

(C)APD & AD/HD



Central Auditory Processing Disorder



- “The inability to understand spoken language in a meaningful way in the absence of what is commonly considered a hearing loss.” (Sineps and Hunter, 1997)
- “...auditory processing disorders can coexist with hearing loss...” (Bellis, 2002)

Sineps, D. and Hunter, L. (1997). I Can Hear But...When Auditory Perception and Listening Break Down: Implications For Language and Reading. Paper presented at the International Dyslexia Association Annual Conference, Minneapolis, MN, November 13, 1997, Session T-45.

Bellis, T.J. (2003). When The Brain Can't Hear: Unraveling The Mystery of Auditory Processing Disorder. New York, NY: Atria, p. 22.

Auditory Processing

“Auditory processing is the ability to attend, discriminate and understand the spoken message, particularly in the presence of competing stimuli and adverse listening conditions.” (p. 2)



Geffner, D. (June, 2006). Language and Auditory Processing Problems in ADHD. ADHD Report, 14 (3), 1-6.

Central Auditory Processing



“Central auditory processing is the perceptual processing of auditory information in the central nervous system. It involves several mechanisms that underlie abilities such as discrimination, recognition, temporal integration, localization of the signal in the presence of competing conditions and under degraded acoustic signals.” (p. 2)

Geffner, D. (June, 2006). Language and Auditory Processing Problems in ADHD. ADHD Report, 14 (3), 1-6.

NIDCD Definition of (C)APD

“Auditory processing is a term used to describe what happens when your brain recognizes and interprets the sounds around you. Humans hear when energy that we recognize as sound travels through the ear and is changed into electrical information that can be interpreted by the brain. The ‘disorder’ part of auditory processing disorder means that something is adversely affecting the processing or interpretation of the information.” (p. 1 of 3)

NIDCD (no date). Auditory Processing Disorders in Children. From website:
www.nidcd.nih.gov/health/voice/auditory.html.

American Speech-Language Hearing Association

Definition of (Central) Auditory Processing Disorder:

“(C)APD is a deficit in neural processing of auditory stimuli that is not due to higher order language, cognitive, or related factors. However, (C)APD may lead to or be associated with difficulties in higher order language, learning and communications functions. Although (C)APD may coexist with other disorders(e.g., attention deficit hyperactivity disorder [ADHD], language impairment, and learning disability) it is ***not the result of*** these disorders.” (p. 1 of 26)

American Speech-Language Hearing Association (April, 2005). Central Auditory Processing Disorders: Working Group on Auditory Processing Disorders, Technical Report. From website: www.asha.org/docs/html/TR2005-00043.html, p. 1 of 26.



Symptoms of (C)APD

“Children with auditory processing disorders appear to be uncertain about what they hear, and may have difficulties listening when there is background noise, following oral instructions and understanding rapid or degraded speech in the presence of normal peripheral hearing.” (p. 361)

Bamiou, D.E., Musiek, F.E., and Luxon, L.M. (2001). Aetiology and Clinical Presentations of Auditory Processing Disorders-A Review. Archives of Disease in Childhood, 85, 361-365.



Symptoms of (C)APD

- Difficulty performing multi-step directions
- Poor listening skills
- Slow auditory processing speed
- Language problems –developing vocabulary and understanding the spoken word, etc.
- Problems with reading, verbal and reading comprehension, spelling and vocabulary
- Poor academic performance



Symptoms of (C)APD

- Behavior problems
- Problems remembering and recalling information presented orally
- Problems attending to auditory information

NIDCD (no date). Auditory Processing Disorders in Children. From website:
www.nidcd.nih.gov/health/voice/auditory.html



Behavioral Symptoms of CAPD

- “difficulty understanding speech in the presence of competing background noise or reverberant acoustic environments
- problems with the ability to recognize the source of a signal
- difficulty hearing on the phone
- difficulty following rapid speech
- difficulty or inability to detect the subtle changes in the prosody that underlie humor and sarcasm



Behavioral Symptoms of CAPD

- difficulty learning a foreign language or novel speech materials, especially technical language
- difficulty maintaining attention
- a tendency to be easily distracted
- poor singing, musical ability, and/or appreciation of music
- academic difficulties, including reading, spelling and/or learning problems.” (p. 5)

American Academy of Audiology (August 24, 2010). Diagnosis, Treatment, and Management of Children and Adults with Central Auditory Processing Disorder. From website:

www.audiology.org/resources/documentlibrary/documents/CAPD%20guidelines%208-2010.pdf.



