**Retained primitive reflexes: Perceptions of parents who have used Rhythmic Movement Training with their children**

2018

https://www.ncbi.nlm.nih.gov/pubmed/29529872

# Persisting primitive reflexes in medication-naïve girls with attention-deficit and hyperactivity disorder

2013

https://www.ncbi.nlm.nih.gov/pubmed/24092983

# The impact of rehabilitation carried out using the Masgutova Neurosensorimotor Reflex Integration method in children with cerebral palsy on the results of brain stem auditory potential examinations

2012

https://www.ncbi.nlm.nih.gov/pubmed/23214200

# The Moro reaction: More than a reflex, a ritualized behavior of nonverbal communication

2017

https://www.ncbi.nlm.nih.gov/pubmed/28222331

# Persistent primary reflexes affect motor acts: Potential implications for autism spectrum disorder

2018

https://www.ncbi.nlm.nih.gov/pubmed/27595468

# Asymmetric tonic neck reflex and symptoms of attention deficit and hyperactivity disorder in children

2013

https://www.ncbi.nlm.nih.gov/pubmed/23659315

# Cognitive-motor interactions of the basal ganglia in development

2014

https://www.ncbi.nlm.nih.gov/pubmed/24592214

# Intrapartum synthetic oxytocin reduce the expression of primitive reflexes associated with breastfeeding

2015

https://www.ncbi.nlm.nih.gov/pubmed/25785487

# Persistence of primitive reflexes and associated motor problems in healthy preschool children.

# 2018

# https://www.ncbi.nlm.nih.gov/pubmed/29379547

# Trunk rotation due to persistence of primitive reflexes in early school-age children

# 2018

# https://www.ncbi.nlm.nih.gov/pubmed/29558021

# Retention of primitive reflexes and delayed motor development in very low birth weight infants.

# 1984

# https://www.ncbi.nlm.nih.gov/pubmed/6736257

# Prevalence of persistent primary reflexes and motor problems in children with readingdifficulties

# 2004

https://www.ncbi.nlm.nih.gov/pubmed/?term=McPhilips+M%2C+Sheehy+N.+Prevalence+of+persistent+primary+reflexes+and+motor+problems+in+children+with+reading+difficulties.+Dyslexia+2004%3B+10%3A+316-38.

# Retained primitive reflexes in children, clinical implications and targeted home-based interventions.

# 2019

https://www.ncbi.nlm.nih.gov/pubmed/31468794

# Moro Reflex.

https://www.ncbi.nlm.nih.gov/pubmed/31194330

# Primary reflex persistence in children with partial hearing.

2014

https://www.ncbi.nlm.nih.gov/pubmed/24742313

# Palmar Grasp Reflex

2020

<https://www.ncbi.nlm.nih.gov/books/NBK553133/>

# Primitive Reflexes

# 2020

# <https://www.ncbi.nlm.nih.gov/books/NBK554606/>

# Retained primitive reflexes in children, clinical implications and targeted home-based interventions.

# 2020

<https://www.ncbi.nlm.nih.gov/pubmed/31468794>

# Nociceptive Primitive Reflexes in Neurologically and Cognitively Healthy Aging Subjects.

2019

<https://www.ncbi.nlm.nih.gov/pubmed/30761966>

# Role of the asymmetrical tonic neck reflex in hand visualization in normal infants.

2020

<https://www.ncbi.nlm.nih.gov/pubmed/443149>

**The Impact of MNRI Therapy on the Levels of Neurotransmitters Associated with Inflammatory Processes**

2020

<https://www.ncbi.nlm.nih.gov/pubmed/32085403>

# The impact of rehabilitation carried out using the Masgutova Neurosensorimotor Reflex Integration method in children with cerebral palsy on the results of brain stem auditory potential examinations.

2012

<https://www.ncbi.nlm.nih.gov/pubmed/23214200>

# Primitive Reflexes

[Alexa K. Modrell](https://pubmed.ncbi.nlm.nih.gov/?term=Modrell+AK&cauthor_id=32119493)[1](https://pubmed.ncbi.nlm.nih.gov/32119493/#affiliation-1), [Prasanna Tadi](https://pubmed.ncbi.nlm.nih.gov/?term=Tadi+P&cauthor_id=32119493)[2](https://pubmed.ncbi.nlm.nih.gov/32119493/#affiliation-2)

In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 Jan.

