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Botany & Zoology

From Booze to Beechnuts

Fresh Water Fishes at Contai

Highlights

Availability of Fresh Water

Theory of Biological Evolution

Discovering Thoughts, Inventing Future

VOLUME 25 ISSUE 1 VERSION 1.0

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From Booze to Beechnuts

By Volker W. Thürey

Abstract The foundation of this paper is the generation of all life by evolution. By this assumption, 'everything' has to be compatible with Darwin's theory. I discuss some issues that concern animate beings. I ask some rhetorical questions. Answers are provided by speculations. I present arguments for an evolution and general thoughts. I show that some properties of animate beings are compatible with an evolution. The arguments except those in the chapter 'Homosexuality' are ideas of mine. All points only are personal views.

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From Booze to Beechnuts

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Abstract

The foundation of this paper is the generation of all life by evolution. By this assumption, 'everything' has to be compatible with Darwin's theory. I discuss some issues that concern animate beings. I ask some rhetorical questions. Answers are provided by speculations. I present arguments for an evolution and general thoughts. I show that some properties of animate beings are compatible with an evolution. The arguments except those in the chapter 'Homosexuality' are ideas of mine. All points only are personal views.

I. Introduction

I assume that each life on earth is generated by evolution. Of course, this assumption is not provable. Some questions about the properties of animate beings are discussed. Basically, I ask how such a thing as 'evolution' can create the properties, for instance, people who have an interest in mathematics.

II. Prejudices

In the first question, I talk about prejudices. I believe that the property that people have prejudices is innate. Of course, I cannot prove it.

A funny example is from the German comedian Johann König. In his show, he described the situation: 'Imagine that you return at home, and there is a lion in your flat.' Even if you never had bad experiences with a lion, you see the claws and teeth, and you will be cautious. This is a good decision! The animal could be dangerous. Although there are friendly lions, it is better to be suspicious and to be careful. This prejudice may save your life.

I think that prejudices are inborn, since for millions of years they have been useful, even though it has had consequences for a few wrong decisions. It helps us to act as fast as lightning. Of course, today some prejudices may not be suitable for a modern life.

III. Booze

Everbody knows the effect of alcohol. The production of wine or beer has been a part of human culture for thousands of years. Beer may has been an important food in the past. Also, it was a beverage of high quality, instead of water, which often was polluted. The human liver has the ability to deteriorate the alcohol, but only ethyl alcohol (C_2H_5OH), while the related methyl alcohol (CH_3OH) is toxic. Fortunately, by the fermentation, the fungi produce nearly always ethyl alcohol. From where does come the difference? This means I ask why the liver can deteriorate ethyl alcohol, but not methyl alcohol. The speculated answer is that people have eaten fruits in autumn. The fruits often had fallen down. They often have started the fermentation process already, i.e. they have contained some alcohol. Those who could digest the fermented fruits have survived, the others perhaps died of hunger. This property was handed to the next generation. Thus, people can digest some ethyl alcohol, but not a bottle of vodka each day. Finally, they detected the positive effect of alcohol, and they invented the ability to generate a fermentation.

IV. Acorns and Beechnuts

In this chapter, I discuss the question of why oaks and beeches have relatively big fruits, i.e. acorns, and beechnuts, compared to willows or poplars. Big fruits need a large amount of material. The question is, why do these trees invest material into the production of big fruits? In my opinion, the answer is animals. The Eurasian red squirrel (Sciursus vulgaris) and the jay (Garrulus glandarius) use acorns and beechnuts as a winter store. The German names ('Eichhörnchen' and 'Eichelhäher') advert to this fact. Of course, they prefer big fruits. They stockpile up to 1000 stores in the autumn. The animals remember most of them, but some they forget. From these forgotten buffer stocks new trees grow. In this way, these trees accrete.

Therefore, evolution pressures to produce bigger fruits. In contrast, willows and poplars need the wind to spawn.

V. Mathematics

Some people have a talent for mathematics. A part of them likes it, too. For instance, the German mathematician Gauß started in his youth to deal with mathematics. I ask, why evolution has generated people which like mathematics, although the possible application would be in the future. I estimate that less than one percent of the created mathematics is exerted. Hence, people do not know whether their mathematics will be used or not. Anyway, these people can not be deterred from keeping busy with mathematics. Why has evolution done that? The possible answer lies in the past.

