

Vaping Alters Inflammatory State of Brain, Heart, Lungs, and Colon

Featured Neuroscience Open Neuroscience Articles

· April 18, 2022

Summary: *Daily vaping of pod-based e-cigarettes alters inflammatory states across multiple organs, including the brain. The effects vary depending upon the vape flavors and influence how the body responds to infections. Mint vapes, for example, leave people more sensitive to the effects of bacterial pneumonia than mango flavoring.*

Source: *UCSD*

Researchers at University of California San Diego School of Medicine report that daily use of pod-based e-cigarettes alters the inflammatory state across multiple organ systems including the brain, heart, lungs and colon. Effects also vary depending on the e-cigarette flavor, and can influence how organs respond to infections, such as SARS-CoV-2.

The study, published April 12, 2022 in the journal *eLife*, is the first to assess JUUL devices and their flavorants in a multi-organ fashion.

“These pod-based e-cigarettes have only become popular in the last five or so years, so we don’t know much about their long-term effects on health,” said senior study author Laura Crotty Alexander, MD, associate professor of medicine at UC San Diego School of Medicine and section chief of Pulmonary Critical Care at Veterans Affairs San Diego Healthcare System.

More than 12 million adults in the United States currently use e-cigarettes, with the highest rates of use among those aged 18-24. Despite their popularity, research on e-cigarettes has been largely limited to studies of short-term use, older devices, such as vape pens or box mods, and e-liquids with significantly lower nicotine concentrations than the modern rechargeable pod-based systems.



Crotty Alexander’s team focused on the current most prominent e-cigarette brand, JUUL, and its most popular flavors: mint and mango. To model chronic e-cigarette use, young adult mice were exposed to flavored JUUL aerosols three times a day for three months. Researchers then looked for signs of inflammation across the body.

Authors saw the most striking effects in the brain, where several inflammatory markers were elevated. Additional changes in neuroinflammatory gene expression were noted in the nucleus accumbens, a brain region critical for motivation and reward-processing.

The findings raise major concerns, they said, as neuroinflammation in this region has been linked to anxiety, depression and addictive behaviors, which could further exacerbate substance use and addiction.

“Many JUUL users are adolescents or young adults whose brains are still developing, so it’s pretty terrifying to learn what may be happening in their brains considering how this could affect their mental health and behavior down the line,” said Crotty Alexander.

Inflammatory gene expression also increased in the colon, particularly after one month of e-cigarette exposure, which could increase risk of gastrointestinal disease. In contrast, the heart showed decreased levels of inflammatory markers. Authors said this state of immunosuppression could make cardiac tissue more vulnerable to infection.



Scientists at UC San Diego School of Medicine show that chronic JUUL use leads to inflammatory changes across the body. Credit: UCSD



While lungs did not show tissue-level signs of inflammation, numerous gene expression changes were observed in the samples, calling for further study of



the long-term effects of pod-based e-cigarettes on pulmonary health.

The researchers also found that the inflammatory response of each organ varied depending on which JUUL flavor was used. For example, the hearts of mice that inhaled mint aerosols were much more sensitive to the effects of bacterial pneumonia compared to those that inhaled mango aerosols.

“This was a real surprise to us,” said Crotty Alexander. “This shows us that the flavor chemicals themselves are also causing pathological changes. If someone who frequently uses menthol-flavored JUUL e-cigarettes was infected with COVID-19, it’s possible their body would respond differently to the infection.”



Every organ has its own finely tuned immune environment, so disturbing that balance through e-cigarette use could lead to many long-term health effects, the authors wrote.

“It’s clear that every e-cigarette device and flavor has to be studied to determine how it affects health across the body,” said Crotty Alexander.

Co-authors include: Alex Moshensky, Cameron S. Brand, John Shin, Jorge A. Masso-Silva, Ira Advani, Deepti Gunge, Aditi Sharma, Sagar Mehta, Arya Jahan, Sedtavut Nilaad, Jarod Olay, Wanjun Gu, Tatum S. Simonson,

Josephine Pham, Samantha Perera, Kenneth Park, Rita Al-Kolla, Hoyoung Moon, Soumita Das, Min Kwang Byun and Joan Heller Brown, all at UC San Diego, as well as Hasan Alhaddad, Daniyah Almarghalani, Zahoor Shah and Youssef Sari at University of Toledo.

