PHARMA HIGHLIGHTS

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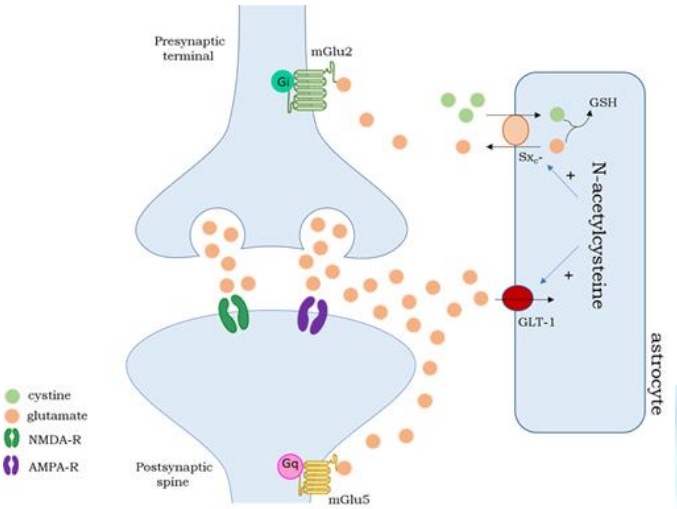
Effectiveness and Safety of Oral N-acetylcysteine (NAC) for Autism Spectrum Disorder (ASD) in Children



Over the last fifty years, autism spectrum disorder (ASD) has evolved from an uncommon, poorly characterized illness with childhood onset to a well-known, supported, and extensively researched lifelong condition that is acknowledged to be both highly diverse and rather prevalent (Lord et al., 2018). While there is no known cure for ASD, ongoing research into potential interventions to improve the quality of life for individuals with ASD is taking place. N-acetylcysteine (NAC), a well-known antioxidant and mucolytic agent, has gained attention as a potential intervention for ASD (Bradlow et al., 2022).

Several studies have investigated the use of oral NAC in children with ASD. The evidence from ongoing research suggests that NAC improves core symptoms in individuals diagnosed with ASD based on the "Diagnostic and Statistical Manual of Mental Disorders," Fourth Edition, text revision (DSM-IV-TR). In their investigations, three randomized controlled trials (RCTs) have reported significant improvements in irritability and hyperactivity in the Aberrant Behavior Checklist, social responsiveness, and repetitive behaviors in children (Aged: 3-12 years) with ASD following NAC supplementation (Ghanizadeh & Moghimi-Sarani, 2013; Hardan et al., 2012; Nikoo et al., 2015). Moreover, NAC is believed to modulate oxidative stress, inflammation, and glutamate production in the brain, which are associated with ASD (Wink et al., 2016). However, among all the available studies, two randomized controlled trials failed to discover any improvement upon NAC administration, and they have pointed out some methodological disparities, such as small sample size (n= 30-100), short study length (8-12 weeks), and the use of lower dosages (Dean et al., 2017; Wink et al., 2016). Furthermore, since ASD is a heterogeneous disease, it is essential to note that individual symptoms of ASD and its responses to NAC may vary.

NAC is generally found to be safe as an intervention in children. This article highlights the potential effectiveness of N-acetylcysteine (NAC) as an intervention for addressing certain core symptoms in individuals with Autism Spectrum Disorder (ASD). Though preliminary findings are encouraging, further research is needed to better understand its long-term effects and its potential as both a combination therapy and monotherapy.