2021 Mar 21.

**Free Books & Documents**

## Excerpt

Primitive reflexes are involuntary motor responses originating in the brainstem present after birth in early child development that facilitate survival. Several reflexes are important in the assessment of newborns and young infants. These central nervous system motor responses are eventually inhibited by 4 to 6 months of age as the brain matures and replaces them with voluntary motor activities but may return with the presence of neurological disease.

Copyright © 2022, StatPearls Publishing LLC.

<https://pubmed.ncbi.nlm.nih.gov/32119493/>

# Rooting Reflex

[Hannah Yoo](https://pubmed.ncbi.nlm.nih.gov/?term=Yoo+H&cauthor_id=32491568)[1](https://pubmed.ncbi.nlm.nih.gov/32491568/#affiliation-1), [Dana M. Mihaila](https://pubmed.ncbi.nlm.nih.gov/?term=Mihaila+DM&cauthor_id=32491568)[1](https://pubmed.ncbi.nlm.nih.gov/32491568/#affiliation-1)

In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 Jan.

2021 May 1.

**Free Books & Documents**

## Excerpt

The rooting reflex is one of the involuntary primitive motor reflexes, which are also known as the frontal release reflexes, that are mediated by the brainstem. It initiates when the corner of an infant’s mouth is stimulated. When the mouth is touched or stroked, the newborn will turn his or her head towards the stimulus and open the mouth with tongue thrusting. The rooting reflex is present at birth (approximately 28 week gestation) and lasts about 4 to 6 months until the frontal lobe of the cerebral cortex develops and suppresses the primitive motor reflexes. As the frontal lobe matures, the primitive reflexes are replaced with voluntary motor functions. The age when each primitive reflex disappears varies. For example, the plantar grasp reflex disappears after about 9 to 12 months.

Copyright © 2022, StatPearls Publishing LLC.

<https://pubmed.ncbi.nlm.nih.gov/32491568/>

# Tonic Neck Reflex

[Cristine K. Arcilla](https://pubmed.ncbi.nlm.nih.gov/?term=Arcilla+CK&cauthor_id=32644636), [Renato C. Vilella](https://pubmed.ncbi.nlm.nih.gov/?term=Vilella+RC&cauthor_id=32644636)[1](https://pubmed.ncbi.nlm.nih.gov/32644636/#affiliation-1)

In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 Jan.

2021 May 9.

**Free Books & Documents**

## Excerpt

Primitive reflexes are innate, automatic motor patterns and reactions emerging during fetal life until after birth crucial for an infant's survival. These reflexes are being integrated and replaced gradually in term infants into higher-level righting, support, and protective postural reactions. This dynamic transition is part of the neuropsychomotor organization and development, physiological maturation, fine-tuning of the nervous system, which includes motor centers in the brainstem to the cerebral cortex - occurring in response to increasing environmental influences and demands. The involved reflex integration allows a change in the quality of movements, from clumsy to more natural, spontaneous, and efficient sensory processing, internal postural control, and acquired, goal-directed, precise, and well-coordinated voluntary motor skills and movements against gravity, which in effect, affect learning and behavior of a child in his later stages of life.

<https://pubmed.ncbi.nlm.nih.gov/32644636/>

# [Primitive reflex in premature healthy newborns during the first year]

[Article in Portuguese]

[Lygia Olhweiler](https://pubmed.ncbi.nlm.nih.gov/?term=Olhweiler+L&cauthor_id=16100977)[1](https://pubmed.ncbi.nlm.nih.gov/16100977/#affiliation-1), [Alexandre Rodrigues da Silva](https://pubmed.ncbi.nlm.nih.gov/?term=da+Silva+AR&cauthor_id=16100977), [Newra Tellechea Rotta](https://pubmed.ncbi.nlm.nih.gov/?term=Rotta+NT&cauthor_id=16100977)

**Free article**

## Abstract

A non-controlled, prognostic cohort study was performed with the aim of establishing markers of neurological development and defining a clinical and epidemiological profile of preterm newborns at 3, 6, 9, and 12 months of gestation-corrected age in terms of primitive reflexes evolution.