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About this vaping and neuroscience research news

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“[Effects of mango and mint pod-based e-cigarette aerosol inhalation](#)”



[on inflammatory states of the brain, lung, heart, and colon in mice”](#) by
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Abstract

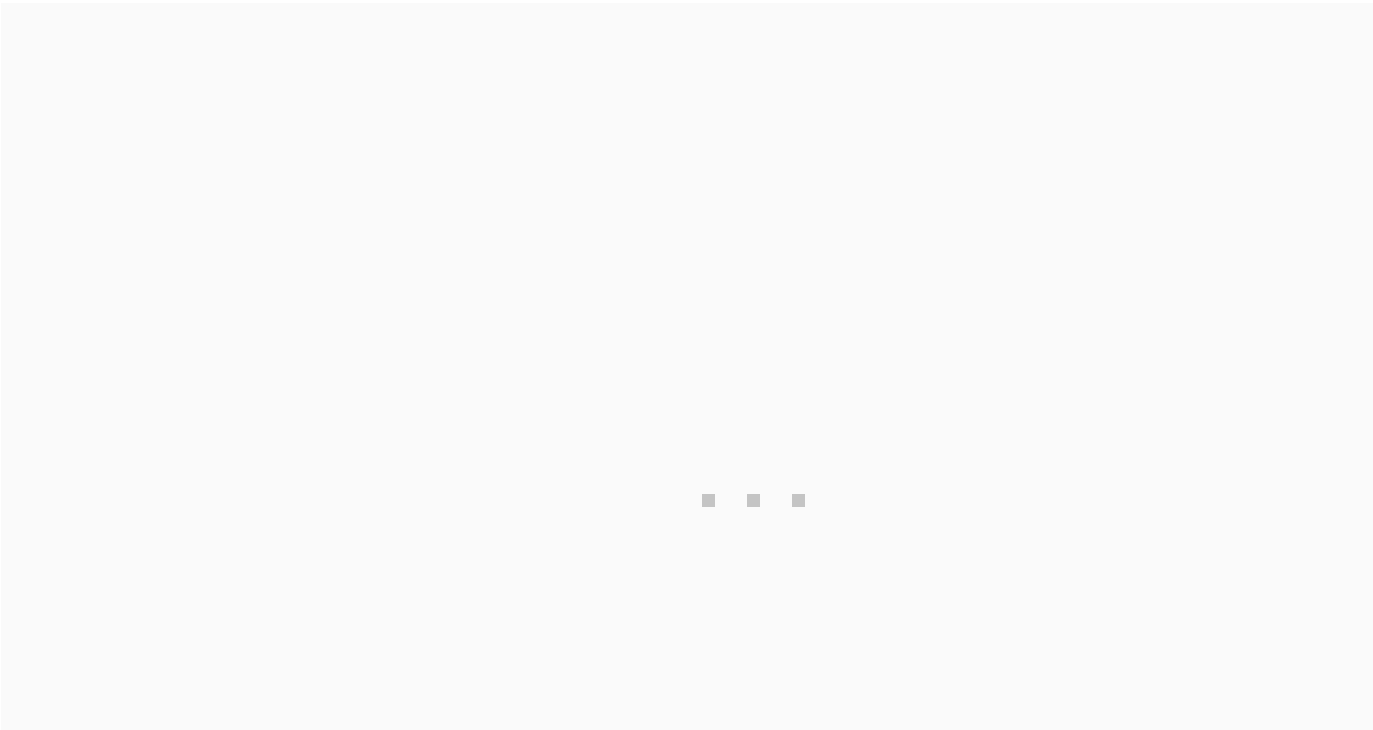
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Effects of mango and mint pod-based e-cigarette aerosol inhalation on inflammatory states of the brain, lung, heart, and colon in mice

While health effects of conventional tobacco are well defined, data on vaping devices, including one of the most popular e-cigarettes which have high nicotine levels, are less established.

Prior acute e-cigarette studies have demonstrated inflammatory and cardiopulmonary physiology changes while chronic studies have demonstrated extra-pulmonary effects, including neurotransmitter alterations in reward pathways.





In this study we investigated the impact of inhalation of aerosols produced from pod-based, flavored e-cigarettes (JUUL) aerosols three times daily for 3 months on inflammatory markers in the brain, lung, heart, and colon.

JUUL aerosol exposure induced upregulation of cytokine and chemokine gene expression and increased HMGB1 and RAGE in the nucleus accumbens in the central nervous system.

Inflammatory gene expression increased in the colon, while gene expression was more broadly altered by e-cigarette aerosol inhalation in the lung. Cardiopulmonary inflammatory responses to acute lung injury with lipopolysaccharide were exacerbated in the heart.

Flavor-specific findings were detected across these studies. Our findings suggest that daily e-cigarette use may cause neuroinflammation, which may contribute to behavioral changes and mood disorders.

