

#BIOCHEMISTRY

Extending Shelf Life Of Vaccines

Most vaccines require strict temperature regulation from the manufacturing line to injection into a human arm.



Early half of all vaccines go to waste. This is due to the logistical obstacles involved in transporting them to diverse regions of the world. Most vaccines require strict temperature regulation from the manufacturing line to the injection into a human arm. Maintaining a constant temperature along the cold supply chain is a challenging feat in the best of circumstances. In the Sub-Saharan Africa and other developing regions for example, limited transport infrastructure and unreliable electricity compounds the already immense challenges of delivering viable vaccines.

Rising to the challenge, scientists from ETH Zurich's Macromolecular Engineering and Organic Chemistry Labs and entrepreneurs from Colorado based Nanoly Biotechnology worked together to develop a safe, versatile platform to increase the thermal stability



of vaccines. Their aim is to vastly improve the distribution of viable vaccines and reduce the economic costs of the cold chain.

Like 'Tupperware' for Proteins

"Think of it like an egg," explains Bruno Marco-Dufort, a doctoral researcher in Professor Mark Tibbitt's Macromolecular Engineering lab. "At room temperature or in the refrigerator the egg maintains its viscous like protein structure but once it hits boiling water or the frying pan its structure changes permanently." It is similar for the proteins in a vaccine - once exposed to certain temperatures they clump together. Cooling them down again will not reverse their denaturation - you can't 'un-cook' the egg.

So rather than altering Mother Nature, Marco-Dufort and the research team developed a new type of hydrogel, the details of which were just published in the journal Science Advances. The gel is based on a biocompatible, synthetic polymer known as 'PEC' that serves as a protective, 'cloaking device' for very large - yet invisible to the naked eye - complex molecules such as the proteins found in vaccines, antibodies or gene therapies. The packaging works kind of like a molecular Tupperware, encapsulating the proteins and keeping them separated. It enables the proteins to withstand a higher range of temperature fluctuations. Instead of the traditional +2 to +8°C (35 to 47°F) range for the cold chain, encapsulation allows for a range of 25 to 65°C (75 to 150°F).



Most importantly, the encapsulated cargo is simply released by adding a sugar solution, enabling easy on-demand recovery of the vaccines at their point of use.

Usage in Cancer Research

In addition to a higher rate of vaccine viability, the real game changer of this new biomedical hydrogel technology is the potential economic effect it could have on reducing costs and health risks associated with the cold chain. "In 2020, the overall market for cold chain services (from manufacturing to distribution) was \$17.2 billion and forecasted to rise," the researchers reported. Rising costs pose potentially dire consequences for public health and public trust if vaccines arrive via a compromised cold chain.

"Most vaccines are sensitive to hot and cold. This creates a large barrier for global immunization campaigns, because vaccine distribution and administrative costs often exceed the costs of production," explains Marco-Dufort. While more investment will be needed to shore up the cold chain, encapsulation offers a cost saving solution that could be put towards production of more vaccines and thus save more lives.

Yet, there is still a long way to go in terms of further research, safety studies and clinical trials before the hydrogels can be implemented for vaccine distribution.