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American Academy of Audiology (August 24, 2010). Diagnosis, Treatment, and Management of Children and Adults with Central Auditory Processing Disorder. From website:

www.audiology.org/resources/documentlibrary/documents/CAPD%20guidelines%208-2010.pdf.

Central Auditory Processing Disorder



- CAPD is not well defined
- May be due to under myelinated neurons in the corpus callosum.
- Those with CAPD process sounds at a slower rate.
- High rate of Otitis Media (ear infections)

Barkley, R. A. (2002). ADHD and Oppositional Defiant Children. Seminar Presented February 19-20, 2002, Phoenix, AZ.

Sineps, D. and Hunter, L. (1997). I Can Hear But...When Auditory Perception and Listening Break Down: Implications for Language and Reading. Paper Presented at the International Dyslexia Association Annual Conference, Minneapolis, MN, November 13, 1997, Session T-45.

Bellis, T.J. (2002). When the Brain Can't Hear: Unraveling The Mystery of Auditory Processing Disorder. New York, NY: Atria.

Causes of CAPD



“Perhaps the most obvious examples are cases of complete central deafness, in which individuals show pronounced auditory deficits due to lesions existing primarily in the brain, despite presence of normal peripheral systems.” (p. 5)

American Academy of Audiology (August 24, 2010). Diagnosis, Treatment, and Management of Children and Adults with Central Auditory Processing Disorder.

From website:

www.audiology.org/resources/documentlibrary/documents/CAPD%20guidelines%208-2010.pdf

Causes of (C)APD



“In terms of pathophysiological mechanisms, APD may be classified as occurring in the presence of : neurological conditions; delayed central nervous system maturation; or other developmental disorders.” (p. 362)

Bamiou, D.E., Musiek, F.E., and Luxon, L.M. (2001). Aetiology and Clinical presentations of Auditory Processing Disorders-A Review. Archives of Disease in Childhood, 85, 361-365.

Causes of (C)APD



“Although most individuals with (C)APD do not exhibit frank lesions of the CANS (Central Auditory Nervous System), there is substantial evidence that many individuals with (C)APD do, upon autopsy, exhibit neuromorphological abnormalities in auditory areas of the CNS (Central Nervous System). Moreover, the same or similar patterns of test findings that are seen in anatomically confirmed central auditory dysfunction also appear in children and adults suspected of having (C)APD who exhibit no frank lesion or pathology.” (p. 10 of 26)

American Speech-Language Hearing Association (April, 2005). Central Auditory Processing Disorders: Working Group on Auditory Processing Disorders, Technical Report. From website: www.asha.org/docs/html/TR2005-00043.html, p. 10 of 26.

Causes of (C)APD

- Tumors of the Central Auditory Nervous System (CANS)
- Prematurity/Low Birth Weight
- Brain Damage
 - Meningitis
 - Head Trauma
 - Heavy Metal Poisoning
 - Lyme Disease
- Cerebrovascular Disorders
- Metabolic Disorders
- Epilepsy
- Delayed Maturation of the Auditory System

Bamiouu, B-F, Musiek, F.E., and Luxon, L.M. (2001). Aetiology and Clinical presentations of Auditory Processing Disorders-A Review. Archives of Disease in Childhood, 85, 361-365

Diagnosis of CAPD



“The diagnosis of (C)APD should be made on the basis of a carefully selected battery of sensitive and specific behavioral tests and electrophysiologic procedures, supplemented by observation and detailed case history.” (p. 5)

American Academy of Audiology (August 24, 2010). Diagnosis, Treatment, and Management of Children and Adults with Central Auditory Processing Disorder. From website:
www.audiology.org/resources/documentlibrary/documents/CAPD%20guidelines%208-2010.pdf.

Diagnosis of CAPD



“The diagnosis should be made by audiologists who have been properly trained in the area of (C)APD, including the administration and interpretation of these tests and procedures.” (p. 5)

American Academy of Audiology (August 24, 2010). Diagnosis, Treatment, and Management of Children and Adults with Central Auditory Processing Disorder.