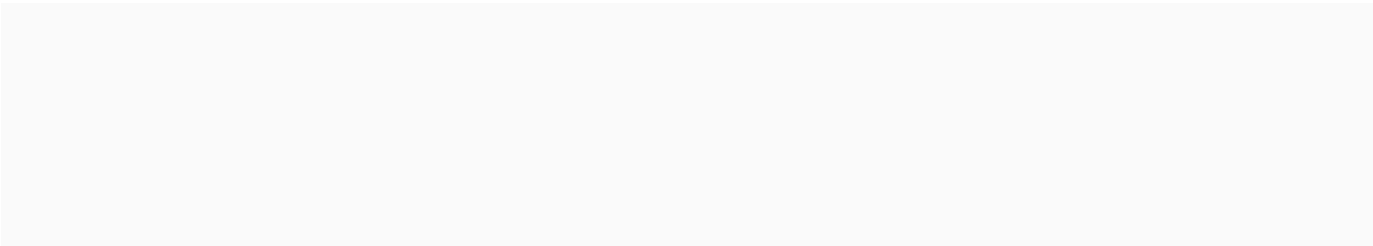
In addition, e-cigarette use may cause gut inflammation, which has been tied to poor systemic health, and cardiac inflammation, which leads to cardiovascular disease.

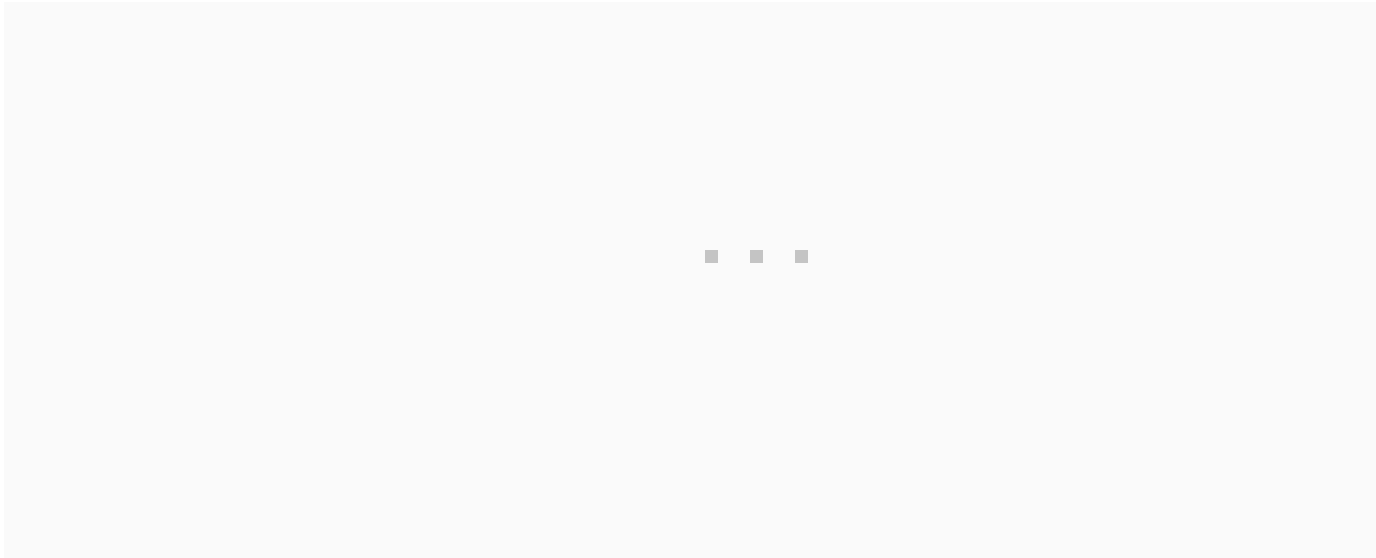
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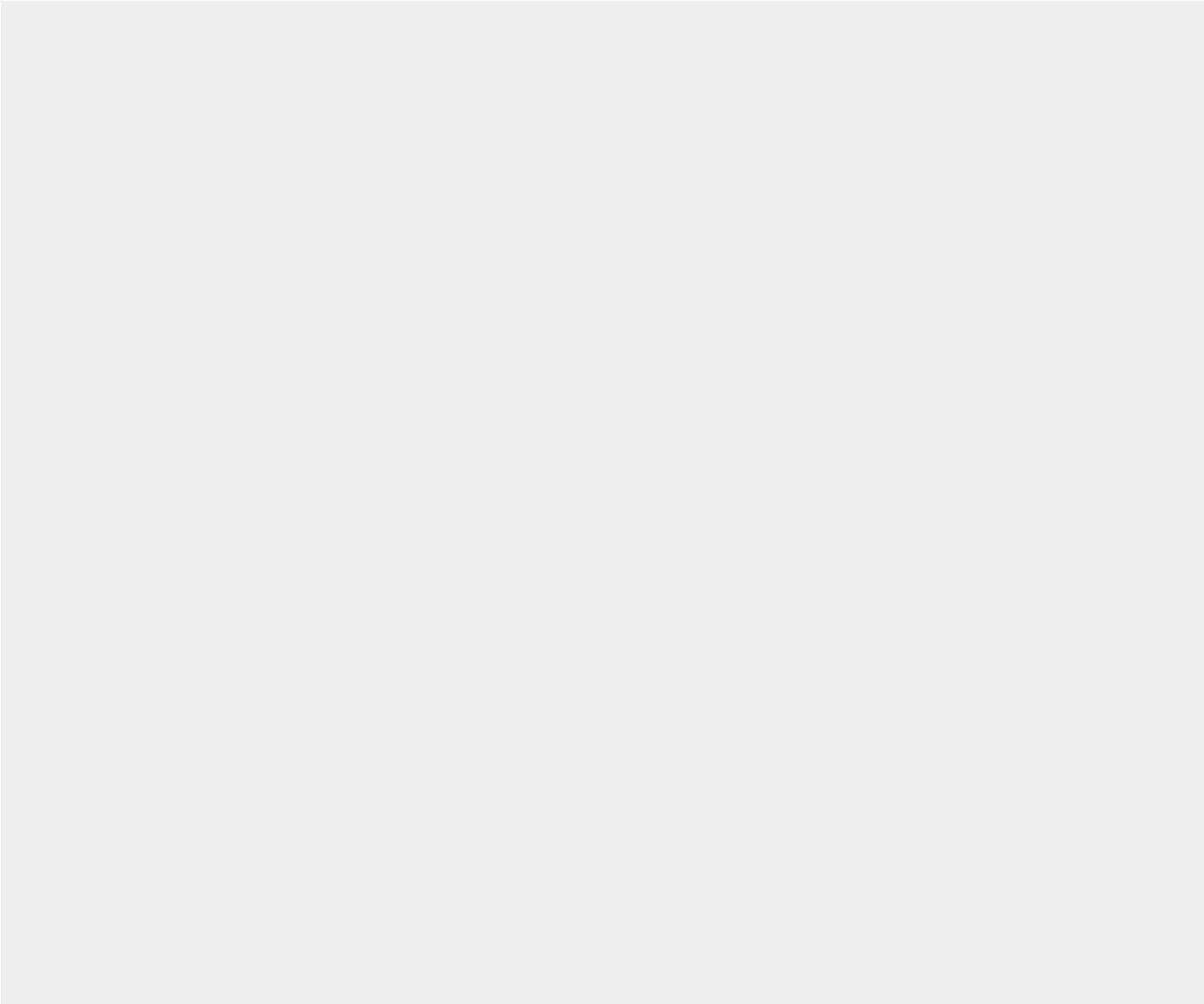
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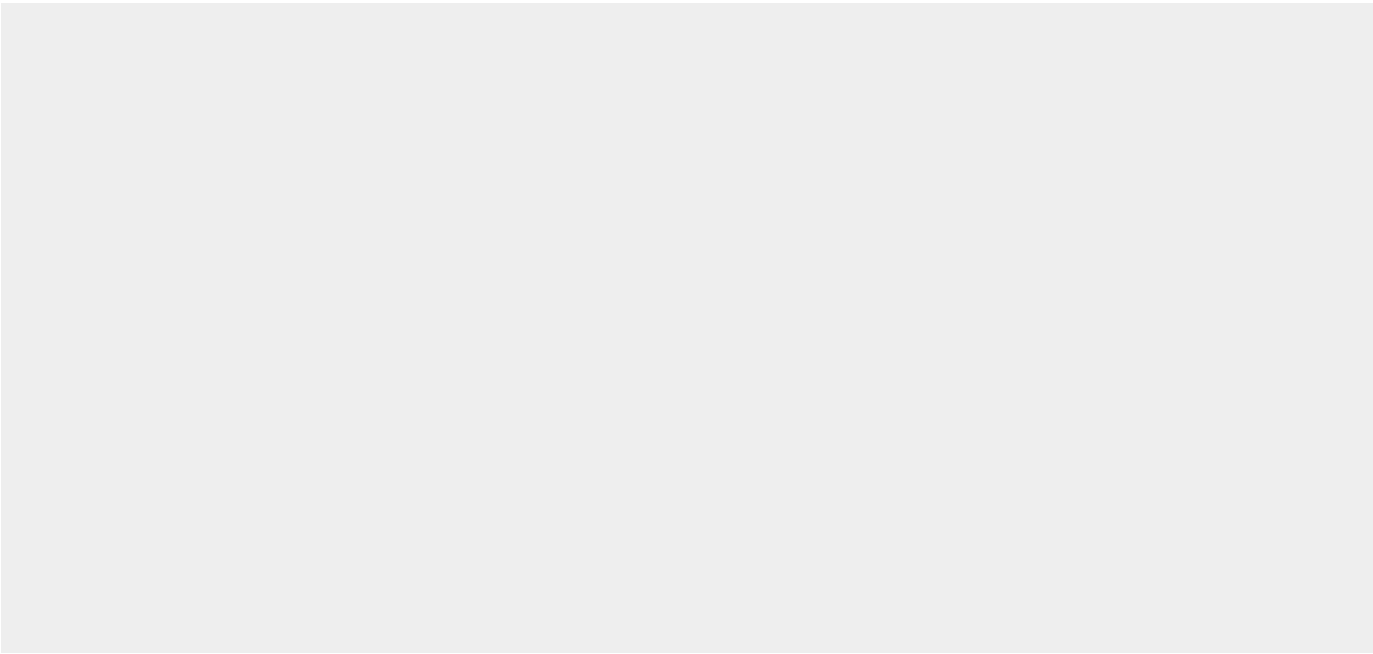