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BRAC UNIVERSITY School of Pharmacy

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Immunotherapy's Next Frontier: UMass Scientists' Innovative Approach to Cancer Eradication

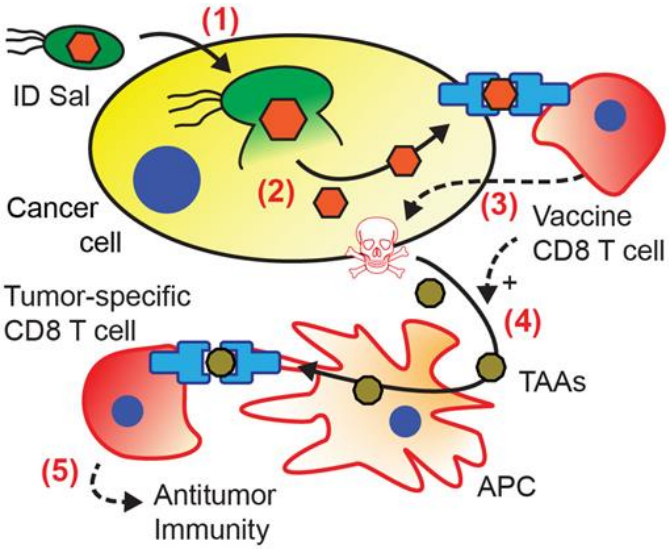


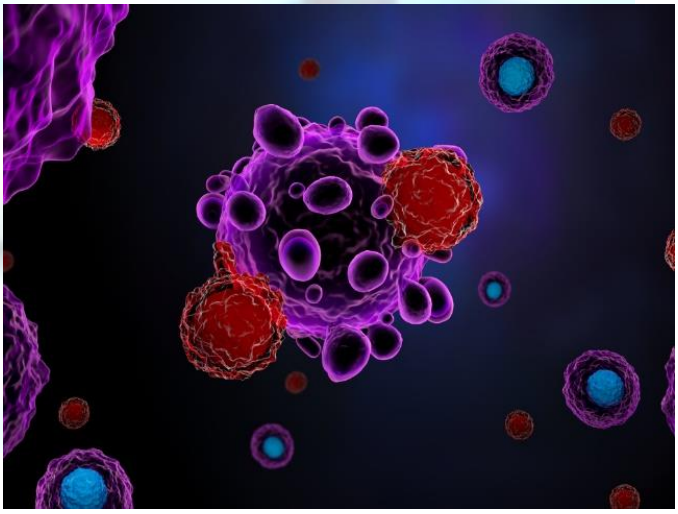
Fig: Mechanism of acquired antitumor immunity from intracellular bacterial antigen delivery. (1) Salmonella invades into cancer cells, and (2) autonomously lyse releasing bacterially expressed antigens (orange) into the cytoplasm. (3) Presentation of the delivered antigen activates antigen-specific vaccine CD8 T cells, which kill the presenting cancer cells. (4) Cancer cell death and T cell activation induce antigen presenting cells (APCs) to cross-present tumor associated antigens (TAAs). (5) Activation of tumor-specific CD8 T cells leads to the formation of antitumor immunity.

Cancer, a worldwide epidemic, continues to devastate individuals' health without a viable solution. In the ongoing battle against cancer, a team of scientists from the University of Massachusetts Amherst has made significant strides in the development of a potentially effective cancer treatment, one that is not just a theoretical concept.

According to a recent article in The Science Daily titled "Can Immunity From Routine Vaccines Be Used to Fight Cancer?" (2023), researchers from UMass have conducted extensive studies on the interaction between antibodies (Ab) and antigens (Ag) within the immune system, with the aim of targeting and eliminating cancer cells in affected individuals. Their breakthrough concept involves presenting a portion of cancer cells as foreign entities to the immune system, potentially leading to the complete eradication of these cancer cells. To test this theory, they conducted experiments in the Forbes Lab at the Institute for Applied Life Sciences (IALS), and their findings indicate the potential effectiveness of this treatment for various types of tumors, including liver, metastatic breast, and pancreatic tumors.

