

**BIOME**  
The **BIO**logy Education **ME**ssenger  
(An ATBS eNewsletter)



*From The Editorial Team.....*

Greetings from the editorial team of Biome – the ATBS eNewsletter!! As we approach the end of this year 2020, we reflect upon the months gone by and the changes that have been brought about by the COVID situation all over the world.

It has been a difficult and challenging year with most parts of our country being in lockdown and with classrooms shifting from physical institutions to virtual platforms. The entire teacher and student fraternity had to put in a lot of hard work to make this change happen and to gain academically from the change. The Association of Teachers in Biological Sciences (ATBS) members have been trying to keep going even during these testing times. A popular online lecture series in biology was organized by the ATBS during the months of July – August, 2020. Several eminent scientists and researchers delivered talks and shared updates in various areas of biological sciences. A glimpse of the topics covered in this lecture series is included in this issue.

As most of you are aware, the intent of bringing out issues of the eNewsletter is to put forth thoughts and ideas of biology teachers across for others in the subject area to comment, deliberate and maybe practice them in regular biology classrooms. With this in mind, in order to get an idea of the experiences of virtual teaching by biology teachers across the country, teaching biology at different levels, we are conducting a survey titled ‘Biology Teaching and Learning in the time of Pandemic’. The responses from a cross-section of the Biology teachers’ fraternity will be shared with you all at a later stage. In the meantime, this issue includes a write-up on the ‘Issues and Challenges for Biology Teaching-learning during the COVID-19 pandemic’.

Additionally, the issue includes a short article on Animal Communication by Prof. P. G. Kale, a lab activity in biology and some interesting trivia in the form of a quiz along with some of the activities organized by the ATBS.

Hope you enjoy reading this issue and we look forward to hearing constructive feedback as well as ideas from you!!

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## Issues and challenges for Biology teaching-learning during the COVID-19 pandemic

*Bimalendu B. Nath<sup>1</sup>, Anupama Ronad<sup>2</sup> and Vikrant Ghanekar<sup>2</sup>*



**Prof. Bimalendu B. Nath, Emeritus Professor; former Head of the Department of Zoology, Savitribai Phule Pune University. He is a passionate teacher and is actively involved in teaching as well as research for over three decades.**

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The year 2020 will be marked and remembered in history not only for the devastating effects of the COVID-19 pandemic but also for the unprecedented disruption of educational activity. Across the world, routine classroom based teaching-learning has been upended due to the prolonged lockdown phases. In India, the Government declared a nationwide complete lockdown in March-2020 and teaching in schools, colleges, universities and institutes abruptly came to a halt. This was a move that was necessary to contain the rapid spread of the novel corona virus SARS-CoV2. Nevertheless, policy makers along with concerned authorities of various educational institutes tried to ensure that the education mechanism should continue without much disruption. This was to be done using online platforms for teaching courses at all levels. Fortunately, in India distance education and methodologies of e-learning were already being worked upon and several systems such as SHAGUN, DIKSHA, e-Pathshala, SWAYAM, etc have been available for quite some time now. But it was a real challenge to shift almost all of the ongoing offline-classrooms to the online mode and complete the syllabi in various courses across various states for all levels of primary, secondary and higher education.

As time progressed and days turned into months and months will soon turn into a year, the entire community of academia has been rather apprehensive trying to gauge whether this pandemic is gradually signaling the end of the traditional classroom teaching as most members were used to so far. In this context, biology as a discipline poses a

number of challenges which are encountered to a lesser extent by teachers of other disciplines.