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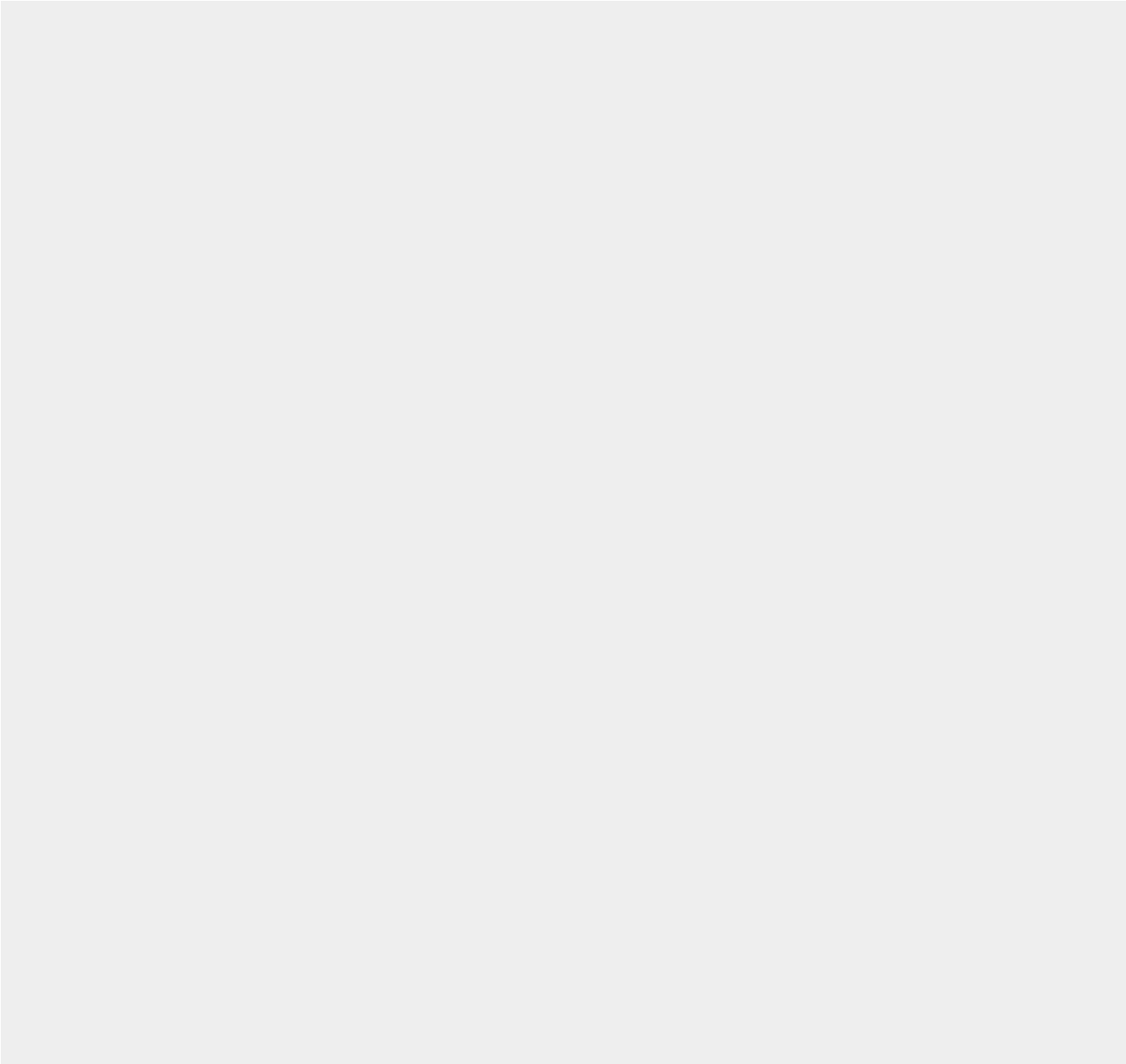
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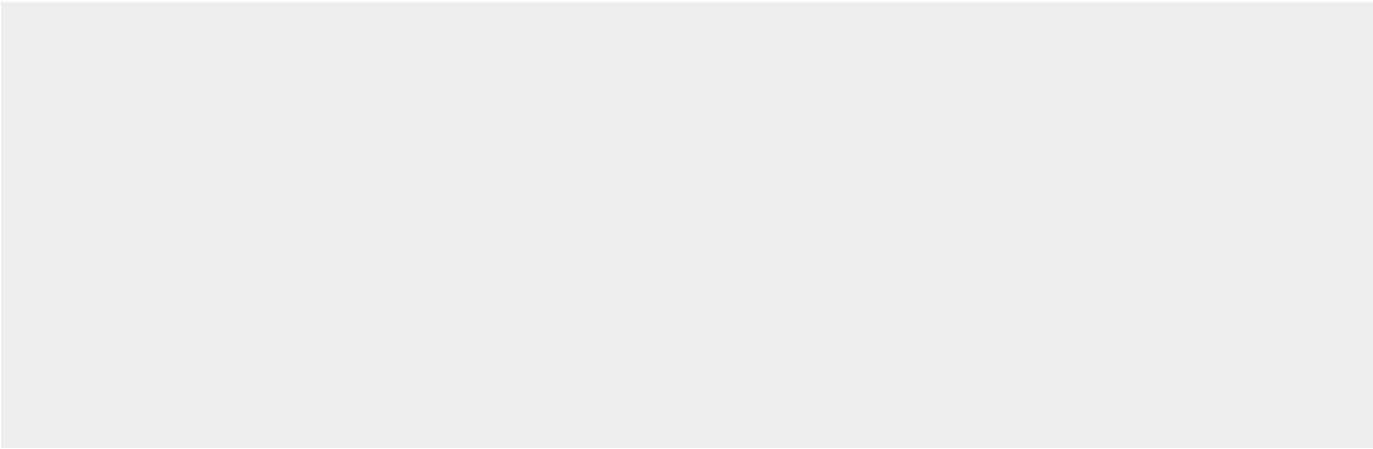