Many years ago, the Stone Age people often starved. Some people have begun to make loops as a form of hunt to trap animals. In this way, they perhaps

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have survived, and their genes were preserved. Those who did not have the ability to do so have died.

Making loops is a very complicated procedure. You have to anticipate what happens if an animal steps in the loop. This requires a lot of abstract considerations. (Apart from that, it was a horrible death for the trapped animal. It may last hours or even days until death has put it out of its misery).

I have gotten the idea in a hospital. I have lain there in a room with a few television sets without sound, to not disturb the others. To hear the sound, there were two small tannoys. First, you had to put the tannoys with two cables in the plug socket. Sometimes it has happened that the two cables were knotted. At this time, I was not able to unbraid them without the aid of others.

I believe that putting loops was a clever way to hunt, for those who could do so. This was perhaps a decisive way for survive. This would explain the joy of some people about abstract thinking.

VI. Sex

Bacteria spawn by cleavage. For them, one sex is sufficient. Why generally, in highly developed animals, there are two sexes? The answer is, of course, the rearrangement of the genes. When animals accrete, the genes are stirred. Hence, the fact that there are two sexes is clearly superior to only one sex. It makes an evolution possible.

Some people have the opinion that there is a third sex. I believe that this is nonsense since there is no reason for evolution to generate that.

VII. Sweat

In the times before farming a decisive way for Stone Age people for survival was a successful hunt. I imagine that youngsters early began to exercise the hunt. One requirement was the ability to run. The body overheats easily. The evolution generated perspiratory glands. The hunter could transpire and in this way, he or she could cool down. Therefore, the hunter could run longer, and this resulted in a more successful hunt. Perhaps the evolution of perspiratory glands was a crucial development for survival.

VIII. Sugar and Salt

In this chapter, I deal with the fact that generally, people like sweet and salty food (usually not together, except in ketchup). The answer to the first is that nearly all sweets are healthy, with one possible exception of honey. Of course not now, but millions of years ago, only in autumn you got sweets in the vegetable form of fruits. In those times without cookies and chocolate, there was nearly only one possibility to eat sweet things. You had to gather ripe fruits in autumn. On some rare occasions, you have found a beehive, and you were able to eat honey. You probably got some painful bee stitches, but this you put up.

When you live near the coast, the supply of salt is no problem. Your food contains enough salt. The difficulties start when you settle afar from the coast. It might be a problem to get enough salt. For a successful hunt you need salt since when you sweat, you lose not only water, but also salt (NaCl). Therefore, evolution has developed an appetite for salty food.

IX. Homosexuality

This chapter contains ideas that are not mine. I have read them anywhere.

Here I ask why homosexual people exist, although they do not accrete. The answer is that groups of people are more peaceful if a minority of people is homosexual. For a man, another homosexual man is no threat since he knows that the other man would not try to steal his wife. The same holds for women. Life was so hard in the Stone Age that survival was only possible in a group. This has required some social behavior since it was important to regard other per sons as fellow campaigners and not as rivals. One way was a common dance or to make music together. A book that broaches the issue of this is [1].

I assume that the genes which make the person homosexual are not only at the homosexual persons, but also at other members of the group.

X. Pedophilia

This chapter deals with the phenomenon called 'Pedophilia'. I will only give a justification that it may be genetically determined. I do not consider the difference of power between an adult and a child; what is more, I will not take up any position.

One million years ago a child played anywhere, monitored by two persons (usually the parents). They did their best to protect the child, but they couldn't see everything. Behind every bush could hide a lion, prepared to kill and eat the child. The probability of survival increased significantly when a third person looked after the child. The third person may be an uncle or an aunt. Or it could be a completely foreign person, who fell in love with the child, or it has only a sexual interest in it. The same situation without the lion can happen today, but I believe that the probability of survival would change hardly.

Similar to the previous chapter, I presume that the genes which make a person pedophiliac are not only at the pedophils, also at other members of the group.