Solving a Global Issue

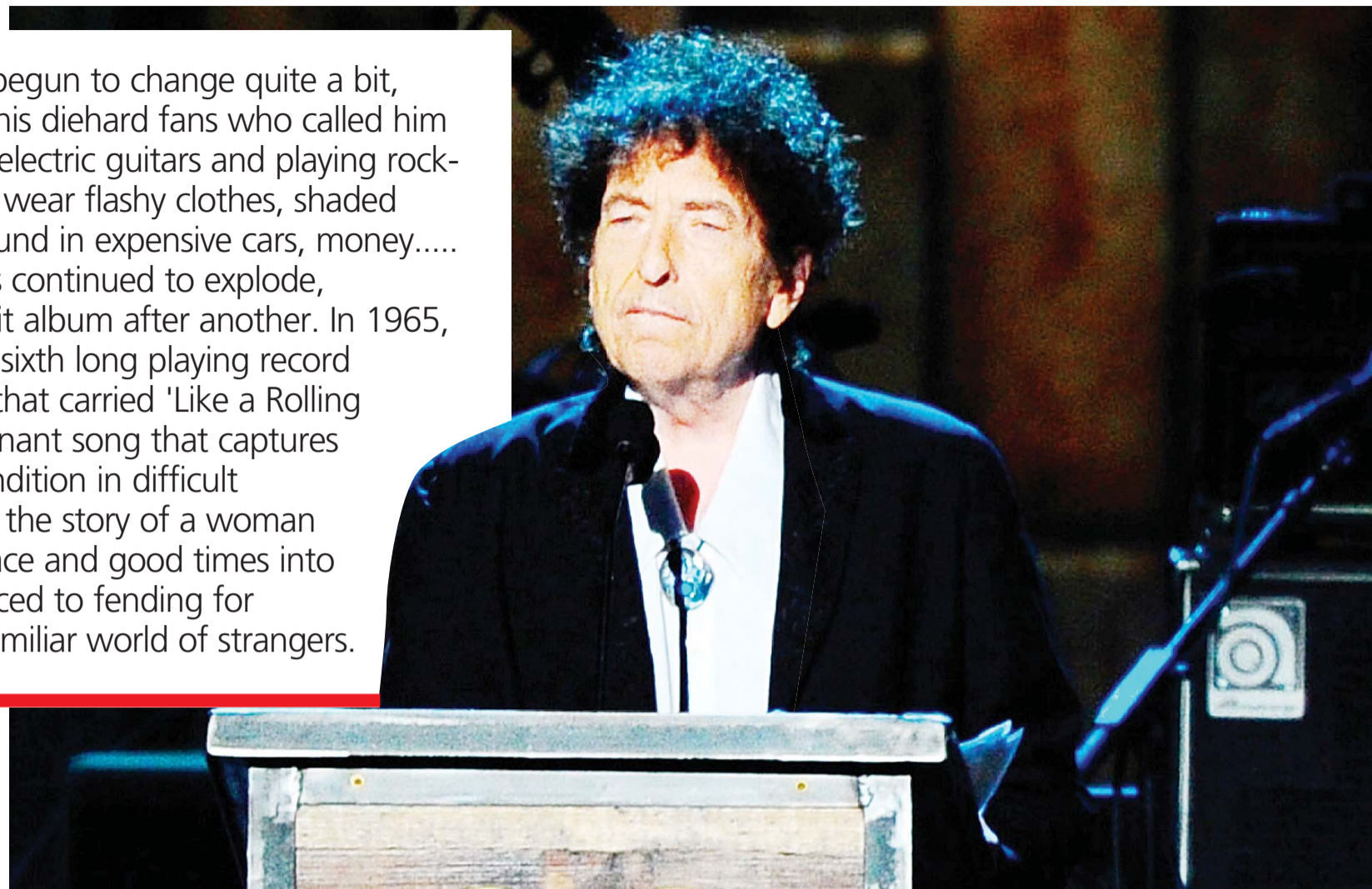
While new biotechnologies and cost savings are a step in the right direction, there are still tremendous logistical, political and socio-economic challenges in resolving the global issues surrounding equitable vaccine distribution and vaccine hesitancy. Marco-Dufort's motivation is undeterred. His childhood experience living in the Democratic Republic of the Congo instilled a deep appreciation for the need for vaccines against infectious diseases not just for Covid-19 but also for Polio, Meningitis and Ebola. He more than most is aware of the tremendous challenges people living in Sub-Saharan Africa face in terms of access to vaccines where infectious diseases are still prevalent.

Mark Tibbitt, Bruno Marco-Dufort and the team's work represent a substantive advancement in vaccine excipient development. Their work also offers a glimmer of hope for a positive societal impact. Even a small relief of the economic factors associated with the distribution of vaccines, medicines and biomedical research could result in larger impacts down the road.

By mid 60s, Dylan had begun to change quite a bit, much to the dismay of his diehard fans who called him names for switching to electric guitars and playing rock-n-roll. He also began to wear flashy clothes, shaded glasses and moving around in expensive cars, money.... But his creative energies continued to explode, producing one smash hit album after another. In 1965, Columbia produced his sixth long playing record 'Highway 61 Revisited' that carried 'Like a Rolling Stone'. It is quite a poignant song that captures the ethos of human condition in difficult circumstances by telling the story of a woman who has fallen from grace and good times into misfortunes and is reduced to fending for herself in a hostile, unfamiliar world of strangers.