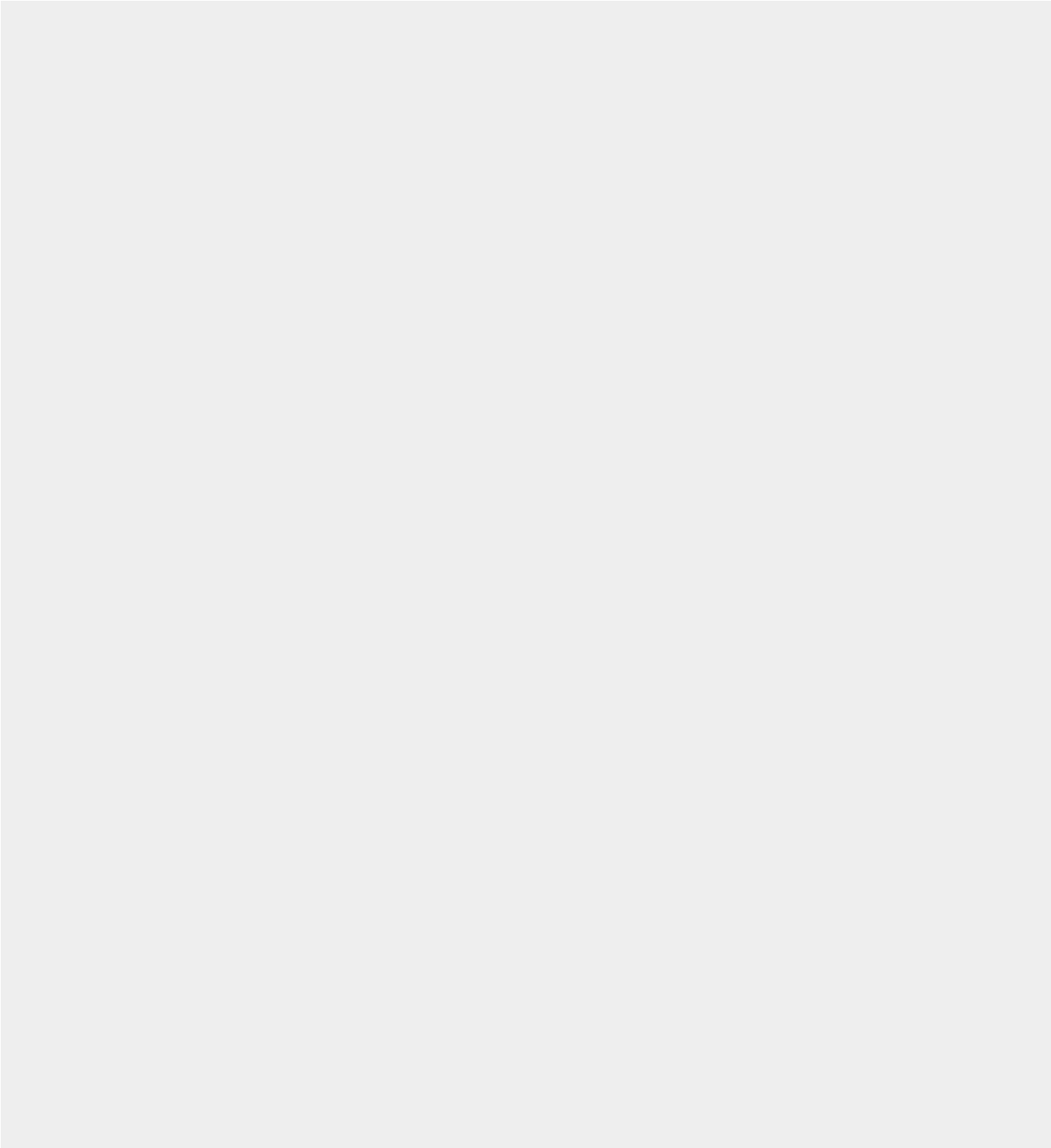
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19 Comments