**Results:**At 3 months old of corrected age, all primitive reflexes were present. At 6 months old, all children showed plantar grasp and 2.7% still showed Moro and palmar grasp. Plantar grasp was the unique primitive reflex found at 9 and 12 months of corrected age.

**Conclusion:**It was possible to evaluate the occurence, as well as the disappearing of primitive reflexes in preterm newborns. The results show delay in the disappearing of primitive reflexes even with the use of corrected age.

<https://pubmed.ncbi.nlm.nih.gov/16100977/>

Randomized Controlled Trial

Psychosomatics. Nov-Dec 2011;52(6):507-12.doi: 10.1016/j.psym.2011.06.008.

# Primitive reflexes associated with delirium: a prospective trial

[Stephen E Nicolson](https://pubmed.ncbi.nlm.nih.gov/?term=Nicolson+SE&cauthor_id=22054619)[1](https://pubmed.ncbi.nlm.nih.gov/22054619/#affiliation-1), [Brenda Chabon](https://pubmed.ncbi.nlm.nih.gov/?term=Chabon+B&cauthor_id=22054619), [Kenneth A Larsen](https://pubmed.ncbi.nlm.nih.gov/?term=Larsen+KA&cauthor_id=22054619), [Susan E Kelly](https://pubmed.ncbi.nlm.nih.gov/?term=Kelly+SE&cauthor_id=22054619), [Adam W Potter](https://pubmed.ncbi.nlm.nih.gov/?term=Potter+AW&cauthor_id=22054619), [Theodore A Stern](https://pubmed.ncbi.nlm.nih.gov/?term=Stern+TA&cauthor_id=22054619)

## Abstract

**Background:**The presence of primitive reflexes (PRs) may have diagnostic or prognostic value in the evaluation of cognitive impairment.

**Objective:**We hypothesized that the presence of preoperative PRs would predict the development of postoperative delirium and that the emergence of PRs postoperatively would be positively associated with the emergence of delirium.

**Methods:**Patients participating in a larger study on the prophylaxis of postoperative delirium were evaluated for the presence of six PRs (grasp reflex [left and right], palmomental reflex [left and right], glabellar tap, and snout reflex), preoperatively and postoperatively. The presence of PRs was then correlated with the development of delirium.

**Results:**Of the 79 patients studied, 29% (n = 23) developed delirium during the postoperative period. The preoperative presence of one PR did not predict the development of delirium, but the only patient with >1 PR preoperatively went on to develop delirium in the postoperative period. Similarly, having one frontal release sign in the postoperative period did not correlate with delirium, while the appearance of more than one PR was associated with a greater likelihood of delirium. Of the 11 patients who had two or more frontal release signs during one postoperative examination, six (55%) developed delirium. Of the five patients who showed three or more frontal release signs, 4 (80%) developed delirium.

**Conclusion:**Our study is the first to investigate the relationship between the appearance of PRs and the development of delirium. We have provided some evidence that PRs are associated with acute CNS dysfunction.

Copyright Â© 2011 The Academy of Psychosomatic Medicine. Published by Elsevier Inc. All rights reserved.

<https://pubmed.ncbi.nlm.nih.gov/22054619/>

J Neurol. 2006 Jul;253(7):935-41.doi: 10.1007/s00415-006-0138-7. Epub 2006 Mar 6.

# Prevalence of primitive reflexes and the relationship with cognitive change in healthy adults: a report from the Maastricht Aging Study

[M P J van Boxtel](https://pubmed.ncbi.nlm.nih.gov/?term=van+Boxtel+MP&cauthor_id=16511641)[1](https://pubmed.ncbi.nlm.nih.gov/16511641/#affiliation-1), [H Bosma](https://pubmed.ncbi.nlm.nih.gov/?term=Bosma+H&cauthor_id=16511641), [J Jolles](https://pubmed.ncbi.nlm.nih.gov/?term=Jolles+J&cauthor_id=16511641), [F W Vreeling](https://pubmed.ncbi.nlm.nih.gov/?term=Vreeling+FW&cauthor_id=16511641)