Nihal Mathur
Filmmaker,
writer, bon vivant



BOB DYLAN

The Vagabond Poet

Sometimes, as inspirational as gospel also! But that's because Dylan wrote about rural American values. His 'city' side would come later.

New York

In 1961, Dylan dropped out of college and arrived in New York as a young man of 19. Like others of his tribe, Dylan landed up performing in Greenwich Village district, especially around MacDougal street, at the now famous Cafe Wha. This was the hip and happening place where all kinds of singers and performers converged to showcase their talents. Dylan came onstage solo with a simple acoustic guitar and a harmonica; and while sitting on high stool, he belted out sheer poetry in

nicotine stained voice that spoke for free speech and right to protest. He was quickly noticed by the press, contracted by Columbia Records and given his first album simply titled 'Bob Dylan' in 1962. It must be said for Dylan that he did not forget to pay homage to his hero in his debut album with a 'Song to Woody':

*"I'm out here, thousand miles from my home
Walkin' a road other men have gone down
I'm seein' your world of people and things
Your paupers and peasants and princes and kings
Hey, hey Woody Guthrie, I wrote you a song
Bout a funny ol' world that's a-*



Joan Baez & Dylan sharing the stage.

#LEGEND

*comin' along
Seems sick an' it's hungry, it's tired
an' it's torn
It looks like it's a-dyin' an' it's hardly been born"*

The Freeheelin' Bob Dylan, 1963

The following year, in 1963 the second album 'The Freeheelin' Bob Dylan' came out to critical acclaim, establishing Dylan's place among the song writers. What caught the nation's imagination and became a worldwide hit was the song 'Blowing in the Wind' which caused a sensation because at that time nobody was writing songs like Dylan. People were listening to his songs over and over again to memorize the lyrics and then discuss the meaning of the poem for hours with their friends. One such interpretation describes 'Blowing in the Wind' as a protest song because it raises questions about war, peace and freedom. The refrain "... answer my friend, is blowin' in the wind..." has been interpreted to mean either the answer is so obvious it is right in your face or the answer is as intangible as the wind. Either way you are unable to find the answer.

*"How many roads must a man walk down
Before you call him a man?
How many seas must a white dove sail*

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Inventors Month

The printing press. The automobile. The internet. Electricity. Penicillin. Glasses. Sliced bread. All of these things and thousands more are inventions made by our ingenious inventors that may have lived thousands or hundreds of years ago or may even still be alive today that we benefit from every single day. Take some time to appreciate the brilliant men and women who have invented ways to make our lives better and easier from glasses to plumbing to spaceships.

ments' but Dylan publicly denied such claims. *"Come senators, congressmen
Please heed the call
Don't stand in the doorway
Don't block up the hall
For he that gets hurt
Will be he who has stalled
There's a battle outside and it is ragin'
I'll soon shake your windows and rattle your walls
For the times they are a-changin'"*

Another Side of Bob Dylan, 1964

Same year Columbia released 'Another Side of Bob Dylan' that featured some brilliant songs including 'Chimes of Freedom'. The poetic imagery of Chimes of Freedom is quite complex and allows an individual to interpret and understand it in a personal way. In fact, there are some lines that you don't quite understand but still these enigmatic lines stay with you all your life. It is the choice of words, their juxtapositioning and unexpected turn of phrases that gets singled in your memory and immortalizes the poet and his poem:

*"Far between sundown's finish and midnight's broken toll
We ducked inside the doorways,
thunder went crashing
As majestic bells of bolts struck shadows in the sounds
Seeming to be the chimes of freedom
Flashin' for the warriors whose strength is not to fight
Flashin' for the refugees on the unarmed road of flight
And for each an' every underdog soldier in the night
And we gazed upon the chimes of*

shaded glasses and moving around in expensive cars, money.... But his creative energies continued to explode, producing one smash hit album after another. In 1965, Columbia produced his sixth long playing record 'Highway 61 Revisited' that carried 'Like a Rolling Stone'. It is quite a poignant song that captures the ethos of human condition in difficult circumstances by telling the story of a woman who has fallen from grace and good times into misfortunes and is reduced to fending for herself in a hostile and unfamiliar world of strangers:

