEDIC IMPAIRMENTS). If adaptive controls are used in the vehicle, the examiner should observe whether the applicant can use them skillfully and efficiently. Serious mental retardation may be present, but emotional or other mental disturbances are more likely. The examiner should be alert for unusual behavior, signs of disorientation or confusion, emotional instability, drowsiness, nervousness, or inattention in the applicant. These may indicate that the condition is not well controlled. The examiner should also be alert for signs of visual problems. Cardiovascular disease will appear often, and frequently can be detected in observed chest discomfort or pain, severe breathlessness upon mild exertion, or bluish coloration of the skin under the fingernails (CYANOSIS).

If the applicant collapses at any point in the licensing procedure, medical help should be summoned immediately.

RENAL DISORDERS (KIDNEY DISORDERS)

CHRONIC KIDNEY FAILURE
HEMODIALYSIS
PERITONEAL DIALYSIS
KIDNEY TRANSPLANTS

Kidney Disease in General:

The kidneys are responsible for filtering metabolic waste products from the blood stream, and for maintaining proper levels of calcium, potassium, sodium, water, and several other components of body fluids. The kidneys may play an additional role in regulation of blood pressure through interaction with the ENDOCRINE system (chiefly the ADRENAL and PITUITARY glands), and are known to be instrumental in stimulating production of adequate numbers of red blood cells by the bone marrow. In serious kidney disease, many vital body functions may become serious affected, and a variety of driving-significant medical problems can be expected. These may include: bone disease with severe pain and crippling, visual disorders, heart disease, mental impairment or emotional disorders, neurological disorders, muscle weakness and wasting, seizures, tremors and muscle jerking, severe ANEMIA (inadequate numbers of red blood cells), PULMONARY EDEMA (see: RESPIRATORY DISEASES), and severe tendencies to uncontrollable bleeding. A host of more minor complaints may appear as well, along with insomnia, tiredness and easy fatigability, and general ill health.

The human normally has a large excess of renal capacity, and kidney diseases generally do not produce signs of serious illness, or increased driving risk, until less than 20 percent of the initial capacity remains. At this point, KIDNEY FAILURE (RENAL FAILURE) sets in, and it may be either acute or chronic. Any or all of the problems outlined above may now emerge, and driving risk is untreated kidney failure is usually high and increasing. Acute kidney failure may often be reversed through medical treatment, with restoration of adequate kidney function and little or no residual damage. When this is the case, driving risk is probably not increased. If the kidney failure was chronic, but reversible, some residual damage to vision, heart, nervous system, or musculo-skeletal system may have been produced. Medical advice should be sought on this point to determine the relationship of the individual applicant's condition to his risk levels in driving.

If the course of the kidney failure is not reversible, specific treatment will be required to control the dangerous side-effects of the disease. Chronic kidney failure that is controlled by diet (such as the GIORDANO or GIOVANETTI DIET), by DIALYSIS (HEMODIALYSIS or PERITONEAL DIALYSIS), or a functioning kidney transplant, probably does not produce serious increases in driving risk provided that the applicant is under close medical supervision (sees his physician at least once/month), is conscientious about following any diet prescriptions or other treatment schedules (such as a dialysis schedule), or does not experience GRAFT REJECTION (failure of his transplanted kidney).

Some Complications of Chronic Renal Failure:

Certain complicating disorders may appear with treated chronic kidney failure, and produce significant risk increases when they do. If any of these conditions are present, medical advice should be sought to determine the relationship between the individual applicant's condition and his risk levels in driving. The first such disorders that should be considered as those conditions which may have produced the failure in the first place. The most significant of these are ENDOCARDITIS, HEART FAILURE, HYPOPARATHYROIDISM, and DIABETES (see: HEART INFLAMMATIONS, HEART FAILURE, THYROID AND PARATHYROID DISORDERS, DIABETES MELLITUS). Risk is particularly high in the diabetic with chronic kidney failure, and especially so if he has had a history of stroke, heart attack, diffuse vascular disease (see: PERIPHERAL VASCULAR DISORDERS), severe HYPERTENSION (high blood pressure), or visual problems (e.g., DIABETIC RETINOPATHY). Some degree of hypertension is usually present in kidney failure and may ultimately cause heart disease, stroke, and other problems. When the hypertension is not controllable by medication, it will cause worsening of the kidney failure, and produce additional risk factors. Some degree of anemia is also usual. However, it is probably not significant for driving unless it is severe.

Impaired balance of sodium, calcium, potassium, or water in the body may be difficult to control, even with dialysis. Imbalance of these substances may produce confusion, alterations in consciousness, mental impairment, psychosis, muscle weakness, tremors, convulsive seizures, severe nausea, or proneness to ARRHYTHMIAS and sudden collapse (see: HEART ARRHYTHMIAS). Presence of any of these complications will require that medical advice be sought. Inadequate removal of metabolic waste products will result in their accumulation in body fluids and intracellular spaces (AZOTEMIA, UREMIA). This may result in severe mental confusion, headache, nausea, and a variety of other effects. PERICARDITIS often results from azotemia, and may progress to CONSTRICTIVE PERICARDITIS and heart failure (see: HEART INFLAMMATIONS).

Bone and joint diseases often follow kidney failure, and may persist and worsen in spite of dialysis. A successful kidney transplant usually controls them. The most common of these are OSTEOMALACIA, OSTEOSCLEROSIS, or OSTEOPOROSIS. They may produce severe pain, bone degeneration, and possibly crippling. Various medications given to help prevent rejection of a transplanted kidney may cause bone or joint disease (ASEPTIC BONE NECROSIS) which frequently attacks the hip joint, and may be crippling (see: ORTHOPAEDIC IMPAIRMENTS).

Risk Increasing Factors:

1. Uncontrolled kidney failure, or a condition that is inadequately controlled. Failure of the applicant to follow his diet (if applicable) or dialysis schedule closely.

2. Absence of a physician's close supervision.

3. Presence of cardiovascular disease, including active heart inflammation, arrhythmia, or congestive heart failure.

4. Presence of uncontrolled parathyroid function abnormalities (see: THYROID AND PARATHYROID DISORDERS).

5. Presence of uncontrolled diabetes mellitus, especially in the presence of cardiovascular or other circulatory disease.

6. Presence of mental impairment or emotional disturbances (see: MENTAL RETARDATION, EMOTIONAL DISORDERS), or of visual problems.

7. Presence of severe neurological, neuromuscular, or musculoskeletal disorders, or control of the pain of such disorders by medications that impair alertness, produce drowsiness, or cause mood changes.

8. Need to drive long distances if the applicant is a dialysis patient and does not carry a portable dialysis machine. Risk is not increased if the applicant can schedule access to dialysis facilities along his route.

Risk Moderating Factors:

1. Presence of a functioning transplanted kidney (RENAL ALLOGRAFT).

2. Successful control of the applicant's condition through periodic dialysis. The risk is further lowered if the dialysis can be performed at home.