XI. Nails

Probably you are a neat person and cut your nails regularly. This is necessary since the fingernails and toenails grow. In this chapter, I ask why this is necessary. Why do the nails grow faster than they are worn off? The answer is that the speed of growth is just the right one. Of course not now, but in the Stone Age life was so hard that the nails grew as quick as they were worn off. I speculate that the speed of growth was just the right one. Now they grow to fast.

XII. Oceans and Rivers

The number of species in rivers and lakes is nearly twice as large as the number in the sea, although the area is smaller. The reason for this may be that salty water is not a good precondition for life. Freshwater perhaps is more suitable for the generation of new species.

XIII. Migratory Birds

Some birds are migratory, for instance, the White Stork (Ciconia ciconia). Others are stationary, for instance, the Greenfinch (Chloris chloris). Why has evolution done that? It seems, that any migration is a 'disadvantage' since it is a dangeous journey. I believe that in the beginning there were no migratory birds since in the north the weather conditions were as bad as today. But the animals have learned that even in the north during the summer the temperatures are pleasant. Those who could migrate, i.e. some birds, have learned to fly in warmer areas in the summer, to raise their offspring since in the warmer climate also there was more food. I believe that finally this knowledge has gone into the genes. Some birds have learned to handle the harsh weather conditions in winter, and for them, there was no reason to migrate. They kept to be stationary.

XIV. Witches

In the Middle Ages, the Christianity was very intolerant. It was a common practise to burn people on the stake, if they were aspersed to be in league with the devil. Mostly the victims were female. For instance, the mother of Johannes Kepler, the man who have found that in space two celestial bodies move around each other in ellipses, was accused to be a witch. Fortunately, her son managed it to absolve her from the accusation. Burning 'witches' makes happy. Not the witch, of course, which suffered a horrible death, but the others probably felt good. Perhaps mostly they have thought 'God is very fair. The bloody witch gets what she deserves'. Some have felt pity with the 'witch', but they did not show it since this has been dangerous. It was better to hide the emotions, otherwise perhaps they were accused to be in league with the devil, too.

XV. Chimpanzees

It is well-known that chimpanzees are social animals. Furthermore, their children are very cute. Some researches were confused as they detected that also chimpanzees are effective and successful hunters. They hunt and eat smaller apes. Some chimpanzees remain on the ground to cut of any escape way, others go into the treetop to hunt and kill the prey. After a successful hunt they brotherly share the poor victims with those apes who have remained on the bottom. In this way, the chimpanzees get flesh, what normaly is impossible since mainly they eat plants. It only works because the apes cooperate, and they are intelligent animals. The chimpanzees have learnt that cooperation increases their personal abilities enormously. I believe that finally this property has gone into the genes; or, in other words, evolution has taught them this capability since those who did not have the competence to be social died out.

XVI. Milk

Some Asian people can not digest the lactose in milk. A great part of the Europian people digests it without problems. The ability to drink milk has been a big advantage when people started livestock breeding. Their survival no more depends on a successful hunt. This means, they could have more children since they had a constant supply of food. Of course, in this day and age, this ability is not of great importance since few people starve, and mostly people do not depend on livestock farming.

XVII. War

War is regarded as a big problem among human societies. Many attempts were made by politicians to solve problems between states. Some remain unsuccessful. I believe that to risk one's life is a very social action since life is the most important thing we can give. To sacrifice the own life for other people, maybe the 'crown', or the 'nation' or the believe or something else is a very social act. This distinguishs us from animals. Generally animals do not risk their own life for others.

XVIII. Medical Science

Fortunately, in many human societies there are medical care. For instance, I would not live anymore without it. On the other hand, we are products of an evolution. Medical science is the contrary to evolution. Nature kills someone who has an anomalous behavior or appearance. It is cruel and merciless. Nearly all creatures suffer a violent death. It is very rare that animate beings die of senile decay. Evolutionary progress comes by death, although it would suffice to exclude them from reproduction.

XIX. Cuckoos

The cuckoo (Cuculus canorus) is a well-known migratory bird. It is famous for its call and infamous since the just hatched birds throw eggs and other birds out of the foreign nest. If they survived the fall, they die of undercooling. This policy is a clever way to accrete, so long as the major part of the birds pursue a different way. I believe that evolution has created these conditions, although this strategy seems to be 'mean' for a social thinking human.