**Dr. Anupama Ronad works with the Biology Olympiad Cell at the Homi Bhabha Centre for Science Education. She is involved with the Olympiad Programme and the NIUS Programme as well as conducts teacher and student orientation programmes in biology at the Centre for the past almost two decades.**

Teaching biology is different from teaching the other science subjects like physics, chemistry and mathematics for a variety of reasons. Firstly, depiction and approaches of inquiry in biology is tackled differently by different teachers based on the need of the student group that he/she is teaching. It is often said that “Biology is a science of exception” unlike other so-called ‘pure science’ subjects. Exceptions are inherent in biology and a meaningful pedagogy in biology demands a teacher to convince the students how ‘exceptions’ are plenty in biology due to dynamic evolutionary processes. The concern during the transition from the physical to the virtual mode for most teachers has been as to how a biology teacher effectively communicates to students without being present physically in front of them to articulate and use several modes such as audio-visual, chalk and board as well as power point slides, etc. Although students have been effectively conceptualizing many complex biological phenomena, animal behavior, intriguing biodiversity from authentic professional TV channels and online educational films, the biology teacher has been an important source of learning especially for students who do not have easy access to such online resources. The pandemic threw a challenge to all teachers – experienced, freshers as well as those who have not been technologically very adept at using these resources to shift their gears and counter the challenges posed before them while trying to make the whole teaching-learning process as efficient as possible

Another major pedagogical challenge for a biology teacher is to connect to different levels of organizations of living systems and the pictorial/illustrative depiction of the same during ‘real-time’ non-virtual lectures. This helps the students to build up their mental-map of rather complex biological phenomena. During lock-down, many biology teachers were apprehensive as to which of the online platforms and software/apps would be appropriate for teaching different topics in biology. The time that it would take to get used to the new teaching methods in virtual classrooms was another challenge. All in all, a teacher would need to put in a lot of extra effort, hard work and time for prior preparation to teach a concept/topic so that he/she could put together all the relevant resources and thereby adhere to timeline restrictions for a particular lecture.



**Mr. Vikrant Ghanekar works with the Biology Olympiad Cell at the Homi Bhabha Centre for Science Education. He is involved with the Olympiad and NIUS Programmes and teacher as well as student orientation programmes in biology at the Centre for the past several years.**

For a biology teacher, another concern has been effective online communication methods to help the students conceptualize processes like gastrulation, ultrafiltration, synaptic transmission and so on. These topics deal with dynamic life processes and one needs to acquire skills to disseminate them using animated tools in online platforms when white-board based opportunities to 'write and explain' for teaching is not possible. Now, not all teachers find themselves prepared to take up the challenges and many of them were not confident to begin with. Several of the teachers asked themselves how do I replace a white/black board style tool in a virtual classroom and what are the different gadgets and apps I need to possess and acquire to get used to. Thus, becoming technologically savvy was another hurdle that most teachers had to face and overcome. Many were skeptical about how effective their teaching would be and whether online learning would soon become monotonous and boring for the students who are continuously exposed to reading texts on the screen. Questions such as how do I upload a power-point presentation with animation and videos appropriate for biology topics to reach out to the students as effectively as it was before the COVID-19 pandemic were constantly bothering many of the teachers. These were several of the concerns that teachers especially in biology have been gradually resolving over time.

Some contemporary issues like disruption of connectivity during online lectures and security related threat perception during online assessments are yet to be solved and may be solved to various extents depending on several factors such as locations and access to facilities for students as well as teachers. But we are optimistically looking forward to receive suggestions from the biology teaching fraternity how to execute online laboratory based exercises in biology and conduct online field-based studies on biodiversity assessment and ecological survey etc. The ultimate challenge is how to make online learning equitable for laboratory and field based exercises and find optimum alternatives to 'hands-on' training in biology classrooms.

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## Popular Lecture Series

*ATBS in collaboration with the R. Jhunjhunwala College, Ghatkopar, Mumbai organized a popular lecture series in the month of August-September 2020. A total of thirteen lectures were delivered by eminent scientists and researchers from across the country. The details of the lectures are given below.*

*Popular Lecture Series 2.1:*

***Primate Worlds***

*20<sup>th</sup> July, 2020*

*Prof. Anindya Sinha,  
National Institute of Advanced Studies*

*Youtube Link to the lecture:  
[https://youtu.be/Mme3x\\_I4PqI](https://youtu.be/Mme3x_I4PqI)*