3. Not driving on long (over about 300 miles) trips unless a portable dialysis machine is available, or access to dialysis facilities can be scheduled. Dialysis is not needed if the applicant has a functioning kidney transplant.

4. Compensation for any orthopaedic impairment that may exist as a result of bone disease with appropriate adaptive control systems in the applicant's vehicle.

Questions for the Applicant:

1. Is the applicant under a physician's care for his condition? If so, how often does he see his physician?

2. How long has he had this condition?

3. Is his condition stable, getting better, or getting worse? (Have respondent explain)

4. Is the applicant taking medication for his condition? If so, how does it affect him?

5. Does his medication control the condition?

6. How much does the applicant drive, and what kind of driving does he do? (Only if the applicant is being re-licensed)

7. Has his medical condition ever been a factor in an accident or close call? If so, what happened?

8. Does he have any additional conditions? (If so, refer to the appropriate sections within this manual)

9. Has the applicant ever lost consciousness, suffered convulsions, or experienced attacks of faintness or dizziness as a result of this condition?

10. Does the applicant have a prescribed special diet? Does he follow it closely?

11. Does the applicant currently receive dialysis treatments? If so, where does he receive them?

12. If the applicant is receiving dialysis treatments, does he frequently need to drive on long (over 300 miles) trips? If so, does he have access to a portable dialysis machine? Can he schedule his trips so as to have access to dialysis facilities?

13. Does the applicant have a functioning transplanted kidney?

Behavioral Observations:

The examiner is unlikely to be able to tell whether dialysis or renal allograft is functioning properly. He should, however, be alert for signs of heart disease (such as chest discomfort, or breathlessness following mild exercise), visual trouble, mental disturbances or mental impairment, orthopaedic impairment (see: ORTHOPAEDIC IMPAIRMENTS), severe muscular weakness or wasting, or severe tremor. Any of these may produce some degree of increased risk, and may indicate that the disorder is not well controlled.

RESPIRATORY DISEASES

ASTHMA and PULMONARY HYPERSENSITIVITY
PULMONARY TUBERCULOSIS
CHRONIC OBSTRUCTIVE PULMONARY DISEASE (C.O.P.D.)
PULMONARY EMPHYSEMA
TOXIC and OCCUPATIONAL LUNG DISEASES
CHRONIC BRONCHITIS or BRONCHIECTASIS
MECHANICAL and NEUROMUSCULAR DISORDERS
PULMONARY INFARCTION and PULMONARY EMBOLISM
PULMONARY HYPERTENSION and PULMONARY EDEMA

Respiratory Diseases in General:

RESPIRATORY DISEASES result from a wide variety of causes and follow differing courses. Some varieties of respiratory disorders are characterized by an acute (brief) episode, after which the victim will recover completely. Other types are marked by recurrent, acute attacks during which there is a notable driving risk increase. In between attacks, the individual may be largely or completely normal. Still other varieties of respiratory disease are of a chronic, continuous nature, with courses running several years. These varieties may be slowly progressive or stable, and often do not have major significance for driving until quite late in the course of the disorder. Indeed, some types of chronic respiratory disorders will be clinically "quiet" for much of their course (insofar as their respiratory effects are concerned). They will produce their most significant driving risk factors in remote organ systems. The most common and significant driving effects of respiratory disease that will be encountered by the examiner are breathlessness (DYSPNEA), pain, headache, mental confusion, severe coughing and RESPIRATORY INSUFFICIENCY. These cause some increase in driving risk. Some forms of respiratory disease, however, are marked by proneness to sudden collapse, fainting after moderate exertion, and strong possibility of sudden death. In such disorders, driving risk is very high.

Especially with disorders that exhibit a chronic, degenerating course, medical re-examination at intervals is appropriate. A condition which, at first, was comparatively insignificant for driving may develop serious risk factors late in its course. Generally important risk factors include: PULMONARY HYPERTENSION from any cause, dyspnea (breathlessness) following modest exertion, constant straining to breathe, CYANOSIS (bluish coloration of the skin, indicating under-oxygenated blood), HEMOPTYSIS (spitting blood), or an active pulmonary lesion (such as an active TUBERCULAR NODE). A brief discussion of several specific conditions follows.

When the examiner is in doubt, medical advice may be sought in evaluating individuals with these conditions to determine the relationship between their condition and possible risk levels in driving. Medical advice should be sought in evaluating diseases not covered in this section.

Asthma and Pulmonary Hypersensitivity:

ASTHMA, also called ACUTE REVERSIBLE AIRWAY OBSTRUCTION, is a fairly common disorder, affecting up to two percent of all children. Up to 10 percent of these will continue to have disability in adult life (i. e., 0. 2% of all adults). The usual course of the disease consists of acute episodes, the severity of which varies widely from individual to individual. The attacks may characteristically last for periods of from several minutes to several days. The attack usually takes a few minutes to develop. The attempt to drive during a severe attack can produce high risk. During an attack, the victim has great difficulty in breathing, may rapidly become exhausted, is usually agitated, and may well be confused. In most cases, between attacks the victim will be quite normal. However, in cases marked by lengthening attacks that resist therapy (STATUS ASTHMATICUS), HEART FAILURE may appear. Enlargement and failure of the right side of the heart (COR PULMONALE) indicates an increase of risk (see: HEART FAILURE). The risk is especially high if ARRHYTHMIAS have appeared (see: HEART ARRHYTHMIA).

Many cases of asthma can be controlled by medication which prevents or aborts attacks. However, since attacks are often precipitated by emotional stress, tranquilizing medication is sometimes given. This may make the applicant drowsy or impair alertness. Other types of medications may make the applicant irritable, excitable, and nervous. In either case, driving risk is increased in relation to the severity of the medication's side effects.

PULMONARY HYPERSENSITIVITY results from exposure to irritating agents or substances in the course of the victim's daily activities. Typically, the symptoms resemble an asthma attack, often with very severe difficulty in breathing. Attempting to drive during an attack produces high risk. Avoidance of the irritating substance will prevent attacks. These disorders can be significant if occupational exposure in connection with driving is likely to occur. Two typical and relatively common diseases in this group are: FARMER'S LUNG, which, in susceptible persons, results from exposure to molded agricultural products, and MAPLE BARK DISEASE, which results from exposure to logs stored under wet conditions.

Pulmonary Tuberculosis:

PULMONARY TUBERCULOSIS is a chronic disease that once was a more serious disorder for driving than it is presently. Modern medications can bring the disease under control in relatively short periods of time. Active, uncontrolled disease still produces some increase in driving risk, however. There is a possibility of sudden collapse from internal bleeding, as well as the possibility of severe breathlessness (leading to drowning in very severe cases) from lung fluid. The disease, if uncontrolled, may also produce serious effects in other organs (notably, the heart and nervous system). A physician's evaluation should be obtained to determine that the disease is well controlled.