The foundation of this promising treatment lies in the functioning of our immune system. Our immune system can detect, destroy, and remember foreign invaders encountered during our lifetime. In this study, scientists introduced a foreign molecule into the cancer cells of mice using a bacterial delivery system. These mice had previously received immunization against this molecule. Specifically, they used genetically engineered Salmonella to deliver ovalbumin (a protein found in chicken eggs) into the pancreatic tumor cells of mice previously immunized with the ovalbumin "vaccine." The researchers demonstrated that ovalbumin was distributed throughout the cytoplasm of cells in both cultures and tumors. The UMass team reported that this introduction of the protein into the "vaccinated" mice triggered an antigen-specific T-cell response within the cytoplasm, resulting in the eradication of approximately 43% of pancreatic tumors. What's even more intriguing is that when they attempted to reintroduce pancreatic tumors into the immunized mice, the tumors did not grow at all.

While this represents one of the most promising potential cancer cures to date, it's important to note that this treatment is still in the trial phase and must meet all necessary requirements for authorization and approval.



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Space Physiology and Joining NASA as a Pharmacist

Physiology is not rocket science, but it can be the science of people who travel through rockets. That's because factors like altitude, low gas pressures, weightlessness, and acceleratory forces directly affect mechanisms inside our bodies. For example, the barometric pressure at sea level is 760 mmHg. However, when you reach 50,000 feet, it decreases surprisingly and becomes only 87 mmHg. This change results in problems related to Hypoxia (a condition where inadequate oxygen supply in the blood occurs).

Sudden exposure to elevated pulmonary ventilation expels a large amount of CO2. As a result, the pH of the body fluids increases. Since blood is movable, it can be affected by centrifugal acceleration and can be translocated. Greater acceleration causes blackout vision, fractures in vertebrae, and unconsciousness.

Microgravity or weightlessness is a common phenomenon in space flights. More than 50% of astronauts experience nausea. The translocation of body fluids, subsided physical stamina, a decrease in blood volume and red blood cell mass, a decrease in cardiac output, low calcium, and phosphate storage, and a decrease in bone mass have been witnessed in prolonged weightlessness. Pharmaceutical products always have issues with stability. They are more unstable in space than on Earth. In space, peptide or protein drugs get degraded within six months, regardless of how many precautions are taken. Generally, drugs get replaced when they expire, but if we take into account longer space expeditions, this won't be possible. Absorption, metabolism, and excretion of drugs are different and irregular in space. For instance, during spaceflight, paracetamol absorption doubles. Drugs like Digoxin and Warfarin, which have a narrow therapeutic index, can be lethal due to changes in blood concentration.

In June 2000, for the first time, a position for a pharmacist at Johnson Space Center (JSC) in Houston, Texas, was created. In 2001, NASA management decided to build an in-house pharmacy. In 2003, a full-time pharmacy was built at Johnson Space Center. Since then, pharmacists have been involved in clinical affairs, medical checklist procedures, drug tolerance testing, med kit design, regulatory guidance, etc. To meet the emerging challenges, the implementation of revised pharmacokinetics and pharmacodynamics is needed. Clinical pharmacist Tina Bayuse is the first one who became a part of NASA. After attending a presentation at her college on the pharmacist's role in the space program, she stepped forward to pursue her interest. She currently runs and leads her pharmacy at Johnson Space Center for 23 years, where her work is divided between medical operations and the pharmacology lab. Undoubtedly, she is an example of breaking the mold, especially for women who want to achieve higher goals or pursue a career in an unconventional way.

Since the Apollo mission (where Marezine tablets were first used for motion sickness), medications have been an unavoidable part of space expeditions. At the International Space Station, Zolpidem and Zaleplon are used to improve sleep, and Ibuprofen and Aspirin for joint, back, muscle pains, and headaches. Pharmacotherapeutics have already been proven essential for space missions.

Currently, when NASA has launched the Artemis program to return humans to the moon by 2024, concepts like space tourism are under scrutiny, and plans to create a lunar gateway are underway. It's a great time to think about astro-pharmacy. So, just in case you are someone like me who wants to join NASA but is currently studying pharmacy, take a deep breath because we still have a chance to fulfill our wish. Imagine designing dosage forms for the next massive Mars or moon expedition at NASA headquarters. Mesmerizing, isn't it?

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