

REFLEX TESTING METHODS  
for  
EVALUATING C.N.S. DEVELOPMENT

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# REFLEX TESTING METHODS for EVALUATING C.N.S. DEVELOPMENT

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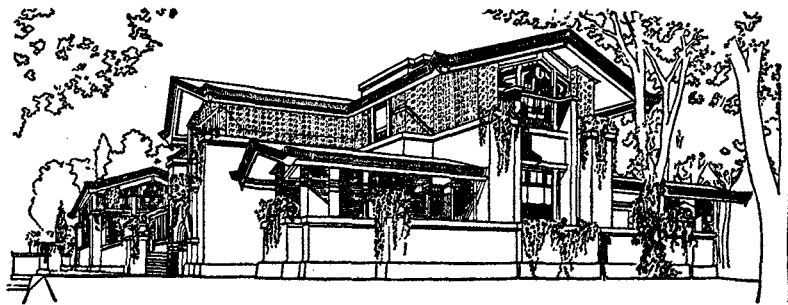
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*This manual is dedicated to the therapists in my department for their conscientious and diligent cooperation in the application of a method of treatment that has been found effective for the child with cerebral palsy.*



## FOREWORD

**I**N THE development of the program for the cerebrally handicapped at Newington Children's Hospital, the necessity for an increasing awareness of what is normal has prompted Miss Fiorentino and others to better document the normal reflex development in children.

Miss Fiorentino has accomplished this through considerable personal effort. She is gifted with a rare ability to impart this information to physicians, other therapists and students. Requests for her knowledge of the subject led her to the writing of this manual which should provide a better understanding of the reflex patterns of both normal children and those afflicted with neurological disorders, and should aid medical and paramedical persons dealing with such children in establishment of diagnosis, programming and recording of progress in their habilitation.

BURR H. CURTIS, M.D.  
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## PREFACE

IT IS believed that a clearer understanding of normal, neurophysiological development and methods of testing will be helpful to physicians and paramedical personnel working closely with handicapped children. It is hoped that this will assist in the evaluation, diagnosis and assessment of children through six years of age, and in programming rehabilitation of neurophysiologically involved children. The testing methods will be of value to the following:

### ***Pediatricians***

In the initial and periodic examination of all infants and children through six years of age.

### ***Neurologists***

In the diagnosis and evaluation of infants and children where abnormal reflexive reactions are suspected.

### ***Orthopaedists***

For the assessment of patients who would lend themselves to a neurophysiologically oriented treatment.

### ***Physiatrists***

A basis for diagnosis and program-planning for rehabilitation.

### ***Occupational, Physical and Speech Therapists***

To determine the maturational level and abnormal reflexes for a treatment program.



## ACKNOWLEDGMENTS

**G**RATEFUL appreciation is extended to Edward D. Mysak, Ph.D., former speech pathologist at Newington Children's Hospital, for introducing this method to the Hospital and this department, and without whose guidance and teaching in the basic theories of the Neurophysiological Approach, this manual would not have been possible at this time.

To the following members of the staff of the Newington Children's Hospital for their assistance and cooperation in making this manual possible: Burr H. Curtis, M.D., Medical Director; John C. Allen, M.D., Visiting Physiatrist; Otto G. Goldkamp, M.D., Associate Physiatrist; Walter F. Jennings, M.D., Myron E. Shafer, M.D., and Charles W. Goff, M.D., members of the orthopaedic staff; Miss Carol Nathan, O.T.R., Assistant Director of Occupational Therapy; Miss Ann P. Grady, O.T.R., staff therapist; Mr. William McCarthy, high school teacher; the photography department; the children and their parents who allowed their pictures to be used.

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Photographs taken by Miss Carol Nathan, O.T.R.

M.R.F.



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for  
EVALUATING C.N.S. DEVELOPMENT





## INTRODUCTION

**E**ARLY diagnosis of persistent abnormal reflexes may be of great significance to a more effective functioning of the cerebral palsied child. We feel that knowledge of normal and abnormal reflex responses and their effect upon motor development is needed to provide a basis for evaluation in the diagnosis and treatment of the cerebral palsied child and certain other cerebral dysfunctions.

Since Little applied the term "spastic paralysis" to all cerebral palsied children in 1843, much research has been undertaken in an attempt to understand the physical, mental, perceptual, visual, auditory, epileptic and psycho-social manifestations of neurological dysfunctions. Though scientist and clinician have contributed much to our knowledge, there is need for further investigation in both theory and therapy of C.N.S. abnormalities.