Chronic Obstructive Pulmonary Disease (C.O.P.D.):

This term encompasses a wide variety of separate disorders, including: PULMONARY EMPHYSEMA, PULMONARY FIBROSIS, PNEUMOCONIOSIS, SILICOSIS, ASBESTOSIS, BLACK LUNG, MINER'S ASTHMA, and other occupational or environmental respiratory disorders. Also included under this term are respiratory diseases that diminish the efficiency of breathing by restricting air flow through the air passages of the lungs and BRONCHIAL TUBES. All of these diseases are long-term disorders, and most of them are progressive. Some occupational respiratory diseases (notably ASBESTOSIS) may continue to develop for years after cessation of exposure. If medical evaluation indicates that the disease is likely to be progressive, periodic re-evaluation may be necessary.

All of these diseases result in diminution of VITAL CAPACITY, FORCED EXPIRATORY VOLUME (FEV), TIDAL VOLUME, and other measurements of respiratory airflow. These collectively are known as "ventilatory capacity measurements." In addition, efficiency of gas exchange (of oxygen for carbon dioxide) may be impaired. If these changes result in breathlessness at rest or with mild exertion, risk is increased. Very advanced disease may produce undersaturation of oxygen in the blood (decrease in blood oxygen content) and may also produce an increase in blood carbon dioxide content. Oxygen (O_2) deficit may produce impaired alertness and mental changes. Carbon dioxide (CO_2) excess may produce mental confusion and headaches. Either of these developments increase risk levels. Individuals with very advanced disease may also develop risk increasing cardiovascular complications (see: HEART FAILURE).

Chronic Bronchitis or Bronchiectasis:

CHRONIC BRONCHITIS is a long-term inflammation of the upper air passages marked by susceptibility to periodic episodes of severe infection. During acute episodes, there are severe spasms of coughing. The coughing tends to worsen in the course of the disease, and fits of coughing while driving may be hazardous. Chronic bronchitis is often associated with, and frequently results in, C.O.P.D. (see: above). The disease may also result in congestive heart failure (see: HEART FAILURE).

BRONCHIECTASIS is a severe, infectious disease of the upper airways that produces extensive respiratory damage. In active form, it produces severe breathlessness and coughing and is, therefore, a major risk increase. A past history of this disease should alert the examiner to resultant C.O.P.D. (see: above).

Mechanical or Neuromuscular Disorders:

These are diseases which interfere with the mechanics of the breathing process itself (IMPAIRED VENTILATORY CAPACITY). Representative types include: MYASTHENIA GRAVIS (see: MYASTHENIA GRAVIS), CARDIO-RESPIRATORY FAILURE of EXTREME OBESITY ("Pickwickian Syndrome"), IDIOPATHIC or PRIMARY ALVEOLAR HYPOVENTILATION, SCOLIOSIS or KYPHOSCOLIOSIS (two skeleto-spinal deformities which crowd the internal organs and reduce useful breathing space). The evaluation of these disorders with relation to driving risk is complex, and medical advice should be sought. It may, however, be stated that appearance of congestive heart failure, fainting, or CARBON DIOXIDE NARCOSIS SYNDROME (insomnia, irritability, impaired judgment, mental confusion, apathy) indicate very advanced disease, and high driving risk. Non-respiratory, musculo-skeletal problems may also be associated with scoliosis or kyphoscoliosis, and should be evaluated separately (see: ORTHOPAEDIC IMPAIRMENTS).

Pulmonary Infarction and Pulmonary Embolism:

The terms refer to partial or complete blockage of the blood supply to the lungs. Such a block produces several consequences, the severity of which will depend upon the size of the blood vessel involved. First, if the blocked section is quite large, the ability of the lungs to maintain proper blood oxygen and carbon dioxide levels will be impaired. This will result in reduced ability to tolerate moderate exertion, with notable breathlessness (dyspnea), and possible mental confusion. Second, the large increase in back pressure will force the

heart to work much harder to circulate blood through the lungs. This extra work load will result in heart changes, including rhythm changes (permanent or transient, see: HEART ARRHYTHMIAS), and often signs of right heart failure (cor pulmonale, see: HEART FAILURE). Lastly, there may be some tissue death in the area formerly supplied with blood by the blocked vessel system. This can be quite extensive in a large infarction. The area of damaged tissue will become tough, unresilient, and useless for respiration. Applicants with a past history of one or more major pulmonary embolisms or infarctions will exhibit some degree of C. O. P. D. (see: above), and should be evaluated on that basis. In addition, a physician's assessment should be obtained to determine whether or not there is a likelihood of additional episodes of embolism or infarction (possibly of the heart or brain as well). Driving risk is increased if a liability to additional attacks exists. During its acute phase, pulmonary embolism or infarction is an unstable condition. It may worsen markedly, and drastic side effects may also appear. Therefore, driving with an unresolved, active condition produces very high risk.

Pulmonary Hypertension:

When pressure in the pulmonary blood vessels is increased, back pressure and heart work loads rise in proportion to the increase in pressure. This condition is known as PULMONARY HYPERTENSION. It may be a result of some other disease condition, or it may sometimes appear on its own. In the latter case, it is called PRIMARY PULMONARY HYPERTENSION. Some fluid engorgement of lung tissue (PULMONARY EDEMA) usually results from pulmonary hypertension. This will impair lung gas exchange function and, therefore, produce breathlessness after exertion, and other symptoms of C. O. P. D. Evaluation of the applicant should be partly based upon this factor (see: above). Medical advice should be obtained to determine the relationship of the condition producing the pulmonary hypertension to risk levels in driving.

Primary pulmonary hypertension is an extremely serious condition that cannot be treated successfully at the present time. Its cause is unknown. It produces an increase in pulmonary vascular pressure of from 10 to 15 times the normal level. It is usually fatal within a few years of the diagnosis. Early, intractable heart failure results from the greatly increased work load on the right side of the heart. Driving risk levels with this condition are very high because of frequent episodes of sudden fainting and the strong possibility of sudden collapse and death.

Malignant Diseases of the Respiratory System:

Malignancies or cancer are treated in a separate section (see: NEOPLASTIC DISEASES). These disorders will often produce remote, non-respitory effects that are highly significant to driving (for example, in the brain or spinal cord).

Risk Increasing Factors:

1. Presence of heart failure or arrhythmias.

2. Greatly reduced exercise tolerance. In general, risk is higher in an individual who is breathless at rest, or who becomes breathless during normal activities. Individuals who experience symptoms only after moderate exercise (such as walking several blocks or climbing several flights of stairs) run a lesser risk.

3. Presence of cyanosis (bluish coloration of the skin). This indicates very advanced disease.

4. An active disease lesion, especially if hemoptysis (spitting of blood) is present.

5. Uncontrollable, sudden coughing spasms, or control of such chronic coughing by medications which produce drowsiness or impaired alertness:

6. Liability to sudden loss of consciousness.

7. Impaired mental alertness, severe headaches, insomnia, irritability or confusion.

8. Uncontrollable asthma or persistence of asthma attacks (status asthmaticus).

9. Treatment of the condition with medications that produce impaired alertness, visual problems, irritability or nervousness.