## Abstract

**Objectives:**Primitive reflexes (PR) generally disappear early in life but may reappear later, in which case they are often associated with chronic neurological conditions, such as dementia or Parkinson's disease. Studies have shown that the presence of PRs may be indicative of both the severity and rate of progression of these diseases and may be the result of disinhibition of cortical networks. The association between PRs and cognitive function in usual ageing is unclear. We investigated whether the occurrence, amplitude, and persistence of four nociceptive (glabbelar tap, palmomental, pollicomental, and snout reflexes), three prehensile reflexes (suck, palmar grasp, and rooting), and two other reflexes (mouth open finger-spread and nuchocephalic reflexes) were related to performance in specific cognitive domains in normal ageing individuals.

**Methods:**Four-hundred and seventy normal aging participants (25-82 years) in the Maastricht Aging Study (MAAS), were included in the study. They were neurologically and cognitively screened at baseline and were retested after 3 (only individuals aged 50 years and older at baseline) and 6 years.

**Results:**The prevalence of most PRs increased with age: 47% of men aged 25-45 years had at least one PR, compared with 73% of men aged 65-85 year (p = 0.002). In women these percentages were 51 and 75, respectively (p=0.008). The prevalence, amplitude, and persistence of PRs were unrelated to cognition at baseline or at the 3- or 6-year follow-up.

**Conclusions:**The prevalence of particularly nociceptive reflexes rises substantially with increasing age in normal individuals. However, the presence of PRs cannot be considered to be a marker of cognitive decline in normal aging individuals.

<https://pubmed.ncbi.nlm.nih.gov/16511641/>

Minerva Pediatr. 2020 Jun 16. doi: 10.23736/S0026-4946.20.05784-9. Online ahead of print.

# Primitive reflexes in very low birth weight infants later diagnosed with autism spectrum disorder

[Yukiyo Nagai](https://pubmed.ncbi.nlm.nih.gov/?term=Nagai+Y&cauthor_id=32549029)[1](https://pubmed.ncbi.nlm.nih.gov/32549029/#affiliation-1), [Kayo Nomura](https://pubmed.ncbi.nlm.nih.gov/?term=Nomura+K&cauthor_id=32549029)[2](https://pubmed.ncbi.nlm.nih.gov/32549029/#affiliation-2), [Osamu Uemura](https://pubmed.ncbi.nlm.nih.gov/?term=Uemura+O&cauthor_id=32549029)[3](https://pubmed.ncbi.nlm.nih.gov/32549029/#affiliation-3)

## Abstract

**Background:**As early screening and diagnosis is very important in treatment and intervention of Autism Spectrum Disorder, we investigated the relationship between primitive reflexes and Autism Spectrum Disorder (ASD).

**Methods:**Of 88 very low birth weight infants (<1500g) born from April 2010 to March 2012, subjects comprised 38 examined for 18 primitive reflexes between age 38 and 45 wks corrected age and followed-up over 6 yrs. ASD was diagnosed using Diagnostic and Statistical Manual of Mental Disorders fifth edition (DSM-5) and Autism Diagnostic Observation Schedule Second Edition (ADOS-2). We compared the number of abnormal primitive reflexes between two groups (11 children with and 19 without ASD) after excluding eight children with cerebral palsy in this case-control study.

**Results:**Twenty cases showed one to four hypoactive reflex(es) and two showed one hyperactive reflex together with hypoactive reflex(es). Ten out of 11 cases with ASD had one to four abnormal reflex(es). The number of abnormal hypoactive primitive reflexes was significantly higher in the ASD group (p=0.002).

**Conclusions:**The result suggests primitive reflexes can be one of the key elements in very early infancy to identify ASD in low birth weight infants. Abnormal hypoactive primitive reflex of low birth weight infants with ASD may inform future research of the pathogenesis of ASD.

Res Dev Disabil. 2018 Dec;83:287-295.doi: 10.1016/j.ridd.2016.07.010. Epub 2016 Aug 29.