XX. Enemies

Enemies are important. For a human, the idea of something very evil is helpful. An enemy image makes happy. The imagination of the 'ill' helps to distinguish between the 'good' and the 'bad'. This common belief generates a feeling of togetherness. For instance, Adolf Hitler considered the Jews as 'bad'. Having an enemy image is a general property of human beings, made by evolution.

XXI. Spiders

Nearly all people find spiders disgusting. Both the slowly, hairy ones and the quick ones. I strongly believe that it is innate since animals like butterflies evoke sympathy. Why has evolution done this since in Europe do not live dangerous spiders? This is a hint that people did not develop here (It is only possible to live in Europe when you have a heat source, because of the foul weather), but in a region where dangerous spiders exist, for instance, in Africa.

XXII. The Peacock Paradox

In this chapter, I mention peacocks (Pavo cristatus), and magpies (Pica pica). Even Darwin wondered about the 'Peacock Paradox'. Male peacocks have a beautiful embellishment, while female peacocks wear an inconspicuous plumage. The solution of the paradox is that female peacocks choose the males to breed. Of course, they prefer the most eye-catching males. Also magpies are conspicuous birds. They are the most beautiful birds in Germany with its salient white and black feathers and a long tail. It is the contrary to a camouflage. Females look similar to males. I don't know why. Perhaps at magpies the appearance is genetically connected with the sex.

XXIII. Corruption and Crime

In this chapter, I deal with the question why the government can not stop corruption, although it causes heavy damage to a human society. The answer is that corruption is advantageous both for someone who gets money for any service and for somebody who receives anything. Therefore, corruption presents itself more as a social act than a crime. I believe that this behavior is generated by evolution since it has an advantage for both. Of course, today the government has to continue to fight against it since in a our society it generates more damage than benefit.

Also, delinquency will not disappear since to commit a successful crime has an advantage for the criminal.

XXIV. Fascism

Two famous dictators have behaved similarly. Both il Duce (the leader) Benito Mussolini and der Führer (the leader) Adolf Hitler stood above and gave speeches, while many others were below and hailed the speaker. I believe that this is more a social act than a wrong behavior. People unify behind a seemingly wise leader. He (generally the leaders are male) promises to lead them into a bright future. I think that this behavior is innate and it is generated by evolution. The leader makes all important decisions; some are terrible. Unfortunately the leaders mostly are not 'wise'. They like to have power. It ends in a dictatorship instead of a bright future. I believe that the majority of people is not suitable for democracy.

Afterword

As I have already said in the Abstract, the above notes are my personal opinions. Therefore, I have abstained from giving more references. Further, I always made an effort to write as briefly as possible.

Acknowledgements

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Références

[1]. William H. Calvin: *The River That Flows Uphill* (2001).

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Availability of Fresh Water Fishes at Contai Municipality in Purba Medinipur District of West Bengal, India

By Dr. Kallol Kumar Hazra & Abhishek Giri

Abstract- Water is the home of fishes which may be fresh, brackish and marine. The present study is entirely based on freshwater fishes. PurbaMedinipur district has the potentiality for large fresh water resources. In this district, Contai is an important vital area because it is also a coastal based zone. Therefore the present study is very significant. Total of 46 native fish species were identified in this Municipality from the period of July 2021 to June 2022. Here total 46 freshwater fish species were observed under the 07 orders and 20 families.

Keywords: *contai municipality, freshwater fish, availability, status, threat.*

GJSFR-C Classification: *FoR Code: 0704*

AVAILABILITYOFFRESHWATERFISHESATCONTAIMUNICIPALITYINPURBAMEDINIPURDISTRICTOFWESTBENGALINDIA

Strictly as per the compliance and regulations of:

Availability of Fresh Water Fishes at Contai Municipality in Purba Medinipur District of West Bengal, India

Dr. Kallol Kumar Hazra [α] & Abhishek Giri [σ]

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Keywords: contai municipality, freshwater fish, availability, status, threat.