*"Once upon a time you dressed so fine
Threw the bums a dime in your prime, didn't you?
People call say 'beware doll, you're bound to fall'
You thought they were all kidding you
You used to laugh about
Everybody that was hanging out
Now you don't talk so loud
Now you don't seem so proud
About having to be scrounging your next meal
How does it feel, how does it feel?
To be on your own, with no direction home
Like a complete unknown, like a rolling stone"*

It is one song Dylan greatly enjoyed himself. In a Playboy interview he said that there was a time when he had decided to quit music but 'Like a Rolling Stone' changed it all. He said, "I mean, it was something that I could dig myself. It's very tiring having other people tell you how much they dig you if you yourself don't dig you." What caught the imagination of the artists was this phrase in the song 'No Direction Home'. Perhaps this is



Dylan playing rock-n-roll using electric guitar.

freedom flashin'

Mr. Tambourine Man

Written and composed around the same time as 'Chimes of Freedom', 'Mr. Tambourine Man' was yet another hit Dylan delivered in his next album 'Bring It All Back Home' in 1965. It is indeed a difficult song to understand but the lyrics sound so good although the message behind them only contains sorrow, longing and misery where Mr. Tambourine Man is seen as a symbol of salvation. The song's popularity led to many recorded versions and was performed by many artists - actually more than 80, according to Google. 'Bring It All Back' had another landmark song 'Subterranean Homesick Blues'. Stylistically it was very different from what Dylan had ever attempted before. For starters, it was written in staccato style, à la hip hop:

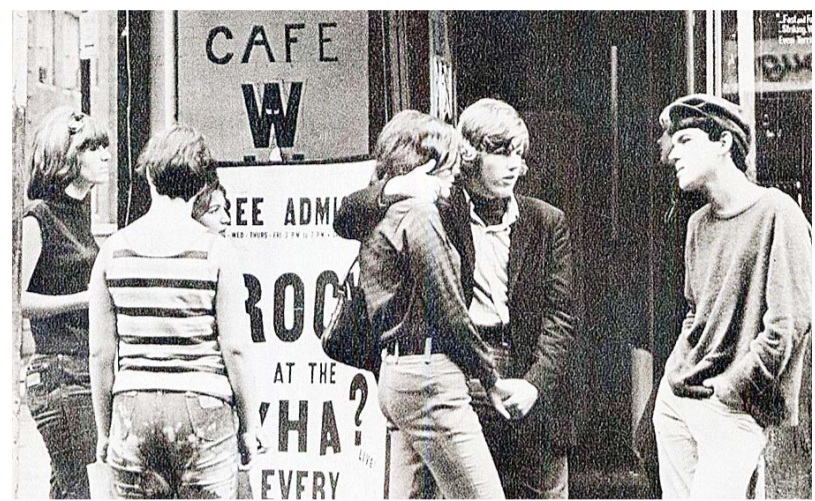
*"Get sick, get well, hang around a ink well,
Ring bell, hard to tell, if anything is going to sell,
Try hard, get barred, Get back, write Braille,
Get jailed, jump bail, join the army, if you fail,
Look out kid, you're gonna get hit..."*

Highway 61 Revisited, 1965

By mid 60s, Dylan had begun to change quite a bit, much to the dismay of his diehard fans who called him names for switching to electric guitars and playing rock-n-roll. He also began to wear flashy clothes,



Dylan strikes the pose with Guthrie, his idol.



Cafe Wha, where Dylan played in New York.