*Popular Lecture Series 2.2:*

***Research Mindset: Quest for Truth***

*22<sup>nd</sup> July, 2020*

*Prof. Madan Mohan Chaturvedi,  
University of Delhi*

*Youtube Link to the lecture:  
[https://youtu.be/\\_n95NUEWytQ](https://youtu.be/_n95NUEWytQ)*

*Popular Lecture Series 2.3:*

***Computer Applications in Biological Sciences***

*24<sup>th</sup> July, 2020*

*Dr. Namita Mukherjee,  
Christ Deemed to be University, Lavasa, Pune*

*Youtube Link to the lecture:  
<https://youtu.be/kSMfeMOL4F8>*



*Popular Lecture Series 2.4:  
Virtual Trek to Valley of Flowers*

28<sup>th</sup> July, 2020

*Dr. Suchandra Dutta,  
R. D. National College, Bandra, Mumbai*

*Youtube Link to the lecture:  
<https://youtu.be/jgp8Hm1qK-M>*



*Popular Lecture Series 2.5:*

*Biodiversity of Sahyadri*

1<sup>st</sup> August, 2020

*Dr. Sachin Punekar,  
Naturalist & Founder of Biospheres*

*Youtube Link to the lecture:  
<https://youtu.be/VwddMitBaU4>*

*Popular Lecture Series 2.6:  
Experiments in Biological Sciences*

3<sup>rd</sup> August, 2020

*Dr. Rekha Vartak,  
Homi Bhabha Centre for Science Education (TIFR),  
Mumbai*

*Youtube Link to the lecture:  
<https://youtu.be/YEccrZ9yv7c>*



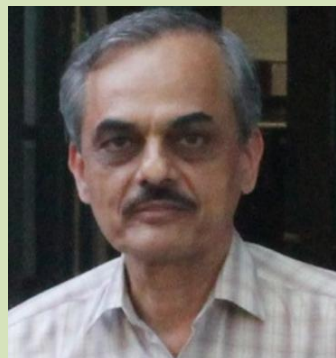
*Popular Lecture Series 2.7:*

***Enzyme Catalysis***

*5<sup>th</sup> August, 2020*

*Prof. Narayan Punekar,  
Indian Institute of Technology (IIT), Mumbai*

*Youtube Link to the lecture:  
<https://youtu.be/Er7kFteSpE8>*



*Popular Lecture Series 2.8:*

***Fungal Diversity Around Us***

*6<sup>th</sup> August, 2020*

*Dr. Kiran Randive,  
P.D.E.A.'s Annasaheb Magar Mahavidyalaya,  
Pune*

*Youtube Link to the lecture:  
[https://youtu.be/\\_dR8UJpXgMk](https://youtu.be/_dR8UJpXgMk)*



*Popular Lecture Series 2.9:*

***Status of Forest & Wildlife & Impact of Climate Change***

*14<sup>th</sup> August, 2020*

*Mr. Ravindra Nath Saxena,  
Alpine Techno-legal Consulting Pvt. Ltd.*

*Youtube Link to the lecture:  
<https://youtu.be/9v2-LIPZGQo>*



*Popular Lecture Series 2.10:  
Systems Biology – Linking Genotype to Phenotype  
18<sup>th</sup> August, 2020*

*Dr. Kareenhalli V. Venkatesh,  
Indian Institute of Technology (IIT), Mumbai*

*Youtube Link to the lecture:  
<https://youtu.be/rDL19CWUkgU>*



*Popular Lecture Series 2.11:  
Researching to Learn & Learning to  
Research with Drosophila  
20<sup>th</sup> August, 2020*

*Prof. Bimalendu B. Nath,  
Savitribai Phule Pune University*

*Youtube Link to the lecture:  
<https://youtu.be/JIPMnWx9uJI>*

*Popular Lecture Series 2.12:  
Giant Viruses & their Evolutionary Origins:  
The unknown unknown  
24<sup>th</sup> August, 2020*

*Dr. Kiran Kondabagil,  
Indian Institute of Technology (IIT), Mumbai*

*Youtube Link to the lecture:  
<https://youtu.be/j4GCyMkciKY>*





**Activities conducted  
by ATBS during 2019  
- 2020!!**

- The 14<sup>th</sup> Annual National Conference on 'Wetlands and Biodiversity' was held on 1<sup>st</sup> February, 2020 at D. G. Ruparel College, Mumbai.
- A Resource Generation Camp (RGC) for generating a question bank for the first stage Olympiad examination, National Standard Examination in Biology (NSEB) was held in early 2020.