I. Introduction

Freshwater is a good resource for fish and other freshwater aquatic faunas. West Bengal, as well as Purba Medinipur district, has the potential for sizeable freshwater resources. The diversity of fish species is influenced by the human, in both positive and negative ways. A total of 46 species belonging to 07orders and 20 families were recorded in this fish market in different seasons. The present study is an essential for the identification, occurrence, and status of freshwater fishes in this Municipality as well as how much essential to local people. The population in this Municipality is about sixty thousand. In this area various kinds of fishes are observed in different seasons. But this study also indicates that availability of freshwater fishes are not so much in respect of population. The people of Purba Medinipur District catches different kinds of freshwater fishes from different sources and finally reach in Fish Market at Contai Municipality. Due to the human interference, the freshwater ecosystem is continuously degraded. Therefore the availability of different kinds of fishes in the fish market gradually declined. So the present study is an attempt to survey and identify the locally available Freshwater fish species in Contai Municipality, PurbaMedinipur.

II. Methodology

The Main Fish market at Contai surveys were carried out every day in the early morning from 6 am - 9 am and late afternoon from 05:00 - 06:00 pm in Summer and rainy seasons and in winter and other seasons it was done during 7 am -9 am every day due to good availability of fish. Fish data were collected every day on the basis of fisherman and also from local people. Average market data were used for this study. Maximum fishes were came from surrounding areas such as Sabajput, Soula, Mukundapur, Aladarput and different ponds from local people, and also from Moyna. They were Surveying the local market as well as discussing with local fishermen to ensure the listing of low abundance or declining in productivity of those species.

a) Study Area

The study area is Contai Supermarket, located in Contai, Purba Medinipur District, WB (Lat. 21.7745^0 N, Long. 87.7477^0 E), where freshwater finfish information were collected from the fish seller and fishermen. Data was collected from April 2021 to May 2022. Thus conducting two samplings per day for the last year, total 46 fish samples were collected during this study period.

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b) Identification Of Fish Samples

Fish samples are collected from the Contai Supermarket from the fish sellers. Generally the fishermen sort non-target fishes after catching in ponds or rivers. Generally the fishermen used bag net, gill net, cast net for fishing operation. The catches were collected by frozen ice box from the fish market for laboratory study. In the laboratory the fish samples were identified through different methods by Talwar and Jhingran 1991, Datta Munshi and Srivastava 1988.

III. Result and Discussion

During the study period, different fin fishes were observed in the contai Supermarket area of the Purba Medinipur district. The result showed that the fish market is rich in fin fish diversity. The fin fish belong to 7 orders and 20 families were recorded. In the present study, 46 fin fishes from different genera and 19 families were recorded.

The member of the order Anguilliformes and Cyprinodontiformes are dominated by single species, but the order Synbranchiformes, Cypriniformes, Perciformes, Siliuriformes and Osteoglossiformes represents 3,16,13,10, and 2 species respectively.

Among all these, order Cypriniformes was the most dominant constituting 35%, followed by the order Siliuriformes which includes 22%, order Perciformes, Synbranchiformes, Osteoglossiformes, Anguilliformes and Cyrinodontiformes comprised 28%, 7%, 4%, 2% and 2% respectively.

Order	Family	Local name	Scientific Name	Characteristic features	IUCN Status
1. Anguilliformes	01.Anguillidae	Bamas	1. *Anguilla bengalensis*	1. Body elongate, snake-like. 2. Light brownish dorsally, bellow and sides are yellowish. 3. Head conical. 4. Dark spots on upper surface of body.	NT
2. Synbranchiformes	02. Synbranchidae	Kuche	2. *Monopterus cuchia*	1. Body long, head slightly compressed. 2. Lower jaw longer. 3. Body colour silvery. A silvery lateral band running from head to tail.	LC
	03. Mastacembelidae	Pankal	3. *Macrognathus pancalus*	1. Mouth small, snout pointed. 2. Greenish olive along back, beneath yellowish.	LC
		Baan	4. *Mastacembelus armatus*	1. Mouth small, snout pointed. 2. Dorsal spines commence over middle of pectoral fin. 3. Dark brown on back and flanks, yellowish beneath.	LC