10. Unavoidable exposure to an agent or substance that produces hypersensitivity attacks in the course of normal activity.

11. Cigarette smoking.

Risk Moderating Factors:

1. Control of symptoms by medication, provided that such medication does not produce dangerous side effects at the dosage levels required.

2. Ability to perform daily activities without breathlessness.

3. Ability to avoid exposure, while driving, to agents that precipitate attacks.

4. Absence of liability to fainting or other sudden collapse.

Questions for the Applicant:

1. Is the applicant under a physician's care for his condition? If so, how often does he see his physician?

2. How long has he had this condition?

3. Is his condition stable, getting better, or getting worse? (Have respondent explain)

4. Is the applicant taking medication for his condition? If so, how does it affect him?

5. Does his medication control the condition?

6. How much does the applicant drive, and what kind of driving does he do? (Only if the applicant is being re-licensed)

7. Has his medical condition ever been a factor in an accident or close call? If so, what happened?

8. Does he have any additional conditions? (If so, refer to the appropriate sections within this manual)

For asthma and pulmonary hypersensitivity:

9. How long do the applicant's attacks usually last?

10. Does the applicant's medication ever make him drowsy, irritable, dizzy or nervous? Does it cause visual problems?

11. Does he know the specific factors that provoke attacks? Is he able to avoid them when he drives?

For all conditions:

12. Does the applicant get breathless after walking a few feet? After walking one block or climbing one flight of stairs? After several blocks or several flights of stairs?

13. Does he smoke cigarettes?

Behavioral Observations:

The examiner should be especially alert for signs of mental confusion, impaired alertness or irritability. During the course of the examination, breathlessness should not appear. Its occurrence is highly significant. For applicants with asthma, the emotional stress of the licensing situation may produce an attack. If it can be prevented or aborted by medication (usually a bronchial aerosol), the attack is not too significant. The examiner should keep in mind that the stresses in the normal driving situation may well be within the applicant's tolerance.

If, at any point during the examination, the applicant has severe difficulty in breathing or loses consciousness, summon medical help immediately.

STROKE

STROKE (cerebrovascular accident) is the term used to describe a number of different cerebrovascular (brain blood vessel) conditions. These conditions affect the supply of blood to the individual control centers within the brain, as well as the delicate balance of fluid and tissue pressure within the skull. In general, strokes are caused by three conditions:

- A blockage in the flow of blood (INFARCTION) to a portion of the brain caused by an EMBOLISM or THROMBUS.
- Tissue/fluid pressure imbalance due to a baloonlike stretching (ANEURYSM) or the wall of a blood vessel, or a traumatic injury to the head.
- Rupture in a brain blood vessel wall (INTRACRANIAL or INTRACEREBRAL HEMORRHAGE).

In most cases, the brain is dramatically and immediately affected by the lack of blood, or by skull pressure imbalance, causing immediate unconsciousness and brain damage. The specific motor, sensory, and intellectual effects depend upon the location and severity of the cerebrovascular damage. This damage can cause one, or a combination of several, temporary or permanent impairments. While any of these impairments may affect safe driving, each stroke victim must be evaluated individually since the functions impaired are directly related to the location and nature of the injury to the brain. The major threat after one stroke is the occurrence of another stroke. The likelihood of occurrence is especially high if the person is afflicted with HYPERTENSION, DIABETES, with widespread vascular disease (see: PERIPHERAL VASCULAR DISORDERS), or some types of CARDIOVASCULAR DISEASE (see: HEART INFLAMMATIONS, HEART ARRHYTHMIAS).

After a stroke, if additional attacks do not intervene, some recovery of lost function is likely to occur. This recovery is generally considered to be complete within six months to one year of the attack. Before this interval has elapsed, accurate assessment of residual impairment may not be possible. Barring an additional attack, no new impairments should appear, but improvements may take place. Any sensory, perceptual, motor, or intellectual deficits that persist for a year or more should be considered permanent, although special training or equipment may greatly reduce their impact upon driving risk levels (see: ORTHOPAEDIC IMPAIRMENTS, MENTAL RETARDATION). Likelihood of additional strokes is often difficult to assess, and medical advice should be sought on this point to determine the relationship of the applicant's condition to his risk level in driving.

Residual musculoskeletal impairments following recovery from strokes may vary widely in severity, location, and type from applicant to applicant. Impairment may be localized to a few muscles, may involve all of one limb (MONOPLEGIA), one side of the body (HEMIPLEGIA), or all of the extremities and the trunk (QUADRIPLEGIA). Observable problems may include simple weakness, tremor, minor incoordination or slowness in movement, or gross irregularity and incoordination in muscle control (ATAXIA). If large areas are involved, especially in hemiplegia or quadriplegia, loss of body-posture control may be evident. This can create serious hazards for driving if the motorist's trunk is not properly restrained. Adaptive controls may be necessary to allow for safe driving, and these should be evaluated as for an orthopaedic impairment. In addition, sensory or intellectual impairment is particularly likely to occur with left hemiplegia. These subtle deficits in perception (especially of spatial relationships) do not occur as frequently in right hemiplegia.

Sensory damage may appear as localized or widespread numbness, loss of balance, double vision (DIPLOPIA), partial blindness or confusion in the visual field (HEMIANOPIA), or hearing dysfunction, often with ringing or other noise in the ears (TINNITUS). If they are apparent, such problems (other than simple numbness) should be referred for medical or other expert advice to determine the relationship of the applicant's condition to his risk level in driving.

Closely related to sensory problems, are certain types of intellectual and emotional problems which may appear. Some of these are quite subtle. The simplest to spot will be slowness in thinking, which may include some degree of memory impairment (see: MENTAL RETARDATION). More difficult to evaluate are the wide variety of disorders collectively termed APHASIA. An applicant with aphasia may be unable to read or understand road signs. He may, however, be perfectly capable of interpreting road signs and reacting to them appropriately, but be incapable of reading them aloud to the examiner. Aphasia is a highly complex condition, and is quite difficult to evaluate without special training. Therefore, medical or other expert advice should be sought in evaluating the aphasic applicant's condition with respect to his risk levels in driving.

Disturbances in the applicant's ability to carry out voluntary movement may be present, even though the affected extremities may not actually be paralyzed. The applicant may (for example) be capable of performing trained reflex actions, but be unable to carry out movements that the examiner requests. If such impairments are present, the applicant should be referred for medical or other expert advice. Emotional disturbances may also be

present, either as a direct result of the stroke, or following the emotional stresses of coping with the disability. When present, such emotional problems may produce some increase in risk, and should be evaluated (see: EMOTIONAL DISORDERS).

Medications used to help prevent additional strokes may produce visual problems, drowsiness, lightheadedness, or impaired attention. In addition, medications that impair or prevent blood clotting (anticoagulants) are sometimes used. While such medications do not produce an additional traffic hazard, the bleeding problems associated with them may be dangerous to the applicant if he does become involved in a crash.