Some of the recent advances in this country are based upon knowledge of the neurophysiological implication of reflexive maturation of the C.N.S. The rationale of treatment and therapeutic application of this approach was described by the Bobaths *et al.* Knowledge gained from this approach can be applied to testing and evaluating the normal, sequential growth and maturation of any child.

## PURPOSE

**T**HE purpose of this manual is to orient the physicians and the various paramedical disciplines to a method of evaluating C.N.S. dysfunction utilizing neurophysiological principles. To accomplish its goal, the manual presents the following:

1. Normal sequential development of reflexive maturation.
2. Possible abnormal responses found in individuals with C.N.S. disorders, such as cerebral palsy.
3. Reflex Testing and Motor Development Charts to assist in the rating of normal and abnormal responses (see pages 50-52).

### ***Purpose of Testing***

To determine neurophysiological reflexive maturation of the C.N.S. at the spinal, brain stem, midbrain and cortical levels. This maturation has been determined in animals, as described by Sherrington. We feel that we can assume similar reflexes seen in humans might correlate in their pattern of neurological maturation.

### ***Who Should Test***

Tests are designed for all those evaluating and treating children with neurophysiological dysfunctions, namely, the general practitioner, pediatrician, neurologist, orthopaedist, physiatrist, occupational, physical and speech therapists.

### ***When to Test***

The initial and periodic examination of all children from infancy, of full-term gestation, through the age of six years, as well as older children demonstrating abnormal reflexes. Therapy should begin before children develop abnormal patterns of turning, sitting, crawling and walking. *Early referral* of patients for reflex therapy cannot be over-emphasized.

## RATIONALE

**W**E feel that primitive reflexes are essential in normal development. Response to these reflexes prepares the child for progressive development, such as rolling over, sitting, crawling, standing, etc. It is to be understood that a child may omit one level of development, such as creeping, and still continue the normal process of developmental maturation. In normal development, these primitive spinal and brain stem reflexes gradually diminish in order that higher patterns of righting and equilibrium reactions may become manifested. When inhibitory control of higher centers is disrupted or delayed, primitive patterns dominate to the exclusion of higher, integrated sensorimotor activities. Certain neurologic dysfunctions are believed to result from specific C.N.S. lesions. Such lesions release primitive, abnormal reflexes from inhibition normally exerted by higher centers. These more primitive reflexes result in abnormalities manifested by phylogenetically older postures and movements and abnormal muscle tone, as seen in cerebral palsied children.

Following the above concept, the cerebral palsied child can be classified according to sequential development of reflex maturation and evaluated in terms of the status of his particular level of reflexology and abnormal muscle tone. There are three levels of reflexive development:

**Apedal**—predominance of primitive spinal and brain stem reflexes with motor development of a prone or supine-lying creature.

**Quadrupedal**—predominance of midbrain development with righting reactions and motor development that of a child who can right himself, turn over, assume crawling and sitting positions.

**Bipedal**—at cortical level of development reveals equilibrium reactions,

TABLE I  
NORMAL SEQUENTIAL DEVELOPMENT

<i>Levels of C.N.S. Maturation</i>	<i>Corresponding Levels of Reflexive Development</i>	<i>Resulting Levels of Motor Development</i>
Spinal and/or Brain Stem	Apedal Primitive Reflexes	Prone-lying Supine-lying
Midbrain	Quadrupedal Righting Reactions	Crawling Sitting
Cortical	Bipedal Equilibrium Reactions	Standing Walking

with motor development that of a child who can assume the standing position and ambulate.

In neurologic dysfunction, varying degrees and combinations of the above levels may be seen in any one child. Knowledge of normal and abnormal reflex responses and their effect on motor behavior will aid in better understanding the nature of the neurophysiologic dysfunction, and in providing a basis for evaluation.