Simple Twist of Fate

Special mention must be made of Dylan's 'Simple Twist of Fate' which was said to have been written for any one of his muse - Suzie Rotolo, Joan Baez and Sara Dylan. It is a narrative about a romantic relationship destined not to work out. Suzie was his first muse and they were together for a couple of years before breaking up in 1964, in circumstances which Dylan has described in his song 'Ballad in Plain D':

*"Beneath a bare light bulb the plaster did proud
Her sister and I in a screaming bathtub
Joan Baez*

'Simple Twist of Fate' was most likely written for Joan Baez, with whom Dylan had a special relationship because they shared a long association together as poets, writers, singers, protestors in their early years. They appeared on stage together, holding hands, just being good friends. In their twenties, they made a fine pair. They collaborated for several years before their relationship blossomed into romance. They may not have taken the vows as husband and wife but the two together were just as good as one. But then Dylan moved on and so did Baez, who wrote 'Diamonds and Rust', a song for Dylan that despite everything memories continue to live on.

Dylan a Poet

Dylan never liked to be called a poet and considered himself a story teller instead. There is no doubt that Bob had this amazing 'ability to

tell stories, create images, inspire ideas and baffle the listener with his words'. Yet in his song 'I Shall Be Free' he clearly says:

*"Now they asked me to read a poem
At the sorority sister's home
I got knocked down and my head was swimmin'
I stood up with the Dean of Women
I'm a poet, and I know it
Hope I don't blow it"*

What made Dylan qualify as a true artist was not just his music alone but his extraordinary sweep and understanding of arts especially literature. Dylan had read all the great poets, the inspiring philosophers, the classic novelists and the timeless thinkers. Dylan was a deep thinking philosophical person who actually said that he did not know who he was most of the time. But he did have the ability to see what was going on in the world around him, process it and then distill it in a song. His message of protest made him a rebel. Dylan always fought the establishment but surprisingly he never wrote and sang anything directly against the Vietnam War.

Tarantula, 1965- 1966
Besides the poet, there was also a writer inside Dylan who dabbled in the experimental prose as well as poetry, and in 1971 he produced a collection of his writings in a book called 'Tarantula'. It is completely gibberish if you are not trained to read a stream of consciousness kind of prose. But apparently Tarantula is also filled with obscure but marvelous imagery' that eventually influenced Dylan's songwriting. Tarantula has been described as a kind of trip in the tradition of modern

ern American Beat writers and poets like Allen Ginsberg, Jack Kerouac and William Burroughs. Dylan also published Chronicles: Volume One, the first part of his memoirs; several books of the lyrics of his songs and eight books of his art. He has also been the subject of numerous biographies and critical studies; and who knows, Ph.D.s in future.

Nobel Prize for Literature, 2016

In what was seen as a surprise, the 2016 Nobel for Literature was awarded to Bob Dylan. Although Dylan's name had been in speculation for years but few expected the Swedish Academy to extend this prestigious award to a genre such as pop music. And, this was a stunning announcement as well because for the first time the award was being bestowed to someone primarily seen as a musician. The Nobel citation said that the award to Dylan was 'for having created new poetic expressions within the great American song tradition'. He embodies the traditions and handles it in a very original way'. This sparked a controversy whether Dylan was even qualified for the 'Literature' tag in the first place. Never mind the debate, what is recognized is that Dylan's poetry is seriously studied by high school and college kids because his songs carry references to TS Elliot, Dylan Thomas, Shakespeare, Ginsberg and a whole lot of other poets, writers and thinkers. Many universities including Harvard, have courses, seminars and lectures on the poetry of Bob Dylan, where he is studied



Joan Baez & Dylan, a fine pair.

not only in context of popular culture of the 1960s but also seen in the tradition of classical Greek and Roman poets like Homer, Virgil, Horace and Ovid.