Risk Increasing Factors:

1. Presence of ataxia, tremor, or exaggerated slowness in movement.
2. Loss of posture control, unless the applicant is effectively restrained.
3. Paralysis of one or more limbs, unless compensated by adaptive controls.
4. Presence of severe aphasic impairment of functions essential to safe driving.
5. Presence of serious visual disturbances.
6. Tendency to inattention or distractability.
7. Presence of serious difficulties with voluntary motor function.
8. Emotional disturbances that produce agressiveness, antagonistic attitude, or emotional instability (see: EMOTIONAL DISORDERS).
9. Presence of serious memory problems with greatly slowed thinking processes (see: MENTAL RETARDATION).
10. Adverse reactions to medication, including: drowsiness, lightheadedness, visual problems, inattentiveness, impaired motor coordination, or serious bleeding problems.

Risk Moderating Factors:

1. History of minor stroke with behavioral effects that are transient, and not present at the time of examination.

2. Compensation of paralysis with adaptive controls.

3. Successful completion of a special driver training program.

Questions for the Applicant:

1. Is the applicant under a physician's care for his condition? If so, how often does he see his physician?

2. How long has he had this condition?

3. Is his condition stable, getting better, or getting worse? (Have respondent explain)

4. Is the applicant taking medication for his condition? If so, how does it affect him?

5. Does his medication control the condition?

6. How much does the applicant drive, and what kind of driving does he do? (Only if the applicant is being re-licensed)

7. Has his medical condition ever been a factor in an accident or close call? If so, what happened?

8. Does he have any additional conditions? (If so, refer to the appropriate sections within this manual)

9. How many strokes has the applicant had? When was the last one?

10. Has the applicant successfully completed a special driver training program? (If so, ask him to explain)

11. Does the applicant use adaptive controls in his vehicle? (If so, ask him to explain)

Behavioral Observations:

In the office, the driver license examiner will need to be a critical observer. During this time, the examiner should:

- Greet the applicant with a firm handshake (remembering that not all people shake hands firmly) to see if there is any obvious weakness in grip strength, or any limited range of motion in the wrist, elbow, or shoulder.

- Watch the applicant sign a document or open a locked car door, using one hand. This allows the examiner to watch the ease or difficulty encountered by the applicant in situations that require precise motor control (manual dexterity).

- Have the applicant extend his arm to reach for an object in order to observe possible disturbances in perception and voluntary muscle coordination.

- Look for any abnormality the applicant may have in neck rigidity, eye lid droop, or eye movement.

- Evaluate the applicant's memory, attention span; and capacity for sustained mental effort with some simple questions. (For example: Over which roads did the applicant travel in coming to the place of examination?)

During the in-car test, the examiner should:

- Before going on the road, check to see if the applicant is able to reach and use all of the required controls.

- Check to see if the applicant can coordinate the quick movement of one foot from the accelerator pedal to the brake and back again several times without missing the controls, or sliding off either control during the exercise.

- Check to see if the applicant can maintain a good grip on the steering wheel.

- While on the road, check to see whether the applicant with severe motor impairment is able to maintain a vertical or near vertical body position when turning, or going through a corner, without clinging to the steering wheel as a balance aid.

- Check to see if the applicant shows any visual difficulty in focusing the eyes (squinting) or adjusting to glare.

- Check to see if the applicant has a full visual field by asking him to look straight ahead and, without moving his head, name objects which appear across the full field of vision.

- Check to see if the applicant can read road signs in the distance without taking his eyes off the road for a long time.

- Check to see if the applicant shows poor perceptual judgment by:

  - Failing to maintain the appropriate distance between cars.

  - Weaving back and forth across lanes.

  - Consistently applying the brakes too close to stop signs or traffic lights.

  - Taking too long to pass.

  - Failing to show adequate attention to possible traffic hazards (especially cars approaching from the rear on either side).

  - Overturning or underturning corners.

- Check the applicant's in-car attitude to make sure that neither the medication nor any neurological damage may be causing an intellectual or emotional state which could cause additional traffic risk.

If adaptive controls are used, the examiner should observe whether the applicant can use them skillfully and efficiently.

THYROID AND PARATHYROID DISORDERS

HYPERTHYROIDISM
GRAVES' DISEASE
THYROTOXICOSIS
HYPOTHYROIDISM
MYXEDEMA
CRETINISM
GOITER
HASHIMOTO'S DISEASE (STRUMA LYMPHOMATOSA)
HYPOPARATHYROIDISM (PARATHYROID TETANY)
HYPERPARATHYROIDISM

Thyroid Diseases in General:

The thyroid gland is primarily concerned with production and storage of certain iodine-containing hormones that are necessary for normal functioning of many body systems. Thyroid disease usually causes production of either excessive or of insufficient quantities of these hormones. When too little hormone is secreted, the result if HYPOTHYROIDISM (GOITER, CRETINISM, MYXEDEMA, GULL'S DISEASE). When hormone production and release is excessive, HYPERTHYROIDISM (GRAVES' DISEASE, PARRY'S DISEASE, BASEDOW'S DISEASE; THYROTOXICOSIS) appears. The primary driving risk factors associated with thyroid disease result from the effects of hormone over or under production. However, direct pressure effects from an enlarged thyroid gland (goiter) may cause choking, constriction of blood supply to the brain, and possibly visual disorders.

Hyperthyroid Disorders:

Hyperthyroidism (Graves' disease) is a relatively common disorder which most often appears between the ages of 30 and 40. It affects women about five times as frequently as it does men. The disorder is characterized by cycles of attack and remission, and the most serious of these attacks, called THYROID STORM (or CRISIS), may be fatal. The attacks are often brought on by emotional or physical stress. The most serious driving risks associated with this condition result from its effects upon the nervous system, or from its effects upon the cardiovascular system and upon the muscles.

In it most common form, serious hyperthyroidism is characterized by nervousness, weakness, restless overactivity, weight loss, tremor or weakness in the extremities, frequently with palpitations in the chest, and

EXOPHTHALMOS (protrusion of the eyes in their sockets). If visual disturbances are present, they may include blurred or double vision. Headaches, nausea, or emotional disorders may appear as well.

Chronic hyperthyroidism may produce serious heart disease, especially in older patients. If heart disease is present, it should be separately evaluated, and medical advice should be sought to determine the relationship between the applicant's condition and his risk levels in driving (see: HEART ARRHYTHMIAS, HEART FAILURE). Serious nervous and neuromuscular effects such as emotional instability, severe tremor and weakness, serious headache, or visual problems may cause a significant driving risk increase. If they are present, it indicates that the condition is not well controlled, and medical advice should be sought to determine the relationship between the applicant's condition and risk levels in driving. Medication and special diet can control hyperthyroidism in many cases, and surgery, radiation, or brief courses of special medication may also restore normal thyroid function. Recurrence of attacks may occur even in individuals under treatment. Such attacks do not appear without warning, however, and sudden collapse is not likely.

