IMMUNOLOGY AT A GLANCE

29th April 2019

World Immunology Day

Sponsored by

Indian Immunology Society (IIS)

Short Movie/Animation Making Competition

Extended Last date of submission: 28th April 2019

Symposium

Venue: Council Hall, Tezpur University

Programme	Time
Inaugural Programme	2:30 – 3:00 PM
Guest Lecture	3:00 – 4:00 PM
Screening of 2 Best movie/animation	4:00 – 4:30 PM
Valedictory and Prize Distribution Programme	4:30 – 5:00 PM
Feedback Session with participants followed by Tea and Snacks	5:00 – 5:30 PM

Short Movie/Animation Making Competition

On the occasion of World Immunology Day, Immunology and Immuno-Genetics lab, Department of Molecular Biology and Biotechnology, Tezpur University, under the aegis of the Indian Immunology Society (IIS), is organising a half-day symposium entitled '**Immunology at a Glance**' to promote the benefits of immunology research during the International Day of Immunology (DoI) that is taking place every year on **April 29**. "The day is dedicated to increasing global awareness of the importance of immunology in the fight against infection, autoimmunity and cancer"- IUIS. The programme is aimed at inculcating and promoting interest in Immunology amongst the University students. In celebration of the day, a short movie/animation making competition is organised. Interested participants may go through the rules and regulations given below.

Rules and Regulations

Guidelines

- Theme for the short film is – **"Immune System-An Army at Work"**
- Please read the write up on the theme for better understanding
- Films are to be made on any aspect of the theme.
- Language used in the films should be English.
- The entries can be documentaries, short films, animations or experimental art forms.
- The duration for the short film must be from 3 minute – 12 minutes.
- The short film must be original and no watermark of any kind should be on the film.
- The film must be of highest quality possible.
- Adult content of any kind will not be entertained and would lead to direct disqualification.
- Due credits must be given to the cast and the crew in the film though the final prize would go to the director(s)/producer(s).
- Last date of submission of film is 28th April, 2019

Details of submission

- There is no entry fee for this competition.
- The film can be submitted as a shareable Google Drive link. The link can be sent to guru-18@tezu.ernet.in along with the filled in registration form.
  (Don't know how to share a file from google drive? – Click here)

Judging Parameters

- Films will be judged entirely on the concept, technical aspects, presentation and clarity of the message.
- The Judges' decision will be considered as the final decision.

Screening & Awards

- Best films will be shortlisted after 25th April, 2019.
- Best films will be screened on 29th April, 2019 in the seminar hall.
- Filmmakers are requested to attend the symposium on the 29th April, 2019 at the Council Hall.
- Cash prizes along with certificates will be awarded for overall excellence to the director(s)/producer(s) of two short films chosen by judges.
- Prizes 1st – Rs. 1500/- 2nd – Rs. 1000/-
- In case of any controversy on a matter not mentioned in the above regulations, the Organizers will decide on appropriate action.
- The Organizers' word shall be final and binding.

****** Immunology and Immunogenetics Lab, Department of Molecular Biology and Biotechnology, Tezpur University, Napaam, Sonitpur, Assam – 784028.******

Immunology at a Glance

World Immunology Day

29th April 2019

Short Movie/Animation Making Competition

REGISTRATION FORM

Name:

Programme :

Department:

Enrollment No. :

E-mail:

Contact No. :

Title of your film:

Concept of the film (150 words):

Signature of the participant

Date: Place:

Organized by : Immunology and Immunogenetics Lab, Department of Molecular Biology and Biotechnology, Tezpur University under the aegis of Indian Immunology Society(IIS)

IMMUNE SYSTEM – An Army at work

You may not know it, but your body is engaged in a never-ending battle to keep it disease free. You are literally bombarded with germs and all sorts of dubious characters that are intent on using you, and your body's many resources, to feed themselves, find shelter, and reproduce as much as they want and it is not your job to give these guys a free lunch. So your body has developed a three-pronged policy toward these shady customers, and its enforcement is handled by your immune system.

The immune system is different from all the other systems in your body, in that it's not a specific, tissue-organ-system kind of system. Instead, it involves a whole bunch of different tissue groups, organ systems, and specialized but widely-distributed defense cells .Together, this league of extraordinary cells and molecules join forces to perform all of the defense functions your body depends on to keep you alive in a rather germy world.