Awards

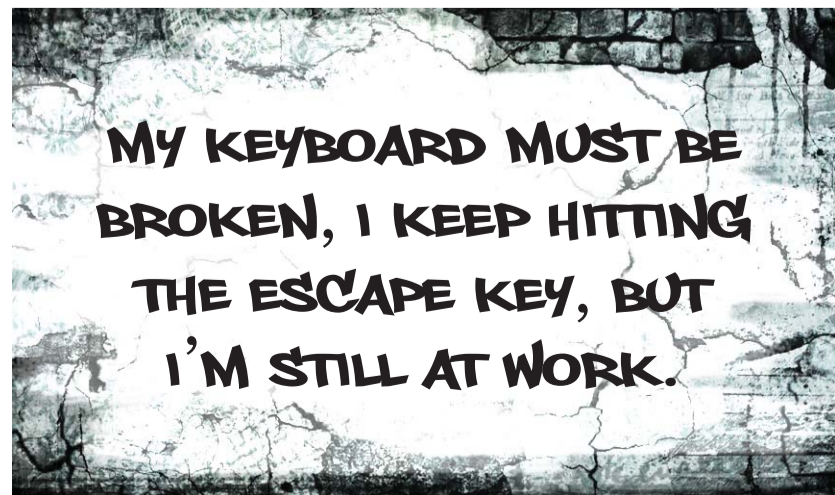
Awards and whatever that comes with it meant nothing to Dylan. But Dylan's career is laced with awards. There are just too many to be listed but Dylan got his first Grammy in 1973 for Album of the Year award. Since then Dylan has won more than 10 Grammys in different categories. Pulitzer Prize in 2008. President Obama presented him with the Presidential Medal of Freedom - nation's highest civilian honor in 2012, and so did the French who decorated Dylan with their Legion of Honor in 2013.

Conclusion: The Vagabond Poet

Dylan is in a perpetual state of flux, forever changing, refusing to conform and be straight-jacketed by others. A vagabond at heart, his inner compulsions keep him moving on, reinventing his persona all the time. But always a singer songwriter. Just as words in Shakespeare's plays were meant to be acted on the stage, the songs of Bob Dylan are meant to be sung and heard, not read on a page. So go out there on YouTube and sing along with some of his old hits.

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THE WALL

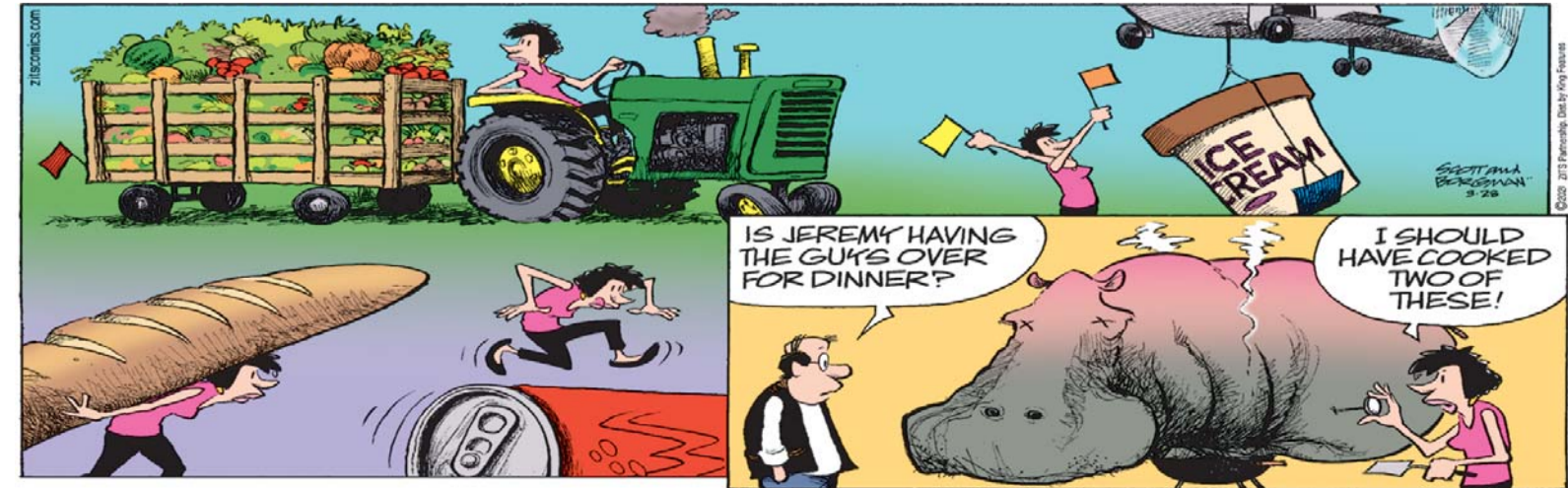


BABY BLUES



By Rick Kirkman & Jerry Scott

ZITS



By Jerry Scott & Jim Borgman