Hypothyroid Disorders:

Hypothyroidism has a wide variety of effects, depending primarily upon the age of the applicant when the disease appeared, and the promptness with which it was treated. The most visible effect will often be a prominent, swelling bulge (goiter) of the neck and throat caused by swelling of the thyroid gland. Unless the goiter produces choking, restriction of the arteries that supply blood to the brain, or serious interference with head and neck movements, goiter itself probably produces no driving risk increase. It is often produced by inadequate iodine intake, and may be controlled by dietary supplements.

Hypothyroidism that appears early may produce JUVENILE MYXEDEMA (cretinism) in children. Normal functioning of the thyroid gland during childhood is essential for normal growth, and for normal development of the brain and nervous system. If early hypothyroidism was present, an applicant may have smaller than normal stature, nusculoskeletal abnormalities (see: ORTHOPAEDIC IMPAIRMENTS), heart disease, and mental retardation (see: MENTAL RETARDATION). Severity of these impairments will depend upon the severity of the thyroid deficit and the success with which it was treated. In cases where serious heart disease, mental retardation, or musculoskeletal abnormalities are present, medical advice should be sought.

Myxedema is the term for the disorder produced by lack of sufficient thyroid hormone production in adults. This disease does not produce irreversible damage to developing organs, but seriously impairs the functioning of established body systems. The disease's early symptoms are tiredness, or an unusual degree of sluggishness. There may be a gradual change in the individual's personality; drowsiness, physical and mental apathy may develop. If the disorder is prolonged, heart disease resembling ISCHEMIC HEART DISEASE (see: ISCHEMIC HEART DISEASE) may appear. Thyroid-supplementing medication can usually completely control the condition and its symptoms. However, the prescribed dosage schedule of the medication may not be closely followed by the applicant, and symptoms could reappear. If the schedule of medication is closely followed, and heart disease is either absent or does not persist, driving risk is probably not increased.

Hypothyroidism sometimes develops as a result of a chronic inflammation of the thyroid gland. HASHIMOTO'S DISEASE (STRUMA LYMPHOMATOSA) is the most common of such diseases. The symptoms that it produces that are significant to driving are similar to hypothyroidism, but the course of the disorder may be very different. Close medical supervision is necessary to keep the disease under control, and medical advice should be sought to determine the relationship between the individual's condition and his risk level in driving if the disease does not appear to be well controlled.

Parathyroid Diseases:

The PARATHYROID glands are small organs located in the neck, near the thyroid gland. They are concerned with control of levels of calcium in the body fluids, and their normal activity is necessary to maintain proper functioning of many body systems. The brain and nervous system, the muscles, and the kidneys are particularly sensitive to parathyroid dysfunction. Chronic effects may include partial or complete blindness due to CATARACTS in the eyes, or serious bone disease.

HYPOPARATHYROIDISM (PARATHYROID TETANY) results when parathyroid function is subnormal, and blood calcium levels are too low. The most common cause of hypoparathyroidism is accidental damage to several of the glands during surgery to correct hyperthyroidism. It may also occur after surgery to correct its opposite disorder, HYPERPARATHYROIDISM, if too much tissue was removed. For these reasons, it is sometimes called POSTOPERATIVE TETANY. Its major symptom is an attack of spontaneous, convulsive muscle contractions that may be localized, or may involve the entire body. Warning symptoms will precede these attacks, so an applicant

who feels an attack coming on will generally have sufficient time to get out of traffic safely. An applicant may have some adverse effect upon his motor performance (impaired coordination and exaggerated reflexes) if he does not follow his medication schedule closely or if he is not under close medical supervision. It is also possible that the symptoms of an oncoming attack might be ignored unless the applicant is made alert to them by his physician. However, the condition can usually be well controlled by medication. Medical advice should be obtained to establish that the disorder is well controlled.

Hyperparathyroidism is due to an excess secretion of parathyroid hormone, and results in a disturbance of calcium and phosphorus metabolism in the body. Its long-term effects may include bone disease (with spontaneous fractures and severe pain), visual problems, HEART ARRHYTHMIAS (see: HEART ARRHYTHMIAS), and severe kidney damage from NEPHROCALCINOSIS (see: RENAL DISORDERS). It also frequently produces severe muscle weakness and impaired reflexes. By itself, hyperparathyroidism produces some degree of driving risk increase. If untreated, its long-term effects in the form of heart disease, kidney failure with AZOTEMIA, and orthopaedic impairments can produce a very high driving risk increase. Treatment is usually in the form of surgery, and medical advice should be sought to determine that the disease is well controlled, and that permanent hypoparathyroidism has not appeared. If well controlled, and if serious heart disease, bone disease, and kidney failure are not present, hyperparathyroidism is not incompatible with safe driving.

Risk Increasing Factors:

1. Presence of serious heart disease, kidney damage, or visual problems.

2. Presence of orthopaedic impairments (see: ORTHOPAEDIC IMPAIRMENTS) or severe mental retardation (see: MENTAL RETARDATION).

3. Presence of neuromuscular coordination impairments or muscular weakness. These may indicate that the disease is not well controlled.

4. Presence of irritability, nervousness, or emotional instability.

5. Presense of drowsiness, inattentiveness, or mental sluggishness.

6. Absence of a physician's close supervision, or carelessness about required medication (if applicable).

Risk Moderating Factors:

1. Absence of serious heart disease, orthopaedic impairment, or visual problems.

2. Absence of dwarfism, mental retardation, or other signs of early damage produced by an uncontrolled condition.

3. A stable, responsible attitude on the part of the applicant.

4. Close adherence to the prescribed scheduling and dosage of medication (if applicable), and regular medical supervision.

5. A stable, well-controlled condition.

Questions for the Applicant:

1. Is the applicant under a physician's care for his condition? If so, how often does he see his physician?

2. How long has he had this condition?

3. Is his condition stable, getting better, or getting worse? (Have respondent explain)

4. Is the applicant taking medication for his condition? If so, how does it affect him?

5. Does his medication control the condition?

6. How much does the applicant drive, and what kind of driving does he do? (Only if the applicant is being re-licensed)

7. Has his medical condition ever been a factor in an accident or close call? If so, what happened?

8. Does he have any additional conditions? (If so, refer to the appropriate sections within this manual)

9. Does the applicant follow his prescribed routine of medication (if applicable) closely?

10. Does the applicant ever have acute attacks? If so, what warning symptoms does he have?

Behavioral Observations:

The examiner should be alert for any signs of a condition that is not under adequate control. Such signs might include extreme nervousness, excitability or irritability, drowsiness, mental slowness (except in mentally retarded applicants), inattentiveness, or impairment of coordination. If these signs are noticed, the condition is not well controlled. If muscular weakness is noticed, the examiner should note whether the effort of driving causes the applicant to become unduly fatigued. The examiner should also note whether the applicant can coordinate quick movements (for example, from the accelerator to the brake and back again several times in a stopped vehicle). The examiner should also be alert for signs of visual problems, or for chest discomfort and breathlessness that might indicate heart disease.