From website:

www.audiology.org/resources/documentlibrary/documents/CAPD%20guidelines%208-2010.pdf

Diagnosis of CAPD



- Evaluations for (C)APD should be done in a soundproof room with acoustic control of environment and test stimuli.

American Academy of Audiology (August 24, 2010). Diagnosis, Treatment, and Management of Children and Adults with Central Auditory Processing Disorder.

From website:

www.audiology.org/resources/documentlibrary/documents/CAPD%20guidelines%208-2010.pdf.

(C)APD and Peripheral Hearing Loss

- The ASHA working group on (C)APD stated that (C)APD can be diagnosed in individual's with peripheral hearing loss.
- “The experienced audiologist can apply several strategies in administering and interpreting central auditory tests to minimize the degree to which peripheral hearing loss influences central auditory test interpretation.” (p 9 of 26)

American Speech-Language Hearing Association (April, 2005). Central Auditory Processing Disorders: Working Group on Auditory Processing Disorders, Technical Report. From website: www.asha.org/docs/html/TR2005-00043.html, p. 9 of 26.

(C)APD and Peripheral Hearing Loss

- (C)APD evaluations can be done on children, adolescents and adults.
- Such evaluations can even be done with those with peripheral hearing loss if special care and procedures are followed.

American Academy of Audiology (August 24, 2010). Diagnosis, Treatment, and Management of Children and Adults with Central Auditory Processing Disorder.
From website:
www.audiology.org/resources/documentlibrary/documents/CAPD%20guidelines%208-2010.pdf.

ADHD Vs CAPD



- “It is often too difficult to differentially diagnose the two, particularly since the rate of co-occurrence is so high.” (p. 2)
- 41 to 83% of children with CAPD have comorbid ADHD.
- It is not yet known what percentage of ADHD children have CAPD.

Geffner, D. (June, 2006). Language and Auditory Processing Problems in ADHD. ADHD Report, 14 (3), 1-6.

CAPD and AD/HD



- Comorbidity rates between 45 and 75%
- CAPD will often respond to stimulant medication. (Tannock and Brown, 2000)
- Audiologist Vs Psychologist/Psychiatrist:
 - CAPD or AD/HD?
- CAPD may be Inattentive AD/HD (Barkley, 2002)

Tannock, R. and Brown, T.E. (2000). Attention-Deficit Disorders in Children and Adolescents, In T.E. Brown (Ed.), Attention-Deficit Disorders and Comorbidities in Children, Adolescents, and Adults. Washington, DC: American Psychiatric Press, pp. 231-296.

Bellis, T.J. (2002). When the Brain Can't Hear: Unraveling The Mystery of Auditory Processing Disorder. New York, NY: Atria.

Barkley, R.A. (2002). AD/HD and Oppositional Defiant Children. Seminar Presented February 19-20, Phoenix, AZ.

Barkley on AD/HD Vs CAPD



“The relationship of ADHD to the language processing problem known as central auditory processing disorder (CAPD) is uncertain. Some researchers imply that they may not be separate disorders at all, given that teacher ratings of inattention in children with ADHD were significantly related to several tests of auditory processing. The problem here is largely though not entirely due to problems in definition.” (p. 131)

Barkley, R.A. (2006). Attention –Deficit Hyperactivity Disorder, 3rd Edition. New York, NY: Guilford, 131.

Barkley on AD/HD Vs CAPD



“Children with ADHD often have difficulty with auditory vigilance or attention..., and so they may automatically qualify for a diagnosis of CAPD on that basis alone.” (p. 131)

Barkley, R.A. (2006). Attention –Deficit Hyperactivity Disorder, 3rd Edition. New York, NY: Guilford, 131.

Barkley on AD/HD



Vs CAPD

“What is clear...is that CAPD and ADHD are not identical disorders if more rigorous definitions and criteria are used to determine the presence of CAPD, apart from merely clinical complaints of auditory inattentiveness. It remains uncertain whether CAPD should be considered a valid disorder apart from other already well-documented language disorders of children or whether it merely represents a more recent relabeling of those previously identified language disorders” (p. 131)

Barkley, R.A. (2006). Attention –Deficit Hyperactivity Disorder, 3rd Edition. New York, NY: Guilford, 131.