# Persistent primary reflexes affect motor acts: Potential implications for autism spectrum disorder

[Alice Chinello](https://pubmed.ncbi.nlm.nih.gov/?term=Chinello+A&cauthor_id=27595468)[1](https://pubmed.ncbi.nlm.nih.gov/27595468/#affiliation-1), [Valentina Di Gangi](https://pubmed.ncbi.nlm.nih.gov/?term=Di+Gangi+V&cauthor_id=27595468)[2](https://pubmed.ncbi.nlm.nih.gov/27595468/#affiliation-2), [Eloisa Valenza](https://pubmed.ncbi.nlm.nih.gov/?term=Valenza+E&cauthor_id=27595468)[3](https://pubmed.ncbi.nlm.nih.gov/27595468/#affiliation-3)

**Free article**

## Abstract

In typical motor development progress in use of goal-directed actions and communicative gestures depends on the inhibition of several primitive reflexes, especially those that involve the hand or mouth. This study explored the relationship between the persistence of primitive reflexes that involve the hand or mouth and the motor repertoire in a sample of 12- to 17-month-old infants. Moreover, since children with Autism Spectrum Disorders (ASD) often have difficulty in performing skilled movements and show poor gesture repertoire, and since ASD represents the upper extreme of a constellation of traits that may be continuously distributed in the general population, we investigated the relationship between the persistence of primitive reflexes in the same sample of infants and the subclinical autistic traits measured in their parents. Results revealed that the persistence of the primitive reflexes correlated with motor repertoire irrespective of infant's age, and it was greater among infants whose parents had more subclinical autistic traits. Our findings suggest that the persistence of primitive reflexes might alter the developmental trajectory of future motor ability and therefore their evaluation might be an early indicator of atypical development.

**Keywords:**Broader Autism Phenotype; Communicative gestures; Motor acts; Primitive reflexes.

Copyright © 2016 The Authors. Published by Elsevier Ltd.. All rights reserved.

<https://pubmed.ncbi.nlm.nih.gov/27595468/>

J Speech Lang Hear Res. 2021 Mar 17;64(3):935-948.doi: 10.1044/2020\_JSLHR-19-00423. Epub 2021 Feb 23.

# Developmental Language Disorder and Uninhibited Primitive Reflexes in Young Children

[Maria Matuszkiewicz](https://pubmed.ncbi.nlm.nih.gov/?term=Matuszkiewicz+M&cauthor_id=33621124)[1](https://pubmed.ncbi.nlm.nih.gov/33621124/#affiliation-1), [Tadeusz Gałkowski](https://pubmed.ncbi.nlm.nih.gov/?term=Ga%C5%82kowski+T&cauthor_id=33621124)[1](https://pubmed.ncbi.nlm.nih.gov/33621124/#affiliation-1)

## Abstract

**Purpose**

Developmental language disorder (DLD) is a developmental disorder where children fail to acquire language in the absence of a clear cause. Many studies have reported general motor deficits in children with DLD, but no studies have uncovered a cure. The purpose of our study is to better understand the underlying motor deficits in DLD, starting from uninhibited primary reflexes-which are the most basic stage of motor development. Knowledge of this motor-language relationship should lead to earlier and more targeted interventions in young children with DLD.

**Method**

Children with DLD (*n* = 75, age range: 4-10 years) and 99 age-matched typically developing (TD) children completed a nonword repetition test to assess DLD and six other tests to assess primitive reflexes. Results Children with DLD demonstrated higher levels of persistent primitive reflexes compared to TD children. As the scores for neuromotor immaturity increased, nonword repetition test scores decreased (*r* = -.44, *p* < .01). Results indicated that TD children exhibited lower neuromotor immaturity (*M* = 7.63, *SD* = 3.75) compared to children with DLD (*M* = 13.51, *SD* = 4.47). All primitive reflexes (the Moro reflex, the symmetrical tonic neck reflex in flexion and in extension, the asymmetrical tonic neck reflex, the tonic labyrinthine reflex, and the Galant reflex) turned out to be statistically significantly different for the TD and DLD groups (*p* < .001). We also observed some differences between sexes.

**Conclusions**

Children with impaired language development underwent slower neuromotor development. However, further research is needed to determine whether motor intervention programs that inhibit primitive reflexes are helpful for children with DLD.