3.Cypriniformes	04. Cyprinidae	Mola	5. *Amblypharyngodon mola*	1. Elongated silvery color body with compressed head. 2. Presence of silvery lateral band running from head to tail. 3. Caudal fin deeply forked, caudal lobe pointed.	NT
		Chela	6. *Salmostoma phulo*	1. Silvery color Body elongate mouth slightly upward. 2. Dorsal fin inserted just opposite to origin of anal fin	LC
		Kalbaush	7. *Labeo calbasu* (Hamilton, 1822)	1. Body colour blackish-green, lighter below. 2. Presence of Two pairs of minutes barbells. 3. Dorsal profile more convex than that of abdomen	EN

Order	Family	Local name	Scientific Name	Characteristic features	IUCN Status
3.Cypriniformes	04. Cyprinidae	Rui	8. *Labeo rohita* (Hamilton, 1822)	1. Body moderately elongated body with brownish color on back, whitish-silvery below . 2. Scales with blackish margins and reddish center.	NT
		Bata	9. *Labeo bata* (Hamilton, 1822)	1. Body colour darkish or bluish above and silvery below. 2. Fins colour orange.	EN
		Katal	10. *Catla catla catla* (Hamilton, 1822)	1. Colour dark grey on back, silvery on abdomen. 2. Head enormously large, mouth wide and upturned. 3. 3. Fins blackish	NT
		Silver Cap	11. *Hypophthalmicthys molitrix* (Valenciennes, 1844)	1. Dorsal fin short. 2. 2.Body colour silvery white. 3. Fins are dark coloured	NT
		Brigade	12. *Hypophthalmichthys nobilis* (Richardson, 1845)	1. Body colour greyish above, silvery below. 2. Fins brownish. 3. Lower jaw slightly protruding.	DD
3.Cypriniformes	04. Cyprinidae	Tita punti	13. *Puntius ticto*	1. Two black spots on lateral line. 2. Silver body color with complete lateral line	VU
		Gheso Rui	14. *Ctenopharyngodon idella* (Valenciennes, 1844)	1. Body colour Dark grey color body above, silvery on flanks and belly. 2. Head broad with a short rounded snout.	NE
			15. *Carassius auratus* (Linnaeus, 1758)	1. Body colour orange on back, whitish orange below. 2. Broad body with large scales .	LC
			16. *Cyprinus carpio* (Linnaeus, 1758)	1. Broad body with large scales and swollen abdomen. 2. Generally orange body color.	NL
		Mirgyala	17. *Cirrhinus mrigala*	1. Grayish along the back silvery on	LC

			(Hamilton, 1822)	the sides and below. 2. Colour of pectoral, pelvic and anal fins are orange.	
		Daria	18. *Rasbora daniconius*	1. Elongated compressed body with wide band at middle. 2. Abdominal portion more covex than dorsal.	LC
		Jat Punti	19. *Puntius sophore(Hamilton-Buchanan,1822)*	1. Presence of red lateral streak primed during breeding season in male. 2. Body fairly deep and compressed.	LC
		Bata	20.*Cirrhinus reba* (Hamilton, 1822)	1. Body is silvery in color; scales are darkest at their edges 2. Body is slender; the dorsal profile is slightly more convex than the ventral profile	LC
4.Perciformes	05. Cobitidae	Ruti	21. *Lepidocephalus guntea*	1. Back dark brown, belly yellowish. 2. Caudal fin cut square with round corner 3. Body elongate, dorsal and central surface nearly parallel	EN
	06. Gobidae	Bele	22. *Glossogobius giuris*	1. Body with two rows of 4-6 dark blotches. 2. Head pointed, lower jaw slightly longer. 3. Two dorsal fins situated closer. Caudal fin rounded	EN
	07.Nandidae	Bheda	23. *Nandus nandus*	1. Body color greenish brown. 2. Three vertical stripes on flanks. 3. Rectangular Body slightly, compressed and deep	VU
	08.Pristolepidae	Kala koi	24. *Badis badis*	1.	EN
	09. Channidae	Shoal	25. *Channa striatus*	1. Body elongate,fairly rounded in cross-section. 2. Scales on head larger. 3. Body colour grey-green on black-green on back in adult, several white or yellowish white vertical stripes on belly.	NT
4.Perciformes		Lata	26. *Channa punctatus*	1. Body elongate, fairly rounded in cross-section. 2. Scales on head irregular. 3. Body colour varies with water they reside. 4. Usually grey on dorsal side,lighter beneath.	NT
		Cheng	27. *Channa orientalis*	1. Body elongate,fairly rounded in cross-section. 2. Mouth large,teeth villiform on jaws. 3. Dorsal side and flanks green,ventral side faint bluish or reddish.	VU