Barkley on AD/HD Vs CAPD



- Barkley indicated the following:
 - Some studies have found that those with CAPD have an improvement in relief from their inattentive symptoms when they are administered stimulant medication. He believes such individuals have comorbid ADHD and the stimulant medication is reducing their inattentiveness.
 - He believes 33% of those with ADHD also have CAPD. The general population's rate is 3 to 5%.

Barkley, R.A. (2006). Attention –Deficit Hyperactivity Disorder, 3rd Edition. New York, NY: Guilford, 131.

AD/HD and Central Auditory Processing Disorder



- Tannock and Brown reported 45% to 75% comorbidity between AD/HD and CAPD.
- Hynd reported 50% of those with CAPD have AD/HD and 87% of those have comorbid Learning Disorders.

Tannock, M, and Brown, T.E. (2000). Attention-Disorders With Learning Disorders in Children and Adolescents. In T.E. Brown (Ed.), Attention-Deficit Disorders and Comorbidities In Children, Adolescents, and Adults. Washington, DC: American Psychiatric Press, pp. 231-296.)

Hynd, G. (2002). ADHD and Its Association with Dyslexia: Diagnostic and Treatment Challenges. Paper presented at the 53rd Annual International Dyslexia Association Conference, Atlanta, GE, November 16.

AD/HD and Central Auditory Processing Disorder



- What appears to be comorbid CAPD in those with AD/HD may be a problem with inhibition and subsequent distraction leading to uncertainty of what was heard.
- There may only be symptom overlap with CAPD.

(February, 2003). Performance of ADHD Children on Auditory Tasks Related to Behavioral Inhibition, Not CAPD. ADHD Report, 11, p. 11/ Summary of: Brier, J.I., et. al. (2002). Dissociation of Sensitivity and Response Bias in Children with Attention Deficit/Hyperactivity Disorder During Central Auditory Masking. Neurology, 16, pp. 28-34.

Symptom Differences

AD/HD, CT

1. Inattentive*
 2. Distracted*
 3. Hyperactive
 4. Restless or Fidgety
 5. Impulsive
 6. Butts in/Interrupts
- * ***Distracted Inattentive symptoms much more prevalent in ADHD, CT***

(C)APD

1. Problems hearing noise
2. Problems following oral instructions
3. Poor listening skills
4. Academic problems
5. Poor Auditory Association Skills
6. Distracted/Inattentive*

Chermak, G.D., Somers, E.K., and Siegel, (1998). Behavioral Signs of central auditory processing disorder and attention deficit hyperactivity disorder. Journal of the American Academy of Audiology, 9, 78-84.

Comorbidity of (C)APD and AD/HD, CT

“Item analysis revealed that only two of the most frequently cited behaviors were judged as characteristic of both disorders (i.e., inattention and distractibility). The majority of frequently cited behaviors were not seen as common to ADHD and CAPD.” (p. 78)

Chermak, G.D., Somers, E.K., and Seikel, J.A. (1998). Behavioral Signs of Central Auditory Processing Disorder and Attention Deficit Hyperactivity Disorder. Journal of American Audiology, 9 (1), 78-84.

Comorbidity of (C)APD and AD/HD, CT

“These data are consistent with the hypothesis that APD and ADHD overlap partly while still being distinct entities. In addition to dimensional aspects, the parent’s rating may provide a guideline for establishing a diagnosis based on categorical dimensions.”

Ptok, M., Buller, N., Schwemmle, C., Bergmann, C., and Luerssen, K. (2006). Auditory processing Disorder Versus Attention Deficit/Hyperactivity Disorder. A Dysfunction Complex or Different Entities? HNO (Otorhinolaryngology), 54 (5), 405-410, 414. Article in German: From Abstract: www.ncbi.nlm.nih.gov/pubmed/15971050.

Comorbidity of (C)APD and Dyslexia

“Approximately half of the participants with developmental dyslexia showed clinically significant diminished performance on the FPT (Frequency-Pattern Test) and DPT (Duration- Pattern Test) indicative of APD. These results indicate that the percentage of persons with developmental dyslexia and comorbid APD may be substantial enough to warrant serious clinical considerations.” (p. 448)

King, W.M., Lombardino, L.J., Crandell, C.C, and Leonard, C.M. (October, 2003). **Comorbid Auditory Processing Disorder in Developmental Dyslexia. Ear and Hearing, 24 (5), 448-456.**

Comorbidity of (C)APD and AD/HD, IT

Research has shown when pediatricians rated symptoms related to AD/HD, Inattentive Type (SCT) and audiologists rated symptoms related to (C)APD from the same list of 58 symptoms there was no overlap of symptoms.