*Popular Lecture Series 2.13:  
Emerging Knowledge & Perspectives on  
COVID-19 pandemic with reference to immune  
response*

*28<sup>th</sup> August, 2020*

*Prof. Kalpana Pai,  
Savitribai Phule Pune University*

*Youtube Link to the lecture:  
<https://youtu.be/xblfWrn9iio>*



## Biological Communication (Part 1 of 2)

**Purushottam G. Kale**  
**R. Jhunjhunwala College, Mumbai**  
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Prof. P. G. Kale is Retired Professor and Former Head, Department of Zoology at the R. Jhunjhunwala College, Ghatkopar, Mumbai. He is also the General Secretary of the Association of Teachers in Biological Sciences (ATBS).

In nature, no animal can survive without perceiving the abiotic and biotic surroundings and the changes taking place in them. This is possible for all living things because of the fundamental properties of life like sensitivity and irritability. Animals stand out, owing to their ability of locomotion. In the struggle for existence, the success of an animal species depends on how well it communicates with its environment.

### Components of communication

Communication technically means transfer of information. Information, in turn, means an organized data or processed data. The transfer of information has to involve at least one living being. A rock in the path of an animal is perceived for its characters such as size, shape, color and texture. This information is processed so as to be able to avoid it or make a burrow underneath, which would constitute the behavioral response, or the animal may simply store this information for a future use.

Generally, the components involved in the communication are:

1. **Sender**, the individuals giving off a 'signal' or 'cue';
2. **Receiver**, the individuals being influenced by the 'signal';
3. **Channel**, the pathway of conduction / transmission of signal;
4. **Noise**, the 'signals' present in the background, from which meaningful information needs to be sorted;
5. **Context**, the specific conditions of internal and external environment under which the signal is emitted, transmitted and received;
6. **Signal / cue**, the organized piece of information emitted by the sender and having a potential to influence the behavior of the receiver;
7. **Code**, the 'understanding' between the communicating individuals, about the 'meaning' of the signal; and
8. **Intent**, the willful signaling on part of the sender for influencing the behavior of the receiver.

The sender or receiver may be a non-living object. A bat, for example, gives out a supersonic sound signal that reflects from the objects in the path of its

navigation and is received by the sender to get the information about size, distance and nature of the obstacle.

Conventionally, however, communication is believed to occur between two or more individuals of same or different species, though it is more intentional between species mates and may be intercepted by another species.

**Signals:** Signals or cues are deliberate or in-deliberate acts on part of an individual that influence the behavior of another individual receiving them. When it is a deliberate act, meaning of it is mutually appreciated. In other words, such act is a 'code', which is cracked by the receiver, who interprets the message and reacts appropriately.

Some signals are discrete (digital or distinct) while others are graded (analog). The alarm calls given out at the same intensity (frequency and duration) each time, are the discrete signals. The graded signals on the other hand, may vary in intensity as a function of the strength of a stimulus. The waggle dance of honeybee illustrates both, the complexity and the graded properties of the signals. The number of turns (waggle) per minute being inversely proportional to the distance from the food source and the duration and liveliness of the dance increases proportionately with the abundance of food. The signals that might at first seem discrete, often upon closer study, turn out to be graded. For example, the bursts of light emitted by fireflies seem to be discrete and species specific. They however vary in intensity and duration under different conditions.

Though, the range of specific types of signals is limited, two or more signals may be combined to form a composite signal with new meaning. In Zebras, for example, flattening of ears indicates hostility while rising of ears signifies friendliness. The intensity of these emotions is indicated by the degree to which the mouth opens simultaneously. This is often termed as 'metacommunication'.