Mack

April 27, 2022 at 4:31 am

Reply

DONT BELIEVE this crud, I know many of people including myself that went from smoking cigs -to- vaping and it has made a huge difference in our lives. Vaping is a heck of a lot better than smoking cigarettes... This “story” Is just about “antihistamine” companies get their fill... Don’t believe everything you read. Real proof stands out above the bull...

Kitti Anderson

Reply

April 26, 2022 at 11:01 pm

I wonder if vaping caused the post nasal drip that started slowly when I switched in 2015? It’s been 14 months of 24 hour dripping & I have seen 8 doctors & spent 4 days in the hospital. No doctor has been able to give me! @ least I quit vaping 9 months ago & if I wasn’t so sick, I know I wouldn’t have quit!

Online Cart Store

Reply

April 26, 2022 at 3:41 pm

This research is important to the vaping community. But I know they wanted neutral research which can tell them which vape brands have the least risk of damaging their health.

With many CBD and THC vape brands and their flavors in the market to choose from, they all can’t offer the same quality. We can’t just study a few vape brands and say “e-cigarettes alter inflammatory states across multiple organs, including the brain” without telling the consumers the best choice. A better study will include doing research on about 100 top trending vape brands with each of their flavors and telling consumers which of them has the least risk of damaging their health.

This is true because they’ll almost always buy vape carts online no matter how research shows that vape carts and oils damage their health. Google trend shows that there is a steady increase in the search volume for these phrases (THC carts for sale and buy

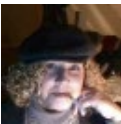
THC carts online); which means there are many vape consumers searching for e-cigarettes online.