INDEX

Acoustic apparatus, 63

Acoustic nerve, 64

Acquired deafness, 63

Acquired structural (heart) defects, 36

Acromegaly, 105

ACTH (see: Adrenal corticotrophic hormone)

Acute coronary insufficiency, 42

Acute heart failure, 24

Acute reversible airway obstruction (see: Asthma)

Adams-Stokes disease (see: Stokes-Adams syndrome)

Adaptive controls or equipment, 74, 78, 92, 125

Addison's disease, 107

Adhesive pericarditis, 30

Adrenal cortex, 106

Adrenal cortical insufficiency (see: Addison's disease)

Adrenal corticotrophic hormone, 106

Adrenal crisis, 107

Adrenal disorders, 90, 105

Affective disorders, 54

Aldosterone, 107

Allergy, 65

Anemia, 85, 110

Aneurysms, 30, 37, 100, 102, 123

Angina pectoris, 40

Anterior pituitary disorders, 105

Antisocial personality disorders, 54

Anxiety neurosis, 54

Aortic coarctation, 37

Aortic regurgitation, 15, 37

Aortic stenosis, 15, 30, 37, 40

Aphasia, 65, 93, 124

Arteriosclerotic heart disease, 15, 39

Arteriovenous fistula, 101

Artificial heart valves, 37

Asbestos, 117

Asthma, 116

Ataxia, 124

Ataxic cerebral palsy, 46

Atherosclerosis, 50

Athetoid cerebral palsy, 46

Atrial fibrillation (flutter), 18

Atrial septal defect, 18, 36

Atrio-ventricular block, 14, 19, 23

Auditory ossicles, 63

Aura, 59

AV block (see: Atrio-ventricular block)

Azotemia, 85, 111, 132

Basedow's disease, 129

Benign neoplasms, 84

Bilateral adrenocortical hyperplasia (see: Cushing's syndrome)

Bilateral ventricular failure, 25

Black lung, 117

Bone marrow depression, 85

Bradycardia, 19

Brittle diabetes, 50

Bronchiectasis, 118

Buerger's disease (see: Thromboangiitis obliterans)

Bundle branch block disorders, 19, 42

Cachexia, 84

Cancer (see: Neoplastic disease)

Carbon dioxide narcosis syndrome, 118

Carcinomas, 84

Cardiac asthma (see: Paroxysmal nocturnal dyspnea)

Cardiac inadequacy, 26

Cardiac syncope, 14, 19, 24, 32, 37, 41

Cardiomyopathy, 30

Cardiorespiratory failure of extreme obesity (see: Pickwickian syndrome)

Cardiovascular diseases, in general, 10, 123

Carotid sinus, 14

Carotid sinus syncope, 14

Cataplexy, 81

Cataracts, 131

Catatonic schizophrenia, 54

Central dysacusis, 65

Central nervous system, 74, 84

Central nervous system integration, 64

Cerebral arteriosclerosis, 65

Cerebral embolism (see: Stroke)

Cerebral palsy, 46, 73, 90

Chemotherapy, 84

Chronic bronchitis, 118

Chronic heart failure, 24

Chronic kidney failure, 30, 86, 110

Chronic leukemia, 86

Chronic obstructive pulmonary disease, 86, 117, 119

Chronic pericardial effusion, 30

Cigarette smoking, 43, 102, 120

Claudication, 104

Coagulation, 68

Cochlea, 64

Conduction disorders, 14, 23

Congenital deafness, 63

Congenital heart block, 37

Congenital heart disease, 36, 40

Congestive heart failure, 15, 23, 30, 41, 106, 111, 116, 117, 118, 119, 130

Constrictive pericarditis, 30, 111

C. O. P. D. (see: Chronic obstructive pulmonary disease)

Cor pulmonale, 25, 116, 119

Coronary arteries, 39

Coronary atherosclerosis, 40

Coronary circulation obstruction, 30

Coronary insufficiency, 32, 39

Coronary occlusion (see: Myocardial infarction)

Coronary thrombosis (see: Myocardial infarction)

Cortisol, 107

Crescendo angina (see: Acute coronary insufficiency)

Cretinism, 130

Cushing's syndome, 106

Cyanosis, 25, 38, 109, 115

Cyclothymic personality disorder, 54

Cystitis, 86

Deafness (see: Hearing dysfunction)

Depressive neurosis, 54

Diabetes insipidus, 105

Diabetes mellitus, 43, 50, 101, 106, 107, 111, 123

Diabetic retinopathy, 51, 111

Dialysis, 111

Dictionary, Dorland's, 5

Diplopia, 75, 78, 124

Dissecting aneurysms, 37

Dressler's syndrome, 30

Dyspnea, 25, 115, 118

Early onset diabetes, 50

Electroconvulsive therapy, 55

Electrolyte imbalance, 18

Embolism, 123

Emotional disorders, 54, 125

Endocarditis, 32, 111

Epilepsy, 47, 58, 81, 90, 93

Epileptiform seizures, 85

Esophageal carcinoma, 86

Exophthalmos, 130

Exsanguination, 85

Farmer's lung, 116

Fibrillation, 15, 41

Fibromas, 84

Focal seizures, 59

Forced expiratory volume (FEV), 117

Gangrene, 101

Gastrointestinal bleeding, 85

Gigantism, 105

Giordano diet, Giovanetti diet, 111

Goiter, 129, 130

Graft rejection, 111

Grand mal epilepsy, 58

Graves' disease
(see: Hyperthyroidism)

Gull's disease, 129

Hand-Schueller-Christian
disease, 105

Hashimoto's disease, 131

Hearing dysfunction, 47, 63

Heart arrhythmias, 14, 15, 18,
24, 30, 37, 40, 41, 85, 111,
116, 119, 123, 130, 132

Heart attack (see: Myocardial
infarction)

Heart block (see: Atrio-ventricular
block)

Heart conduction system, 23, 30

Heart dysrhythmias (see: Heart
arrhythmias)

Heart failure (see: Congestive
heart failure)

Heart inflammations, 30, 40, 101,
123

Heart structural defects, 15, 18, 24,
30, 32, 36, 40, 41

Hebephrenic schizophrenia, 54

Hemarthrosis, 68, 90

Hemianopia, 124

Hemiplegia, 91, 124

Hemodialysis, 30, 111

Hemophilia, 68, 90

Hemoptysis, 115

HGH (see: Human growth hormone)