The sequence of displays or 'syntax' may be changed to convey additional information using a limited number of displays. For example, the two composite signals A & B would have different meanings depending on whether A or B comes first. In chimpanzees it has been observed that they can assemble words in novel ways while communicating with human companions.

The same signals may have different 'meanings' depending on the context. The lion's roar, for example, may function as a spacing signal for neighboring prides; as an aggression display in fights between males; or as a means of maintaining contact among the members of the prides. Similarly, the 'ruff out' display of the male cowbird serves in courtship as well as in the conflict with other males.

### Do you know??

Here are a few questions about some animals which have certain interesting facts associated with them!!

1. Which animal is the slowest in the world?
2. Which animal is called the 'man of the forest'?
3. Which is the smallest (in size) mammal in the world?

.....Answers on page numbers 12, 13 and 14!

## Answers and more to 'Do you know?'

### 1. The three-toed sloth



- These sloths belong to the genus 'Bradypus'
- They are arboreal in nature.
- Sloths have an extremely low metabolic rate and move very sluggishly on trees.
- They move with a speed of 0.005km per hour and can cover an area of about half a football court in an entire day.
- As a beneficial defense mechanism, sloths have an extra vertebra at the base of their neck which allows them to get an almost 360° view of the surroundings.

Using certain display to precede other displays can possibly increase the information content of displays. This is called **meta-communication**. The preceding display of a relaxed open-mouthed face, in monkeys, signals that 'what follows is play, join in'. Canids such as dogs, wolves etc. precede play with the 'play bow'.

Communication generally involves sharing of information for mutual benefit of species mates. When potential mates meet, it is advantageous to both to communicate for establishing species identity so as to conserve their breeding efforts. The animals produce signals when they are to their advantage, regardless of whether other species benefit from receiving them.

### Why Communicate?

John Smith (1969) has recognized a set of 12 major classes of signals or messages involved in animal communication as:

**Identification messages** to identify the sender;

**Probability messages** to indicate cause of action by the sender;

**General messages** to accomplish a variety of needs;

**Locomotion messages** to indicate movements;

**Attack messages** to declare aggression and probably attack;

**Escape messages** to indicate movements;

**Non-agonistic messages** to indicate improbability of agonistic acts;

**Association messages** to indicate closeness among individuals;

**Bond limited messages** to indicate bonds like mates, parents – off springs;

**Play messages** to indicate mock, playful actions;

**Copulation messages** to indicate copulatory behavior and

**Frustration messages** to indicate conflict induced frustration.

We are yet to understand the complexity and efficacy of animal communication and hope to derive benefits from understanding the same.

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## Answers and more to 'Do you know?'

### 2. The Orangutan



- The term 'Orang' means 'person' and 'utan' means 'man of the forest' in the Malay language.
- They are the world's largest tree-climbing mammals and they belong to the genus Pongo.
- They are omnivores.
- They have very long arms with a potential reach of 8ft. This helps them live on trees and suspend themselves from branches for feeding.
- Orangutans are known to be intelligent and it has been observed that some of these animals also make use of sticks and tools to catch their prey such as insects from the holes of trees.

## Biology can be fun.....

Dichotomous keys are an interesting way to observe and learn about the morphology of various biological specimens in a comparative manner. They are used to identify and classify specimens based on the morphological characters. Dichotomous (meaning 'divided into two parts') keys are used by answering a series of steps wherein two contrasting observations for any given feature is to be observed and answered at each step. Thus each step in the key can have two possible outcomes. Following the sequences of steps in a dichotomous key will eventually lead one to the identification of the specimen. A simple dichotomous key for fish scales is given here. We will include a few more dichotomous keys in the future issues.

### Dichotomous key for fish scales

#### Materials & Specimen:

Croaker fish or pink perch, Shark skin, 0.4% KOH, plastic vials, forceps, dropper, distilled water, glass slides, compound microscope

#### Collection of fish scales:

Different types of scales can be collected from fish such as Croaker fish commonly known as Doma or the Pink Perch commonly called Raja Rani. These fish are easily available in the local fish markets. Using a pair of forceps, carefully pluck the scales from the head region and collect them in a vial labeled A. Also pluck the scales from the body region and transfer to a vial labeled B. A third type of scale can be collected from the skin of the shark. Cut the skin into smaller pieces and immerse in 0.4% KOH solution. Boil this till the soft tissue in the skin is dissolved and only particulate matter remain at the bottom of the beaker. Let this cool and using a dropper, transfer the particulate matter (scales) into a vial labeled C.