Dr.M

April 25, 2022 at 5:50 pm

Reply

Whenever the natural balance of the human body (homeostasis) is interfered with, the results are deleterious to varying degrees. The human body is the product of long term evolution and as such it is not possible to interfere with its natural functioning sans deleterious consequences. To bad mouth the study is an expression of anger that the study was conducted at all. A thorough literature search will reveal greater support for the principle enunciated herewith. Smoking, vaping, chewing tobacco, inhaling snuff and the like are all known vices. Live a clean life free of addictions, live long and enjoy life. Maintain a measure of reverence for all things not created by man. Look at the wonders of creation all around you and marvel at the fact that your body is part of that creation as well. Broaden your intellectual horizon and live clean, free of vices.



cigarbabe

April 25, 2022 at 1:28 am

Reply

This is simply another garbage study to find harms from vaping. Ok you exposed mice to ecig vapors far longer than a human would use a JUUL yet still found zero actual harms! Great job wasting money the NIH should be spending on actual harms like dementia. In 20 years not a single person has died or gotten ill from switching to ecigs from cigarettes.

Heather McCall

April 24, 2022 at 3:25 pm

Reply

Yes I think they are horrible but I am a vapor and it's the hardest thing I've ever had to stop. Yes, even harder then when I just stopped smoking cigarettes. I now believe I have some brain

damage from vapes or act scan showed a couple years ago a 8mm spot on my left side of my brain but anyway I do think they cause bone spurs, damage of the brain, lungs etc. okay well thanks. HM

Marcus

Reply

April 24, 2022 at 12:29 am

So they found markers of inflammation, but not actual tissue inflammation. They, then, speculated what could happen if the markers increase (in mice). They didn’t have a control group that included cigarette smoke. And didn’t have a control group for caffeine (since nicotine and caffeine have similar effects on the body) Why is this study even considered important enough to publish. “News flash! inhaling something not meant to be inhaled made the body do something weird that we can’t explain, but no actual damage or ha came from it!”

Frederick Farias

Reply

April 22, 2022 at 4:21 pm

It is a good study, since it is looking at details (i.e.colon, heart, lungs) but you must incorporate context. These are mice, and the effect on the larger human who is active or inactive is going to be different.
So you can only accurately interpret results with a human study.

Peggy

Reply

April 20, 2022 at 6:52 pm

Why or how are you conducting such a study on products that are no longer available? Mango Juul pods have been removed from the market for quite some time – over 2 years, I believe. Cigarettes when used as directed are guaranteed to cause harm. Replacing combustible cigarette usage with nicotine vaping reduces that harm!

Victor Ramos

April 20, 2022 at 11:08 am

Reply

I have been vaping since it came out I feel great no issues my health is good my health check ups every 3 months are normal and feel a lot better than when smoked cigarettes.Probably another false ploy from the cigarette companies to ban vaping cause they keep losing money!

Joy Gonnerman

April 22, 2022 at 12:06 pm

Reply

Big Tobacco owns vaping companies or large portions of shares. Tobacco benefits greatly from the vaping epidemic.



C. B.

April 25, 2022 at 1:35 am

Reply

Vaping was always independent from tobacco companies. Only JUUL sold a fraction of it’s business to B.T. Vape shops are all independently owned by small retailers. There isn’t nor was there ever a “vaping epidemic”. Get a grip Karen!

Marcy

April 20, 2022 at 10:39 am

Reply

Was this study replicated or is this like the many other promoted studies that sre not peer reviewed. Am i supposed to take this more seriously than the random herbal diet pill studies or cricket sounds cure dementia?

Jennifer

April 20, 2022 at 8:42 am

Reply

Although the research is very beneficial for smokers to see that VAPING is just as dangerous as paper cigarettes, it is Ling past due to stop abusing animals for HUMAN studies...there are more than enough age grouped people you could have convinced to be “lab mice /rats” instead of exposing actual mice (other animals) for these studies.

Jeff Strohman

April 20, 2022 at 2:18 pm

Reply

4 chemicals make up vape juice. 7,000 in cigarettes. ...you were saying...

Dick Buttkiss

April 20, 2022 at 5:30 am

Reply

No one uses juul. Fucking useless science with useless scientists studying shit that doesnt matter for politicians with no thought of anyone but themselves.



Milky

April 19, 2022 at 4:38 pm

Reply

Zero I formation about the study, the amount of subjects, quantity of flavorings, type of atomizer...etc

Garbage science

Ed

April 19, 2022 at 3:57 pm

Reply

It’s sad that the research performed was just limited to Juul products. Maybe before you publish articles on vaping you should check out all of the available products and available home product supplies.
You cannot hope to make a comment on vaping if you’re

restricting yourself to one companies product.

Glynis

April 26, 2022 at 3:30 pm

Reply

I agree. I use the vuse,golden tobacco, 2.4% nicotine. For 1.5 years. Quit smoking after 45 years and feel great! No coughing or weezing, lungs are clear!!

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