Chermak, G.D., Tucker, E., and Seikel, J.A. (2002). Behavioral Characteristics of Auditory Processing Disorder and Attention-Deficit Hyperactivity Disorder: Predominately Inattentive Type. American Journal of Audiology, 13 (6), 332-338.

Comorbidity of (C)APD and Asperger's Disorder

“We now have research evidence to confirm significant problems for children and adults with Asperger's syndrome in their ability to understand what someone says when there is background speech or noise...and perceive, discriminate and process auditory information.”
(p. 221)

People with Asperger's Disorder are not good at filling in gaps in hearing.

Attwood, T. (2007). The Complete Guide to Asperger's Syndrome. Philadelphia, PA: Jessica Kingsley, p. 221.

Special Treatment Considerations with Asperger's Disorder

- **After you give a child with Asperger's disorder a task ask, "Tell me what you have been asked to do?"**
- **Write down directions. The more multi-sensory they are the better.**
- **Directions must be based on the child's language comprehension, not their ability to read and speak complex words.**
- **When giving oral instructions pause a few seconds between sentences to allow the child to process the information.**

Attwood, T. (2007). The Complete Guide to Asperger's Syndrome. Philadelphia, PA: Jessica Kingsley, p. 221.

Diagnosing CAPD

- Team approach:
 - Audiologist (Case Manager)
 - Speech-Language Pathologist
 - Educator
 - Psychologist
 - Parents



Bellis, T.J. (1996). Assessment and Management of Central Auditory Processing Disorders In the Educational Setting: From Science to Practice. San Diego, CA: Singular.

****National Coalition for Auditory Processing Disorders: www.ncapd.org**

Diagnosing CAPD



- Physicians – “If there is a disease or disorder related to hearing, you may be referred to an otolaryngologist, a physician who specializes in diseases and disorders of the head and neck.” (National Institute on Deafness and Other Communication Disorders, May 8, 2002, p. 3)
- American Medical Association: www.ama-assn.org

Treating CAPD

- Help with Grieving Process
- Environmental Modifications
 - FM Loop Systems, Amplification, Seating, Etc.
- Remediation (Direct Therapy)
 - Phonological Awareness, Temporal Patterning, Prosody Training, Interhemispheric Training
- Compensatory Strategies



Bellis, T.J. (2002). When the Brain Can't Hear: Unraveling The Mystery of Auditory Processing Disorder. New York, NY: Atria.

Treating (C)APD



“The accumulated auditory and cognitive science literature supports comprehensive programming incorporating both bottom-up (e.g., acoustic signal enhancement, auditory training) and top-down (i.e., cognitive, metacognitive, and language strategies) approaches delivered consistent with neuroscience principles.” (p. 13 of 26)

American Speech-Language Hearing Association (April, 2005). Central Auditory Processing Disorders: Working Group on Auditory Processing Disorders, Technical Report. From website: www.asha.org/docs/html/TR2005-00043.html, p. 13 of 26.

Treating (C)APD



➤ Audiologists may use formal auditory training to take advantage of the brain's plasticity using computer programs like:

➤ FastForWord: Scientific Learning Corporation (1997), www.scilearn.com

➤ Earobics: Cognitive Concepts, Incorporated, www.earobics.com

Bamiou, D.E., Musiek, F.E., and Luxon, L.M. (2001). Aetiology and Clinical presentations of Auditory Processing Disorders-A Review. Archives of Disease in Childhood, 85, 361-365.

Treating (C)APD



- Such training should take place in the workplace, home and school.
- The following training should be done simultaneously: environmental modifications, direct instruction, remediation and compensation strategies.

American Speech-Language Hearing Association (April, 2005). Central Auditory Processing Disorders: Working Group on Auditory Processing Disorders, Technical Report. From website: www.asha.org/docs/html/TR2005-00043.html, p. 13 of 26.

