SANFILIPPO SYNDROME
(MPS-III)

OVERVIEW:
Sanfilippo syndrome is an inherited metabolic disease caused by an absence or malfunctioning of certain enzymes needed to breakdown molecules called glycosaminoglycans (GAG). It is in a group of diseases known as the mucopolysaccharidoses (MPS).
Sanfilippo syndrome is named after Dr. Sylvester Sanfilippo who discovered the cause of this disease in 1963. He was able to identify that persons with this disorder are missing one of four specific enzymes essential for breaking down GAG, called heparan sulfate.

CAUSES:
- Only affects individuals who inherit the defective gene from both parents
- When both parents carry the defective gene, there is a one in four chance the child will be affected

INCIDENCE:
- One in every 25,000 babies born in the U.S. will have some form of the mucopolysaccharidoses.
- One in every 70,000 births results on Sanfilippo syndrome.
- Children affected by Sanfilippo syndrome show marked decline beginning around age 2.

CHARACTERISTICS:
- This disease is marked by severe neurological symptoms, including:
  - progressive dementia
  - aggressive behavior
  - hyperactivity
  - seizures
  - some deafness and loss of vision
  - decreased intellectual functioning (severe mental retardation)
  - inability to sleep for more than a few hours at a time
  - thickened skin
  - mild changes in facial features, bone and skeletal structures
  - severe diarrhea or constipation
  - liver and spleen enlargement
  - narrowing of airway passage in the throat
  - enlargement of tonsils and adenoids (difficulty eating and swallowing)
  - recurring respiratory infections

- Three main stages of the disorder:
  - Stage 1: Early mental and motor skill development may be delayed
    Marked decline in learning between ages 2 and 6, following by eventual loss of language skills and loss of some or all hearing
    Some children may never learn to speak
    Difficult to diagnose at this age because children do not appear abnormal
  - Stage 2: Typically during ages 5 to 10 years
    Aggressive behavior, hyperactivity, profound dementia and irregular sleep make the child more difficult to manage
    Many children chew on their hands or anything they can get ahold of, a definite safety concern
  - Stage 3: Typically after the age of 10
    Children become increasingly unsteady on their feet and most are unable to walk by age 10
    Growth in height usually stops by age 10
    Most children are nonverbal by this stage

TYPES:

There are four distinct types of Sanfilippo syndrome. Each is caused by the alteration of a different enzyme. Symptoms and progression are different with these four types of the syndrome. Duration of the disease is typically 8 to 10 years following the onset of symptoms. Most people suffering from Sanfilippo syndrome live into adolescence, and some live even longer.

- Sanfilippo A:
  - Most severe type of disorder
  - Most common in Northwestern Europe
  - Caused by missing or altered enzyme *heparin N-sulfatase*
  - Shortest survival rate among other MPS-III disorders
- Sanfilippo B:
  - Most common in Southeastern Europe
  - Caused by missing or altered enzyme *alpha-N-acetylglucosaminidase*
- Sanfilippo C:
  - Caused by missing or altered enzyme *acetyl-CoAlpha-glucosaminide acetyltransferase*
- Sanfilippo D:
  - Caused by missing or altered enzyme *N-acetylglucosamine 6-sulfatase*

TREATMENT:

Currently, there is *no cure* for Sanfilippo syndrome.
Enzyme Replacement Therapy (ERT) is offered as treatment to some children with MPS disorders. This involves injecting enzymes into the patient to stop or even reverse the storage that causes the disease. Unfortunately, this treatment (ERT) is not beneficial for children with Sanfilippo syndrome because the enzyme administered into the bloodstream is prevented from entering the blood-brain barrier. Umbilical cord blood transplantations are another experimental treatment for children with MPS, but research is still inconclusive as to the benefit for children with Sanfilippo syndrome.

EDUCATIONAL CONCERNS/ROLE OF SCHOOL PSYCHOLOGIST:

- Early Intervention: Resources may be necessary for infants and very young children with MPS-III. Children with this disorder may benefit from an early intervention and stimulation program where maximum intellectual gain can be encouraged, especially because of the disease's effect on early learning and development.
- Frequent IEP monitoring: Because of the rather rapid regression in skills and behavior experienced in the severe forms of Sanfilippo syndrome, schools should frequently monitor changes in behavior so the IEP can quickly be adapted as needed to support a child who is losing skills. The IEP should be developed to encourage social and academic participation, new learning, and the preservation of established skills. Alterations to the learning environment and methods of instruction are frequently necessary to adapt to difficulties with cognitive skills, mobility or behavior problems. Teachers frequently need additional support to accept the limitations of the child's skills and disease progression, and to resist the impulse to demand performance for which the child is not capable. Planning and goal development may be difficult for school personnel who do not have experience with children whose disorders are progressive. The traditional focus is on improvement in skills and lessened support as improvement occurs rather than maintaining skills.
- Current revisions to IDEA law may include language to specifically address children with degenerative disorders. The change would allow the IEP team to consider recommendations from professional consultants, including additional therapeutic services, prior to the expected loss of abilities in order to extend current skills.
- Medical Care Needs: Mobility problems, hearing loss and vision difficulties may need the special attention of school personnel in program planning. All schools should have teachers who specialize in working with children with vision or hearing impairments. These teachers help the IEP team develop alterations to deal with these problems. Mobility problems and limitations due to physical manifestations of the disorders can be addressed by consultation with physical and occupational therapists and adaptive physical educators. Class assignments and

projects (such as art projects) can be modified to allow children with physical limitations to participate in similar projects with their peers.

- Behavior Problems: Behavior problems may be identified by school personnel as misbehavior rather than symptoms of Sanfilippo syndrome. For children with more severely handicapping types of Sanfilippo syndrome, most behavior problems are likely caused by neurological issues, lack of understanding, difficulty with communication or sensory limitations. School personnel must take an intervention approach to these problems rather than a discipline approach. Sending the child to the principal's office is not the most appropriate way to deal with behaviors that are a result of a medical condition. Behavior difficulties should be treated as a complication of the medical condition and not as misbehavior. Alterations to the learning environment and methods of instruction may be helpful in decreasing some behavior problems. Teachers and administrators may need training and consultation in interventions for over-activity, restlessness and fearfulness. Behavior support and management principles should be well known by teachers and school psychologists. There should be an emphasis on modification to the classroom environment and the use of reinforcements to promote appropriate behavior.
- Socialization: School attendance and socialization should be encouraged and fostered through classroom integration and specific social skills interventions. Independence should be supported. Teachers can do much to improve the acceptance of the child through instructional activities, such as cooperative learning and encouraging support for all children in the classroom.

SUPPORT GROUPS AND RESOURCES:

- National MPS Society: www.mpssociety.org
- National Organization for Rare Disorders: www.rarediseases.org
- Sanfilippo Research Foundation: www.bensdream.org
- Children's Medical Research Foundation: www.curekirby.org
- Sanfilippo Syndrome Research Foundation: www.juliashope.org
- The Sanfilippo Children's Research Foundation: www.alifeforlisa.org
- RESNA Technical Assistance Project (Information on state resources on assistive technology): www.resna.org/taproject
- Parents, Let's Unite for Kids (Family Guide to Assistive Technology): www.pluk.org/ABLEDATA
- U.S. Dept. of Education Assistive Technology Clearinghouse: www.abledata.com