And the first line of defense in this never-ending battle is the?

That's your **innate or nonspecific defense system**. Like your average frontline soldier, it's prepared to immediately engage with anyone suspicious. The system mostly includes stuff we were born with, like the external barricades of your skin and mucous membranes, and internal defenses like phagocytes, antimicrobial proteins, and other attack cells.

But some enemies must be fought with special forces. And here, your body can deploy your **adaptive, or specific defense system** - which is more like your SEAL Team Six. It takes more time to call in, but it's specially designed to go after specific targets. And it keeps files on those bad guys so it knows how to handle them next time around.

Innate Immune System

Your Innate Immune system uses an arsenal of physical and chemical barriers, killer cells, and even fever, to keep you healthy.

A lot of your innate immune system's functions aren't exactly subtle. For example, your body's very first line of defense is a simple physical barrier. And it works! Like a wall around a fortress, your skin does a fantastic job of keeping out all manner of malevolent microorganisms, as long as that tough, keratinized epithelial membrane doesn't get torn open or busted up too much. Your many mucous membranes as in your nasal passages also provide a handy physical barrier. They line any cavity that opens up into the germy outside world, including the respiratory, digestive, urinary, and reproductive tracts. Not only do your skin and mucosa supply simple physical protection, they also pack some serious chemical weaponry.

Ate some questionable leftovers for lunch? Don't worry, your stomach is literally filled with acid, so you probably are covered.

Walked face-first into your friend's nasty sneeze cloud? No worries, your nasal passages can whip up a tissue-box worth of sticky mucus to help trap viruses before they enter your lungs.

You've also got bacteria-fighting enzymes in your saliva and lacrimal eye fluid, and peptides called defensins in your skin and membranes that help keep bacteria and fungi from setting up shop around inflamed or scraped skin.

When your epithelial i.e. skin and mucous membranes line of defense is breached-that first simple line of defense; it's time to call on your second line of internal innate defenses.

This is where your body starts pulling strategic maneuvers like firing up a fever, releasing chemical signals, causing inflammation, or other defensive tactics that help identify and attack infectious invaders. Some of the first defensive cells on the scene are your **phagocytes**. Their name literally means "to eat," and like Pac-Man, they indiscriminately chase down intruders and gobble them up. And they come in a few different varieties:

First you've got **NEUTROPHILS**, which are the most abundant type of your white blood cells. They kind of self-destruct after devouring a pathogen – a disease causing organism. And, in fact, you've actually seen piles of their little dead bodies, because that's what pus is made of. But the bigger, tougher phagocytes are the **MACROPHAGES**. They're derived from monocyte white-blood cells that have moved out of the blood stream to occupy tissues. And some are free types that patrol tissues looking for any micro organism, while others are fixed – attached to fibers in specific organs, devouring anything suspicious that passes by. So when a macrophage sees a new bacterium coming along, it snares it using cytoplasmic extensions, reels in it, completely engulfs it, and -- essentially -- digests it and spits the rest out. And unlike neutrophils, it can do this over and over again, like a Boss.

But not all your defense cells are phagocytic. You've also got cells with what is by far the awesomest name of any cell in the body: the **NATURAL KILLER CELLS**. Anyway, these tiny assassins patrol your blood and lymph looking for abnormal cells, and are unique in that they can kill your own cells if they are infected with viruses or have become cancerous.

How can they tell?

A normal, healthy cell contains a special protein on its surface called MHC, or **Major Histocompatibility Complex**. But if it's infected, many a times it stops making that protein. And if an NK cell detects a defective cell, it doesn't swallow it whole like a macrophage -- it pokes it with an enzyme that triggers its death by a process called apoptosis, or programmed cell death, which is pretty awesome.

So those are some ways your innate immune cells handle their enemies, but how do they know where to look in the first place?
So, let's talk strategery.

Say, you scraped your knees on a fall. Your outer fortress has been breached, and the pathogens are just flooding in. Now your body wants to contain the spread of pathogens, clean up the mess, and get healing as quickly as possible, so it cues up your inflammatory response. This is basically an internal fire alarm, only it uses chemicals instead of sirens to get the message across, and instead of smoke and fire you sense redness, swelling, heat, and pain.