Front Psychiatry. 2021 Nov 8;12:430685.doi: 10.3389/fpsyt.2021.430685. eCollection 2021.

# Disinhibition of Primitive Reflexes in Attention Deficit and Hyperactivity Disorder: Insight Into Specific Mechanisms in Girls and Boys

[Petr Bob](https://pubmed.ncbi.nlm.nih.gov/?term=Bob+P&cauthor_id=34819879)[1](https://pubmed.ncbi.nlm.nih.gov/34819879/#affiliation-1), [Jana Konicarova](https://pubmed.ncbi.nlm.nih.gov/?term=Konicarova+J&cauthor_id=34819879)[1](https://pubmed.ncbi.nlm.nih.gov/34819879/#affiliation-1)[2](https://pubmed.ncbi.nlm.nih.gov/34819879/#affiliation-2), [Jiri Raboch](https://pubmed.ncbi.nlm.nih.gov/?term=Raboch+J&cauthor_id=34819879)[1](https://pubmed.ncbi.nlm.nih.gov/34819879/#affiliation-1)

**Free PMC article**

## Abstract

**Objective:** Cognitive and motor disintegration and other functional disturbances in various neuropsychiatric disorders may be related to inhibitory deficits that may manifest as a persistence or re-expression of primitive reflexes and few recent data suggest that these deficits may occur in Attention Deficit and Hyperactivity Disorder (ADHD). **Methods:** We have tested a hypothesis to which extent ADHD symptoms and balance deficits are related to persisting primitive reflexes, such as Asymmetric Tonic Neck Reflex (ATNR) and Symmetric Tonic Neck Reflex (STNR) in 80 medication-naïve children with ADHD (40 boys and 40 girls) in the school age (8-11 years) and compared these data with a control group of 60 children (30 boys and 30 girls). **Results:** These data show new finding that ADHD symptoms and balance deficits are strongly and specifically associated with persistent ATNR in girls and STNR in boys. **Conclusions:** These results provide first evidence in medical literature that ADHD in girls and boys is specifically related to distinguished neurological developmental mechanisms related to disinhibition of primitive reflexes.

**Keywords:**ADHD (Attention Deficit and Hyperactivity Disorder); Asymmetric Tonic Neck Reflex; Symmetric Tonic Neck Reflex; balance deficits; developmental disorders; dissolution; primitive reflexes integration.

Copyright © 2021 Bob, Konicarova and Raboch.

### Conflict of interest statement

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

https://pubmed.ncbi.nlm.nih.gov/34819879/

Neurosci Lett. 2013 Nov 27;556:89-92.doi: 10.1016/j.neulet.2013.10.028. Epub 2013 Oct 21.

# Are effects of the symmetric and asymmetric tonic neck reflexes still visible in healthy adults?

[S M Bruijn](https://pubmed.ncbi.nlm.nih.gov/?term=Bruijn+SM&cauthor_id=24157848)[1](https://pubmed.ncbi.nlm.nih.gov/24157848/#affiliation-1), [F Massaad](https://pubmed.ncbi.nlm.nih.gov/?term=Massaad+F&cauthor_id=24157848), [M J Maclellan](https://pubmed.ncbi.nlm.nih.gov/?term=Maclellan+MJ&cauthor_id=24157848), [L Van Gestel](https://pubmed.ncbi.nlm.nih.gov/?term=Van+Gestel+L&cauthor_id=24157848), [Y P Ivanenko](https://pubmed.ncbi.nlm.nih.gov/?term=Ivanenko+YP&cauthor_id=24157848), [J Duysens](https://pubmed.ncbi.nlm.nih.gov/?term=Duysens+J&cauthor_id=24157848)