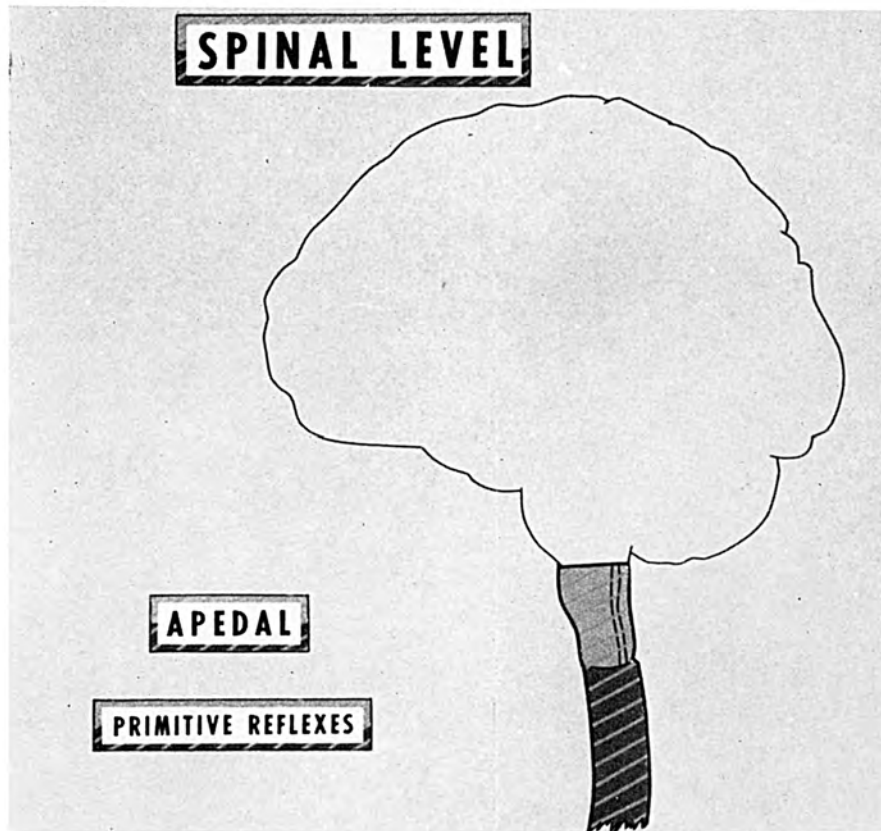
## PROCEDURE

THE following pages present photographs and explanation of the four levels of the C.N.S. in their sequence of reflexive maturation. Photographs and explanations of reflex responses within the four levels and test positions with normal and abnormal responses are illustrated. *Negative reactions* of the first two levels imply *normal* responses; *positive reactions*, *abnormal* responses. *Negative reactions* of the upper two levels imply *abnormal* responses; *positive reactions*, *normal* responses. Each reflex tested can be rated on a Reflex Testing Chart and resulting functional responses on a Motor Development Chart.

These reflexes are normal within certain age limits and should be interpreted as abnormal beyond those limits. Normal growth and developmental levels vary somewhat; therefore, *age levels* are *approximate*.

## SPINAL LEVEL

**S**PINAL reflexes are mediated by areas of the C.N.S. Deiters' nucleus which is in the lower third of the pons.



Spinal reflexes are “phasic” or movement reflexes which coordinate muscles of the extremities in patterns of either total flexion or extension. Positive or negative reactions to spinal reflex testing may be present in the normal child within the first two months of life. Positive reactions persisting beyond two months of age may be indicative of delayed maturation of the C.N.S. Negative reactions are normal. Complete domination by these primitive spinal reflexes results in an apedal (prone, supine-lying) creature.

***Flexor Withdrawal   Extensor Thrust   Crossed Extension***

## Flexor Withdrawal

### Negative Reaction

#### **Test Position**

Patient supine.  
Head in mid-position.  
Legs extended.

#### **Test Stimulus**

Stimulate sole of foot.

#### **Negative Reaction**

Controlled maintenance of stimulated leg in extension or volitional withdrawal from irritating stimulus.

#### **Positive Reaction**

Uncontrolled flexion response of stimulated leg. (Do not confuse with response to tickling.)



### Positive Reaction

Positive reaction is normal up to two months of age. Positive reaction after two months of age may be one indication of delayed reflexive maturation.

**Extensor Thrust****Negative Reaction****Test Position**

Patient supine.  
Head in mid-position.  
One leg extended, opposite  
leg flexed.

**Test Stimulus**

Stimulate sole of foot of  
flexed leg.

**Negative Reaction**

Controlled maintenance of  
leg in flexion.

**Positive Reaction**

Uncontrolled extension of  
stimulated leg. (Do not  
confuse with response to  
tickling.)

**Positive Reaction**

Positive reaction is normal up to two months of age. Positive reaction after two months of age may be one indication of delayed reflexive maturation.



### Crossed Extension

#### Negative Reaction

**Test Position**

Patient supine.  
Head in mid-position.  
One leg flexed, opposite leg extended.

**Test Stimulus**

Flex the extended leg.

**Negative Reaction**

On flexion of the extended leg, the opposite leg will remain flexed.

**Positive Reaction**

On flexion of the extended leg, the opposite, or initially flexed, leg will extend.



#### Positive Reaction

Positive reaction is normal up to two months of age. Positive reaction after two months of age may be one indication of delayed reflexive maturation.