Treatment of (C)APD



“Environmental accommodations to enhance the listening environment may include but are not limited to preferential seating for the individual with (C)APD to improve access to the acoustic (and the visual) signal; use of visual aids; reduction of competing signals and reverberation time; use of assistive listening systems; and advising speakers to speak more slowly, pause more often and emphasize key words.” (p. 14 of 26)

American Speech-Language Hearing Association (April, 2005). Central Auditory Processing Disorders: Working Group on Auditory Processing Disorders, Technical Report. From website: www.asha.org/docs/html/TR2005-00043.html, p. 13 of 26.

Classroom Environmental Modifications

“These modifications may include decreasing reverberation by covering reflective surfaces (e.g., black/white boards not in use, linoleum or wood floors, untreated ceilings), using properly spaced acoustic dividers, using other absorption materials throughout open or empty spaces(e.g., unused coat areas), and/or changing the location of “study” sights. External noise sources can be eliminated or moved away from learning space e.g., aquariums, fluorescent lights that hum, and open door or wall.” (p. 14 of 26)

American Speech-Language Hearing Association (April, 2005). Central Auditory Processing Disorders: Working Group on Auditory Processing Disorders, Technical Report. From website: www.asha.org/docs/html/TR2005-00043.html, p. 9 of 26.

Classroom Accommodations

- “Accommodations that utilize technology to improve audibility and clarity of the acoustic signal itself (assistive listening devices such as FM or infrared technology) may be indicated for some individuals with (C)APD...The strongest indicators for the use of personal FM as a management strategy are deficits on monaural low redundancy speech and dichotic speech tests...” (p. 14 of 26)
- Such people have great difficulty in the acoustic environments encountered in schools, home and work.

American Speech-Language Hearing Association (April, 2005). Central Auditory Processing Disorders: Working Group on Auditory Processing Disorders, Technical Report. From website: www.asha.org/docs/html/TR2005-00043.html, p. 13 of 26.

Curriculum Adaptation

“Specific suggestions may include support for focused listening (e.g., use of note-takers, preview questions, organizers), redundancy (e.g., multisensory instruction, computer mediation), and the use of written output e.g., e-mail, mind-maps.” (p. 15 of 26)

American Speech-Language Hearing Association (April, 2005). Central Auditory Processing Disorders: Working Group on Auditory Processing Disorders, Technical Report. From website: www.asha.org/docs/html/TR2005-00043.html, p. 9 of 26.

How to Make your Classroom Acoustically Available

- CAPD students sit in first row.
- Provide good lighting in the room.
- Avoid assigning a teacher to student who **DOES NOT** speak with a common or local accent.
- Acoustical tile in the ceiling
- Carpeting with thick carpeting pad on the floor
- Beards and moustaches need to be well trimmed away from lips. This allows for better speech reading.
- No mini-blinds! Use draperies! Draperies absorb ambient sound better.

Classroom Acoustics



- The American Speech-Language Hearing Association (www.asha.org) has a position paper on this that includes a comprehensive bibliography: Paper number 37, supplement 14.
- The Counsel of Educational Facility Planners International (CEFPI) has the following article on their website about how to build in good classroom acoustics:
- Erdreich, J. (July, 1999). Teaching in the Dark. Brief on Educational Facilities.

Sound Suppression Technology



Bose QuietComfort Sound suppression headphones:

www.bose.com

FM Loop System

Website: www.harriscomm.com

http://www.harriscomm.com/catalog/default.php?cPath=1141_46_158



Helpful Websites for CAPD



- National Institute on Deafness and Other Communication Disorders: www.nidcdinfo@nidcd.nih.gov
- American Academy of Audiology: www.audiology.org
- American Speech-Language Hearing Association: www.asha.org
- National Coalition for Auditory Processing Disorders: www.ncapd.org
- American Academy of Otolaryngology-Head and Neck Surgery (AAO-HNS): www.entnet.org

Helpful Books on (C)APD

- ✓ Bellis, T.J. (2002). When the Brain Can't Hear: Unraveling the Mystery of Auditory Processing Disorder. New York, NY: Atria.
- ✓ Bellis, T.J. (2003). Assessment and management of central auditory processing disorders in the educational setting: From science to practice. Clifton Park, NY: Delmar Learning.

Helpful Book on (C)APD

- ✓ Chermak, G.D., & Musiek, F.E. (1997). Central Auditory Processing Disorders: New Perspectives. San Diego, CA: Singular.

