

CASE STUDY

How DNA Extraction Automation *Improved* the Detection of Genetic Illnesses in the Amish and Mennonite Populations



Background:

About the Clinic for Special Children

Since its founding in 1989, the Clinic for Special Children (CSC) has brought compassionate clinical care to children and adults with complex medical disorders. While primarily focused on the treatment and research of disorders identified in Old Order Amish and Mennonite communities, the impact of CSC's clinical and research work has been felt worldwide.

Over three decades later, the clinic is still thriving on the cutting edge of genomic research.

Thanks to collaborative relationships with surrounding medical practices and a fully equipped research lab, CSC treats patients with genetic disorders of all types and acts as an affordable and comprehensive medical practice for patients in the Lancaster County Old Order Amish and Mennonite communities.

One of the many diseases the clinic diagnoses and treats is spinal muscular atrophy (SMA). The occurrence of SMA is much higher within Old Order Amish and Mennonite populations than in the general population.

This case study will highlight how CSC has evolved its DNA workflows to improve clinical outcomes for families with SMA, thanks in part to the help of automated instrumentation from AutoGen.

Making Care Affordable with In-house DNA Isolation

To make testing and treatment more affordable for their patients, CSC has done a lot of work to bring testing and diagnostics in-house for many of the tests that their patient community needs. A foundational step in their testing for common genetic disorders is DNA isolation. CSC uses isolated gDNA for many foundational applications, including:

- + Standard PCR
- + High-resolution melting analysis (HRM)
- + Quantitative PCR
- + Affymetrix HD CytoScan (CMA) – most finicky
- + Sanger sequencing
- + Exome sequencing (NGS)

The Initial Challenge: Manual Extractions with Low Throughput

For many years, the lab at CSC had been using the Genra Puregene Kit to manually isolate DNA. While they saw initial success with that method, in 2015, the number of samples running through the lab became overwhelming. That's when they turned to AutoGen for the first time, purchasing a **QuickGene-610L** in 2016 to automate their DNA isolation.

With the QuickGene-610L up and running, the team at CSC was able to keep pace with the clinic's extraction needs. However, in 2019, two initiatives brought new challenges to CSC's throughput capabilities.

Further Bandwidth Challenges: Two Critical Testing Initiatives

In 2019, CSC launched two initiatives to better understand the prevalence of genetic disorders so they could roll out faster, more targeted and accessible treatment.

- + **Plain Insight Panel:** The first initiative was developing a next-gen sequencing assay called the "Plain Insight Panel." This panel, when paired with exome data of the known pathogenic variants and associated clinical variants, would be able to better identify the carrier status of common genetic disorders in people of "Plain" descent (Amish, Mennonite and Brethren).
- + **SMA Prevention Readiness Trial:** The second initiative was the SMA Prevention Readiness Trial. The goal of this trial was to screen 2,000 Amish and Mennonites for SMA carrier status (prevalent in Lancaster County Amish) over a three-year period.

These two initiatives required CSC to rethink and reinvest in its DNA isolation process. To do that, they turned to AutoGen once again. This time, they acquired a new **XTRACT 16+®**, a powerful benchtop DNA extraction automation instrument.



Results:

DNA Extraction Capabilities to Meet the Increase in Demand

Armed with both the XTRACT 16+ and the QuickGene-610L from AutoGen, the lab at CSC was able to drastically increase their sample throughput to meet the increased sample volume brought in from the new Plain Insight Panel and SMA Prevention Readiness Trial.

In addition to increasing their throughput, maintaining both instruments allows the CSC lab to offer rapid testing options for faster identification and treatment of SMA from birth. The AutoGen QuickGene-610L, while low throughput, is able to isolate DNA from cord blood samples in 12 minutes.

Ultimately, the lab screened more than 2,000 individuals for SMA in only 9 months in addition to the sample volume brought in by the Plain Insight Panel. In those screenings, they found 318 carriers, 9 carrier couples, 6 unaffected infants, **and 3 affected infants who were all able to receive treatment in a timely manner.**

Full Results

AutoGen's instruments outperformed other instruments tested and allowed the team at CSC to meet the sample extraction demands of the Plain Insight Panel and SMA Prevention Readiness Trial.

Yield and Quality Comparison

	Anti-coagulated Blood Input	Concentration (ng/uL)	260/280
Gentra Puregene (n=452)	0.3 - 3 mls	366 (274)	1.847 (0.037)
QuickGene-610L (n=1393)	1 - 2 mls	221 (139)	1.874 (0.036)
Autogen XTRACT 16+ (n=66)	1.2 mls	210 (67)	1.851 (0.017)

Added Benefits: Future Initiatives Enabled by the XTRACT 16+

In addition to throughput benefits, the flexibility of the XTRACT 16+ enabled CSC to look into other avenues for DNA isolation saliva kits and cell-free fetal DNA (cffDNA) samples. The ability to isolate from these samples makes field and rapid testing possible for SMA and other common genetic disorders, ultimately making treatment more accessible to Old Order Amish and Mennonite communities.

About autogen

AutoGen is a leading provider of automated nucleic acid extraction workflows that allow lab professionals to produce premier-quality and value-added extraction results. Our workflows provide solutions that are the best fit for our customers' laboratory needs and budgets, and our customers include biorepositories, contract research organizations, academic research laboratories, pharmaceutical companies, clinical diagnostic laboratories, and government institutions all over the world. We strive to provide quality instrumentation and chemistries, as well as dedicated technical support — all with a level of post-sale service that is truly unmatched.