## Abstract

When a cat's head is rotated in a transverse plane to one side, the legs on that side of the body extend, while on the other side, they flex (asymmetric tonic neck reflexes ATNR). On the contrary, when the head is rotated in a sagittal plane both legs flex when the head flexes, and extend when the head extends (symmetric tonic neck reflexes STNR). These reflexes have also been found in newborn babies and are thought to be a motor primitive, which is suppressed later in life. Still, using a test in which children sit on hand and knees, the ATNR and STNR can be found in children up to 9 years of age. This may suggest that these reflexes may still be involved in motor control in these children. Whether this is also the case in full-grown adults has thus far only been studied using coarse methods. Thus, for the current study, we set out to measure in detail whether the ATNR/STNR can still be evoked in healthy adult subjects. We measured 10 subjects who were asked to sit on their hands and knees while (1) their head was rotated left and right by an experimenter, (2) their head was flexed and extended by an experimenter. Kinematics was registered using a Vicon system. Elbow and head angles were detrended, and a regression analysis was performed, to investigate the effects of head angle on elbow angle. Results clearly showed the existence of the ATNR and STNR in adult subjects. A next step will be to assess the effects of the ATNR and STNR during everyday motor control tasks, such as making head rotations while driving a bike.

**Keywords:**Asymmetric tonic neck reflex; Head movements; Reflexes; Symmetric tonic neck reflex.

Copyright © 2013 Elsevier Ireland Ltd. All rights reserved.

https://pubmed.ncbi.nlm.nih.gov/24157848/

# Retained Primitive Reflexes and Potential for Intervention in Autistic Spectrum Disorders

[Robert Melillo](https://pubmed.ncbi.nlm.nih.gov/?term=Melillo+R&cauthor_id=35873782)[1](https://pubmed.ncbi.nlm.nih.gov/35873782/#affiliation-1), [Gerry Leisman](https://pubmed.ncbi.nlm.nih.gov/?term=Leisman+G&cauthor_id=35873782)[1](https://pubmed.ncbi.nlm.nih.gov/35873782/#affiliation-1)[2](https://pubmed.ncbi.nlm.nih.gov/35873782/#affiliation-2), [Calixto Machado](https://pubmed.ncbi.nlm.nih.gov/?term=Machado+C&cauthor_id=35873782)[3](https://pubmed.ncbi.nlm.nih.gov/35873782/#affiliation-3), [Yanin Machado-Ferrer](https://pubmed.ncbi.nlm.nih.gov/?term=Machado-Ferrer+Y&cauthor_id=35873782)[3](https://pubmed.ncbi.nlm.nih.gov/35873782/#affiliation-3), [Mauricio Chinchilla-Acosta](https://pubmed.ncbi.nlm.nih.gov/?term=Chinchilla-Acosta+M&cauthor_id=35873782)[3](https://pubmed.ncbi.nlm.nih.gov/35873782/#affiliation-3), [Shanine Kamgang](https://pubmed.ncbi.nlm.nih.gov/?term=Kamgang+S&cauthor_id=35873782)[4](https://pubmed.ncbi.nlm.nih.gov/35873782/#affiliation-4), [Ty Melillo](https://pubmed.ncbi.nlm.nih.gov/?term=Melillo+T&cauthor_id=35873782)[5](https://pubmed.ncbi.nlm.nih.gov/35873782/#affiliation-5), [Eli Carmeli](https://pubmed.ncbi.nlm.nih.gov/?term=Carmeli+E&cauthor_id=35873782)[1](https://pubmed.ncbi.nlm.nih.gov/35873782/#affiliation-1)

**Free PMC article**

## Abstract

We provide evidence to support the contention that many aspects of Autistic Spectrum Disorder (ASD) are related to interregional brain functional disconnectivity associated with maturational delays in the development of brain networks. We think a delay in brain maturation in some networks may result in an increase in cortical maturation and development in other networks, leading to a developmental asynchrony and an unevenness of functional skills and symptoms. The paper supports the close relationship between retained primitive reflexes and cognitive and motor function in general and in ASD in particular provided to indicate that the inhibition of RPRs can effect positive change in ASD.

**Keywords:**autism spectrum disorders; bottom-up processing; maturational delay; neuronal synchrony; retained primitive reflexes; top-down processing.

Copyright © 2022 Melillo, Leisman, Machado, Machado-Ferrer, Chinchilla-Acosta, Kamgang, Melillo and Carmeli.

### Conflict of interest statement

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

<https://pubmed.ncbi.nlm.nih.gov/35873782/>