**Crossed Extension****Negative Reaction****Test Position**

Patient supine.  
Head in mid-position.  
Legs extended.

**Test Stimulus**

Stimulate the medial surface  
of one leg by tapping.

**Negative Reaction**

No reaction of either leg  
upon stimulation.

**Positive Reaction**

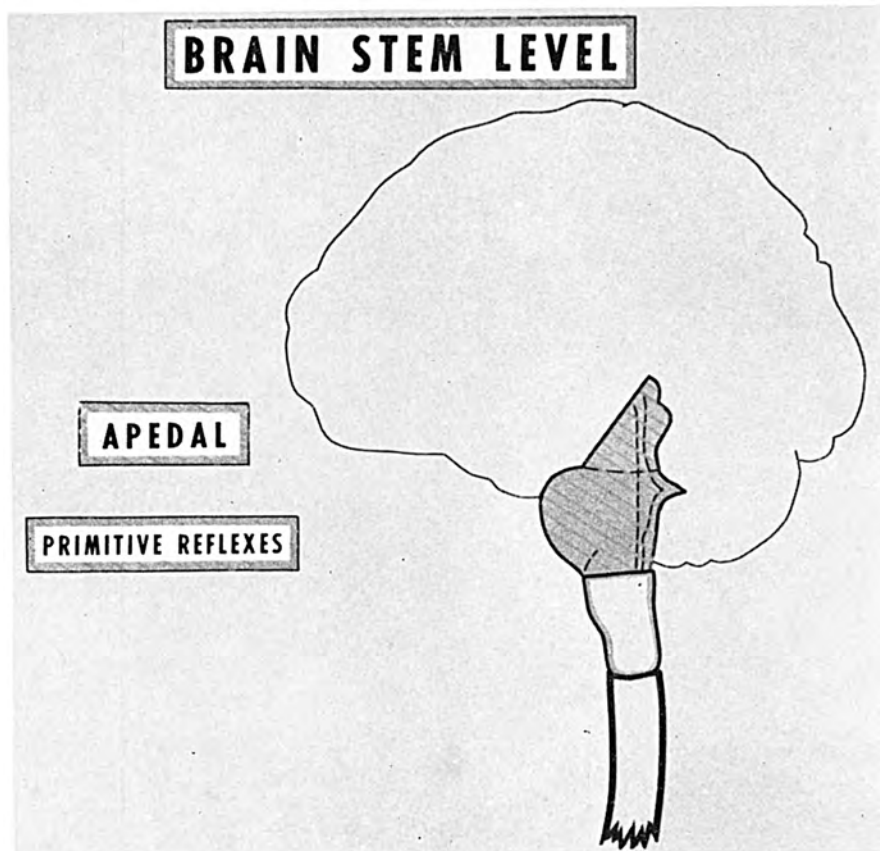
Opposite leg adducts,  
internally rotates and foot  
plantar flexes. (Typical  
scissor position.)

**Positive Reaction**

Positive reaction is normal up to two months of age. Positive reaction after two months of age may be one indication of delayed reflexive maturation.

## BRAIN STEM LEVEL

**B**RAIN stem reflexes are mediated by areas from Deiters' nucleus to the red nucleus which sits at the most caudal level of the basal ganglia.



Brain stem reflexes are “static” postural reflexes and effect changes in distribution of muscle tone throughout the body, either in response to a change of the position of head and body in space (by stimulation of the labyrinths), or in the head in relation to the body (by stimulation of proprioceptors of the neck muscles). Positive or negative reactions to brain stem reflex testing may be present in the normal child within the first four to six months of life. Positive reactions persisting beyond six months of age may be indicative of delayed motor maturation of the C.N.S. Negative reactions are normal. Complete domination by these primitive brain stem reflexes results in an apedal (prone, supine-lying) creature.

*Asymmetrical Tonic Neck    Symmetrical Tonic Neck*  
*Tonic Labyrinthine—Supine    Tonic Labyrinthine—Prone    Associated Reactions*  
*Positive Supporting Reaction    Negative Supporting Reaction*

## Asymmetrical Tonic Neck

### Negative Reaction



### *Test Position*

Patient supine.  
Head in mid-position.  
Arms and legs extended.

### *Test Stimulus*

Turn head to one side.

### *Negative Reaction*

No reaction of limbs on either side.



### *Positive Reaction*

Extension of arm and leg on face side, or increase in extensor tone; flexion of arm and leg on skull side, or increase in flexor tone.

### Positive Reaction

Positive reaction is normal up to four to six months of age. An obligatory ASTN reflex is pathologic at any age. Positive reactions after six months of age may be one indication of delayed reflexive maturation.