Hodgkin's disease, 85

Human clotting factor, 68

Human growth hormone, 105

Hydrocortisone, 107

Hyperglycemia, 50

Hyperparathyroidism, 131

Hyperpituitarism, 107

Hypertension, 39, 106, 111, 123

Hyperthyroidism, 129

Hypertrophy, 23

Hyperuricemia, 85

Hypnagogic hallucinations, 81

Hypoadrenocorticism (pituitary),
107

Hypochondriacal neurosis, 54

Hypoclycemia, 18, 50, 105

Hypoparathyroidism, 107, 111, 131

Hypopituitarism, 105

Hypothyroid dwarfism, 106

Hypothyroidism, 107, 130

Hysterical neurosis, 54

Idiopathic (non-specific) heart inflammation, 30

Infarction, 123

Insulin, 50

Insulin shock, 50

Intermittent complete AV block (see: Stokes-Adams disease)

Intracerebral hemorrhage, 123

Intracranial hemorrhage, 123

Involutional melancholia, 54

Ischemic heart disease, 15, 18, 19, 26, 30, 32, 39, 51, 93, 100, 131

Jacksonian seizures (see: Focal seizures)

Juvenile myxedema (see: Cretinism)

Kidney disease (see: Renal disorders)

Kidney failure, 110

Labyrinth, 65

Labyrinthitis, 65

Left ventricular failure, 24

Leukemia, 65, 85

Little's disease (see: Spastic cerebral palsy)

Lung cancer, 86

Lymphoblastoma, 85

Lymphomas, 85

Lymphoreticular neoplasms, 85

Lymphosarcoma, 85

Malignant neoplasms, 84

Manic-depressive illness, 54

Maple bark disease, 116

Meniere's syndrome, 64

Mental deficiency (see: Mental retardation)

Mental disorders (see: Emotional disorders)

Mental retardation, 47, 71, 93, 123, 124, 125, 130, 132

Miner's asthma, 117

Mitral valve disease, 18, 37, 41

Monoplegia, 91, 124

Morgagni-Adams-Stokes disease (see: Stokes-Adams disease)

Multiple endocrine adenomatosis, 105

Multiple sclerosis, 73, 74, 90

Myasthenia gravis, 78, 90, 118

Myocardial failure (see: Congestive heart failure)

Myocardial infarction, 15, 18, 30, 32, 41, 101

Myocarditis, 18, 30, 40

Myopia, 51

Myxedema, 129

Narcolepsy, 81

Narcolepsy proper, 81

Narcoleptic tetrad, 81

Neoplastic diseases, 30, 84, 119

Nephritis, 86

Nephrocalcinosis, 132

Neurosis, 54

Nystagmus, 75

Obsessive compulsive neurosis, 54

Obsessive compulsive personality disorder, 54

Organ of corti, 64

Orthopaedic impairments, 71, 73, 74, 79, 90, 97, 99, 100, 106, 108, 109, 118, 123, 130, 132

Orthopnea, 25

Osteomalacia, 112

Osteoporosis, 112

Osteosclerosis, 112

Otitis media, 65

Otosclerosis, 64

Oxygen deficit, 117

Pacemakers, 15, 19, 37

Palpitations (see: Heart arrhythmias)

Pancarditis, 33

Paralysis agitans (see: Parkinson's disease)

Paranoia, 54

Paranoid personality disorder, 54

Paranoid schizophrenia, 54

Paraplegia, 91

Parathyroid disorders, 107, 129, 131

Parathyroid tetany (see: Hypoparathyroidism)

Parkinson's disease, 90, 97

Paroxysmal atrial tachycardia, 18

Paroxysmal nocturnal dyspnea, 25

Paroxysmal vertigo, 64

Parry's disease, 129

Partial aphasia (see: Aphasia)

Partial seizures, 59

Pericarditis, 30, 111

Peripheral vascular disorders, 42, 50, 51, 65, 93, 100, 111, 123

Peritoneal dialysis, 111

Petit mal epilepsy, 59

Phlebothrombosis, 100

Phobic neurosis, 54

Pickwickian syndrome, 118

Pituitary disorders, 90, 105

Pituitary dwarfism, 106

Pituitary myxedema, 105

Poliomyelitis, 90

Post cardiotomy syndrome, 30
Post MI syndrome (see: Dressler's syndrome)
Posterior pituitary disorders, 105
Postoperative tetany (see: Hyperparathyroidism)
Postphlebotic syndrome, 102
Prenatal deafness, 63
Primary aldosteronism, 107
Primary alveolar hypoventilation, 118
Primary growth (neoplasm), 84
Primary pulmonary hypertension, 27, 119
Prosthetic devices, 92
Psychomotor epilepsy, 59
Psychophysiologic disorders, 54
Psychosis, 54
Ptosis, 78
Pulmonary edema, 25, 110, 119
Pulmonary embolism, 118
Pulmonary emphysema, 117
Pulmonary fibrosis, 86, 117
Pulmonary hypersensitivity, 116
Pulmonary hypertension, 115, 119
Pulmonary infarction, 93, 100, 118
Pulmonary tuberculosis, 117
Quadriplegia, 91, 124
Remission maintenance chemotherapy, 86
Renal allograft, 110, 112
Renal disorders, 30, 85, 132
Renal failure (see: Kidney failure)
Respiratory diseases, 25, 27, 78, 86, 100, 110, 115
Respiratory insufficiency, 115
Rheumatoid arthritis, 90
Right ventricular failure, 25
Sarcomas, 84
Schizoid personality disorder, 54
Schizophrenia, 54
Scoliosis, kyphoscoliosis, 118
Scotoma, 47
Seizures, 58
Senile dementia, 54
Sensory-neural transmission disorders, 63
Sexual deviation, 54
Sheehan's syndrome, 105
Silicosis, 117
Simmond's disease (see: Hypopituitarism)
Sleep paralysis, 81
Solid tumors, 84
Sound conduction disorders, 63

Spastic cerebral palsy, 46

Spontaneous remissions, 84

Status asthmaticus, 116

Stokes-Adams syndrome, 14, 19, 22

Stroke, 19, 32, 40, 51, 65, 73, 90, 93, 101, 123

Struma lymphomatosa (see: Hashimoto's disease)

Sudden death, 42

Tachycardia, 15

Thromboangiitis obliterans, 101

Thrombocytopenia, 85

Thrombophlebitis, 100

Thrombus, 123

Thyroid crisis (see: Thyroid storm)

Thyroid diseases, 79, 129

Thyroid disorders, 107

Thyroid storm, 129

Thyrotoxicosis, 129

Tidal volume, 117

Tinnitus, 64, 124

Total aphasia (see: Aphasia)

Triplegia, 91

Tubercular node, 115

Tympanic membrane, 63

Unstable angina (see: Acute coronary insufficiency)

Uremia, 85, 111

Uremic pericarditis, 30

Varicose veins, 102

Ventilatory capacity measurements, 117

Ventricles, 19

Ventricular enlargement (distension, dilatation), 23, 42

Ventricular extrasystole, 42

Ventricular fibrillation, 19, 41

Ventricular premature beats, 42

Ventricular tachycardia, 19, 42

Vestibular reflex, 64

Wolff-Parkinson-White syndrome, 20

WPW syndrome (see: Wolff-Parkinson-White syndrome)