For example, in the event of injury, specialized mast cells in your connective tissue send out histamine molecules. And histamine is great at calling in the cavalry. For one thing, it causes vasodilation, which creates redness and heat at the site of the injury. Now, those things might freak you out a little, but they're actually signs of healing -- the increased temperature, for example, ratchets up the cells' metabolic rates so they can repair themselves faster. Meanwhile, histamines and other inflammatory chemicals also increase the permeability of blood vessels,

causing nearby capillaries to release protein-rich fluids. This causes swelling -- which again, is actually a good thing -- because that leaked protein helps clot blood and form scabs, while the lymphatic system sucks up and filters that extra fluid, cleaning it up before putting it back into your bloodstream.

And of course, like bait to sharks, an inflamed knee is also going to attract a bunch of local phagocytes -- which find it easier to escape your now-leaky capillaries -- and lymphocytes that are also flowing freely, helping to destroy .And don't forget: During all this, the neutrophils have been doing their best, but they were the first wave to arrive, so by this time, they're starting to die in heaps. They're triggered when the injured knee-skin cells release chemicals that begin leukocyte migration and the release of neutrophils from the bone marrow, where they're made, into the bloodstream.

To attract the neutrophils to the damaged area, inflamed endothelial cells in the capillaries send out chemicals that act like homing devices-- and when the neutrophils arrive, they cling to the capillary walls near the injury, flatten themselves out and squeeze through the vessel walls to get to work.

Your big monocytes eventually roll up to the battle, and transform into hungry macrophages,replacing that first line of now-dead neutrophils and basically just eating up any lingeringenemies and then cleaning up the carnage.Now, all this works pretty well in most circumstances. But you may have noticed if you've sustaineda more major injury, or are battling an especially nasty virus or infection, that sometimes yourlocal troops get overrun.

When white blood cells and macrophages run into more foreign invaders than they can handle, they let loose pyrogen chemicals that tap the hypothalamus and raise your body's thermostat, calling in a systemic fever. The resulting temperature rise increases the metabolism of your cells so they can heal faster, and it also tells the liver and spleen to hold onto all of their iron and zinc, so those things can't contribute to bacterial growth. But even then, sometimes, well sometimes you find yourself facing a more formidable foe.That's when you call in the specialists -- your adaptive immune defenses.

ADAPTIVE IMMUNITY

What's true in World of Warcraft is also true in your immune system:
To defeat your enemy, you have to know your enemy.
Uncover its weaknesses. Learn how to see it, before it sees you.

While your innate system takes it's zero-tolerance policy very seriously, and tries to toast any foreign microbe that it encounters, your adaptive immune system does things differently. It has to be expressly introduced to a specific pathogen, and recognize it as a threat, before it will attack – like interrogating a suspect before taking action.

As its name suggests, you're not born with a working adaptive immune system -- it's slow to act, in part because it takes time for it to shake hands with so many pathogens and get to know them.
These introductions may be organic -- like touching a dirty faucet in the bathroom or walking into a sneeze cloud. Or they may be premeditated with vaccines. Once it's been introduced to a

potential threat, your adaptive defenses never forgetit. And this ability to remember specific pathogens is one of the key differences betweenthe adaptive and innate defenses.

Another main difference is that adaptive immunity is systemic -- rather than being restricted to a particular infection, your adaptive system canfight throughout your whole body at once. And it does this by deploying one or both of its separate, but cooperating, defenses -- your **humoral immunity** and your **cellular defenses**.

Humoral Immunity

Your humoral immunity works by dispatchingimportant proteins called**ANTIBODIES**.They're made by special white blood cells, and they patrol the body's "humors"or fluids like blood and lymph, where they combat viruses and bacteria moving aroundthe interstitial space between your cells.Much of what you know, or have heard about, or think of, when your immune system comesup actually has to do with your humoral immunity. It's why, if you had chickenpox as a kid, you probably don't have to worry about gettingit again for the rest of your life.And it's why vaccinations work.

Whether you're protecting yourself from infections or playing an MMO, one of the firststeps in any good defensive strategy is to be able to tell your friend from your foe.And in the case of your immune system, that means being able to identify antigens (An antigen could be an invader from the outside world, like a bacterium, virus, or fungus.Or it could be a toxin or a diseased cell within your own body.But in any case, antigens are large signaling molecules not normally found in the body,and they act as flags that get the adaptive immune system riled up.)