Mount each type of the scale in water on clean glass slides and observe under 4X objective lens of compound microscope. Use the dichotomous key given below and identify the type of scales. The figures of various types of scales are given below for reference.



Answers and more to 'Do you know?'

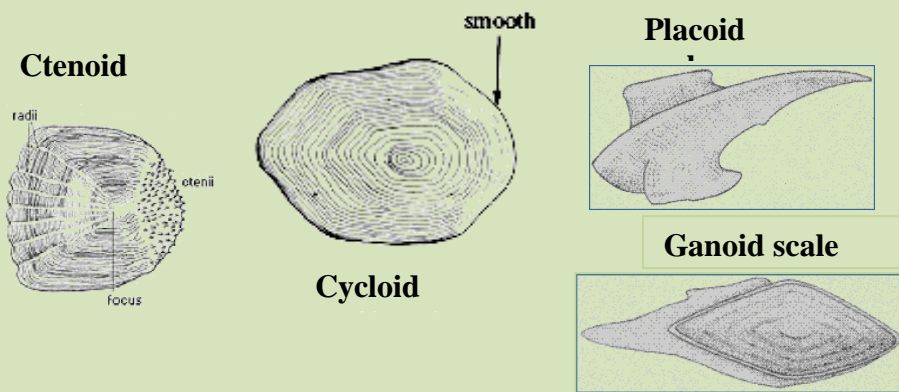
3. The bumblebee bat



- The smallest mammal in terms of size is the bumblebee bat. It measures around 1.1 to 1.3 inches in size ie slightly bigger than the bumble bee and weighs about 2 grams.
- On the other hand the Etruscan shrew is the smallest mammal in terms of mass since it weighs just about 1.3 grams and is about 1.57 inches in size.
- The bumblebee bat is known as the Kitti's hog-nosed bat due to its distinctive pig-like snout.
- They live in huge colonies of about 100 bats per cave mainly in limestone caves along rivers.
- Their wings are large with pointed tips to facilitate hovering.

Note: Use forceps for transferring scales A and B on to the slides. Use dropper for the scale type C.

Types of fish scales



No.	Feature	Go to
1a	Scales do not possess a base plate	2
1b	Scales possess a basal plate	5
2a	Scale surface shows presence of lines	3
2b	Scale surface shows absence of lines	Non-cosmoid
3a	Scales show distinct teeth (cteni) on one side	Ctenoid
3b	Absence of cteni	4
4a	Lines in the form of concentric circles	Cycloid
4b	Lines not in the form of concentric circles	Cosmoid
5a	Scales show presence of a spine	Placoid
5b	Scales do not possess spine	Ganoid

Specimen A is: \_\_\_\_\_

Specimen B is: \_\_\_\_\_

Specimen C is: \_\_\_\_\_

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**A National Level Essay Competition 2019 - 20 was organized by ATBS and the winners are as follows:**

- **1<sup>st</sup> Prize:** Ms. Abhilasha Kumar Gawde, Std. IX, New English School, Lanja, Ratnagiri, MS
- **2<sup>nd</sup> Prize:** Mst. Kevin Pereira, Std. IX, DAV School, Chennai, TN.
- **3<sup>rd</sup> Prize:** Ms. Prerna A. Wadhvani, Std XI, Jai Hind Educational Trust, Zulal B. Patil Junior College, Dhule, MS.

**Encouragement Prizes for participation in the National Level Essay Competition 2019 - 20 was awarded to the following students:**

- **Mst. Abhram Tilak Potula, Std. X, FIIT JEE World School, Hyderabad**
- **Ms. Sonal Keni, Std. X, BGS National Public School, Bangalore, Karnataka.**

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