So let's say a flu virus gets inside of you, and it's floating around trying tofind a good host cell to start multiplying inside of.Before it finds that cell, hopefully it will be paid a visit by one of the stars of yourhumoral response -- a **B lymphocyte**.

Like all blood cells, these guys originate in your bone marrow. But unlike other whiteblood cells, they also mature in the bone marrow too.And as a B cell matures, it develops the ability to determine friend from foe, developing both**immune-competence** (how to recognize and bind to a particular antigen) as well as **self-tolerance** (knowing how to NOT attack your body's own cells).

Once it's fully mature, a B lymphocyte displays at least 10,000 special protein receptors on its surface -- these are its **membrane-bound antibodies**.All B lymphocytes have them, but the interesting part is, every individual lymphocyte hasits own unique antibodies, each of which is ready to identify and bind to a particular kind of antigen.That means that, with all of your B lymphocytes together, it's like having 2 billion keyson your immune system's keychain, each of which can only open one door.

So, part of your immune system's strategy is just to win with overwhelming odds: The more unique antibodies your lymphocytes have, the more likely it is that one will eventually find, bind to, and mark a particular antigen.

Once they've matured, B cells colonize or "seed" your secondary lymphoid organs,like your lymph nodes, and start roaming around in your blood and lymph.At this point they're still naive and untested, and they won't truly be activated untilthey meet their perfect enemy match.

Which brings us back to the flu virus.

When the right B cell finally bumps into an antigen it has antibodies for and recognizes it, it binds to it. This summons the fullpower of the humoral immune response, and the cell basically goes into berserker mode.

Once activated, the B cell starts cloning itself like crazy, quickly producing an army of similar cells, all with the instructions for the exact same antibodies that are designed to fight that one particular antigen. Most of these clones become active fighters, or effector cells. But a few become long-lived memory cells that preserve the genetic code for that specific, successful antibody. This ensures that, if and when the antigen returns, there will be a prepared secondary immune response that's both stronger and faster than the first. This is key to why vaccinations are so brilliant and important.

But while the memory cells are just there to hang back and record things, the effector, or plasma cells, are packed with extra amounts of rough endoplasmic reticulum, which acts as an antibody factory. These cells can mass-produce the same antibodies over and over for that particular invader, spitting them out into the humor at a rate of around 2,000 antibodies per second for four or five days until they die. And the antibodies they make work the same way that the membrane-bound ones do; they're just free-floating.

So they ride the tides of blood and lymph, binding to all the antigens they can find, and marking them for death.Now, antibodies can't really do the killing themselves, but they do have a few moves thatcould make it hard for intruders to take hold. One of their most effective and common strategies is **neutralization**, where antibodies physically block the binding sites on viruses or bacterial toxins, so they can't hook up to your tissues. And because antibodies have more than one binding site, they can bind to multiple antigensat the same time, in a process called **agglutination**.The resulting clumps can't get around easily, which makes it easier for macrophages to come and gobble them up.And not only that, but while all this is going on, antibodies are also ringing a chemicaldinner bell, calling in phagocytes from the innate immune system, and special lymphocytesfrom the adaptive system, to destroy these messy little antigen-antibody clumps.

So, the point of all this in the short term is to keep you healthy. But in the long term,this process also adds to your overall immunity.The humoral response allows your body to achieve immunity by encountering pathogens eitherrandomly or on purpose.

Vaccines

Active humoral immunity is what we were just talking about -- it's when B cells bump into antigens and start cranking out antibodies. This can occur naturally, like when you catch the flu or get chickenpox or pick up somenasty bacterial infection, or it can happen artificially -- particularly through vaccination.

Most vaccines are made of a dead or extremely weakened pathogen. And they work on the premisethat, because a secondary immune response is more intense than a primary response, by introducing a pathogen into your body, you're priming it to fight hard and fast should that antigen show up again. In the case of typically non-fatal infections, like the common flu, this immunity shouldat least spare you from some of the most severe symptoms.But in the case of

more serious diseases, like polio, smallpox, measles, and whoopingcough, vaccinations can be truly life-saving.

Now, some antigens -- like those for mumps or measles -- don't really change much overtime, so a few immunizations will leave you set for life. But others, like influenza, are constantly evolving and changing their surface antigens.So immunity to last year's flu probably doesn't work against this year's flu.

B cells and antibodies are only part of the immunity equation. There are plenty ofpathogens that quickly worm their way right inside your cells, where they're safer fromthe humoral response and free to multiply as much as they'd like.Luckily, your immune system has yet another game plan and new set of players ready tofight that final battle with cell to cell combat.

Cellular Defense

Let's talk about one of your body's efforts to defend itself.

Your skin and mucous membranes did what they could, as physical barriers against infection. Andyour humoral immune response cranked out antibodies, in an effort to keep your interstitial spaces healthy. But your cells themselves were breached, pathogens and abnormalities began to run amok where antibodies could not get to them.Now, it becomes the business of your cell-mediated, or cellular immune response.And that's where stuff gets real. Where cell fights cell. And where the heroes look like **T lymphocytes**.

These lymphocytes, known as T cells, go after body cells that have been hijacked by things like viruses, or bacteria, or become cancerous.T cells cause inflammation, activate macrophages, get other T cells fired up, and generally regulate much of the immune response.

We've already talked about how, in the innate response, when a phagocyte sees a suspicious character, it engulfs it, and kills it, right? But what we didn't get into before is that, during its attack, the phagocyte actually breaks the pathogen into tons of tiny molecules, and then proudly displays those broken bits in grooved proteins on its outer membrane. These proteins are called **major histocompatibility complexes**, or **MHCs**. And they're a lot like how a battle-crazed warrior might show off a necklace made of knucklebones.

The system of presenting antigens on MHC molecules allow the T cells to survey the proteins inside the cells via MHC class I and around the cells via MHC class II. So if a particular cell is healthy, the antigens on its MHC 1 tell roving immune cells that everything's ok inside, nothing to see here. But if the cell is, say, cancerous and it's making abnormal proteins, then it'll fix bits of those proteins to its MHC, which alerts immune cells that there's a problem inside, and basically asks to be killed.

Class 2 MHC proteins present on the surface of Antigen Presenting Cells – like dendritic cells, bind to fragments of exogenous antigens, like a virus that has been engulfed, broken up, and displayed to get the attention of T cells. And this is how MHCs are totally essential to the cellular immune response. Because, the heroes of your cellular defenses, the T cells, can't actually detect whole antigens --they can only recognize them when they're all diced up and decorated on the MHCs of antigen-presenting cells.

Like how any National Defense Forces have their army, navy and air forces – you have distinct populations of specialized T cells that perform specific functions, the best defined of which are Helper T Cells and Cytotoxic T Cells. Helper Ts themselves can't kill, but they can activate cells that do, and they help call the shots for the adaptive immune response by releasing a cocktail of chemicals known as cytokines. Meanwhile, Cytotoxic Ts are the ones that actually do the killing of cells gone bad by releasing special enzymes that punch holes in the cell's membrane or otherwise triggering a programmed cell death. You also have Memory T Cells have become "experienced" by having encountered antigen during a prior infection, encounter with cancer, or previous vaccination.

So, by now it should be pretty obvious that without T cells, there basically is no adaptive immune response. Which is why immunodeficiencies can be so deadly.

AIDS, for example, is caused by the human immunodeficiency virus that specifically attacks Helper T cells. And without the Helper T's, there wouldn't be much of a humoral response, either. Because the cytokines that come screaming out of the helpers not only activate other T cells, but they also finish the training of the B cells.

On the other hand, a hyperactive immune system can cause mayhem by losing its ability to distinguish enemy from self, as it turns on your own body. Your regulatory T cells -- another type of effector -- help prevent this by releasing inhibiting cytokines that tell other immune cells to stand down once the initial threat has been handled. Without that regulation, the body might start cranking out too many antibodies and cytotoxic cells that could damage or destroy its own tissues. This dangerous confusion is what causes many autoimmune diseases -- like multiple sclerosis, which eats away at the myelin sheaths around neurons, or Type One Diabetes which tears up the pancreatic cells that make insulin.

So the takeaway here is that your immune system is usually really good at its job, which is to kill stuff in the name of keeping you alive. And you really don't want it to go rogue on you, because if there's one thing you should know is that your body is both resilient and fragile, and it survives only when the sum of its many complicated parts stays balanced and works together.

And that is the glorious wonder of you.