4. Perciformes	10. Osphronemidae	Khalisha	28. *Trichogaster fasciata*	1. Greenish color with oblique orange or bluish stripes descending downwards and backwards from the back to the anal fin. 2. Vertical fins with alternating dark and pale spots. 3. The anal fin often with a red margin.	LC
	11. Anabantidae	koi	29. *Anabas testudineus*	1. Lower jaw slightly longer. 2. Scales ctenoid. 3. Back greenish brown, yellowish beneath.	NT
	12. Cichlidae	Telapia	30. *Oreochromis mossambicus*	3.	VU
		Nilotica	31. *Oreochromis niloticus*	4.	LC
	13. Ambassidae	Chanda	32. *Chanda mama*	5.	LC
		Gol Chanda	33. *Parambassis ranga*	6.	LC
5. Siluriformes	14. Clariidae	Magur	34. *Clarias batrachus*	1. Body colour brown to blackish. 2. Pectoral spine strong,finely serrated on both edges.	LC
		Thai mangur	35. *Clarias gariepinus*	1. Body colour brown to blackish. 2. Anterior portion of Head is blunt. 3. Barbells are long.	LC
5. Siluriformes	15. Heteropneustidae	Shingi	36. *Heteropneustes fossilis*	1. Body elongate, compressed behind, head depressed. 2. Dorsal fin small, pectoral fin with a strong spine seratted internally. 3. Caudal fin rounded, separated by a distinct notch from caudal fin.	LC
	16. Pangasidae	Pungas	37. *Pangasius pangasius*	7.	LC

	17. Bagridae	Tengra	38. *Mystus tengara*	1. Dorsal spine long upto head keep out the head. 2. 4-5 longitudinal bands along sides 3. Body color yellow or brown with a dark spot on shoulder.	LC
		Arr tengra	39. *Hemibagrus menoda*	1. Head dorso-ventrally flattened with terminal mouth. 2. Adipose fin well developed and caudal fin forked. 3. Body color grayish brown on back and yellowish or dull white beneath.	LC
5. Siluriformes		Rani Tengra	40. *Mystus vittatus*	1. pairs of barbels, maxillary barbels extending beyond the pelvic fins. 2. A narrow dusky spot often present on the shoulder.	LC
	18. Siluridae	Boal	41. *Wallago attu*	1. Caudal fin is deeply forked. 2. Body colour greyish or yellowish grey in above and whitish in below but the fins grey. 3. Eyes are small. Mouth wide	VL
		Pabda	42. *Ompok bimaculatus* (Bloch, 1794)	1. Two pairs of barbels; maxillary barbels reaching pelvic fins or anal fins; mandibulary barbels minute. 2. Brown, usually marmorated body with conspicuous round black blotch above pectoral base.	NT
			43. *Ompok pabda* (Hamilton, 1822)	8.	NT
6. Osteoglossiformes	19. Notopteridae	Chital	44. *Notopterus chitala* (Day, 1878)	1. Body is very strongly compressed with a short pre-caudal region. 2. Dorsal fin is short and ventral fin very much reduced or absent.	NT
		Folui	45. *Notopterus notopterus* (Pallas, 1769)	1. Colour is silvery dark. 2. Very much elongated anal fin confluent with reduced caudal fin.	LC
7. Cyprinidontiformes	20. Belonidae	Gangtara	46. *Xenentodon cancila* (Hamilton-Buchanan,1822)	1. Elongated body with greatly elongated both jaws and studded with sharp teeth. 2. Body greenish above, white ventrally and laterally silver in color.	LC

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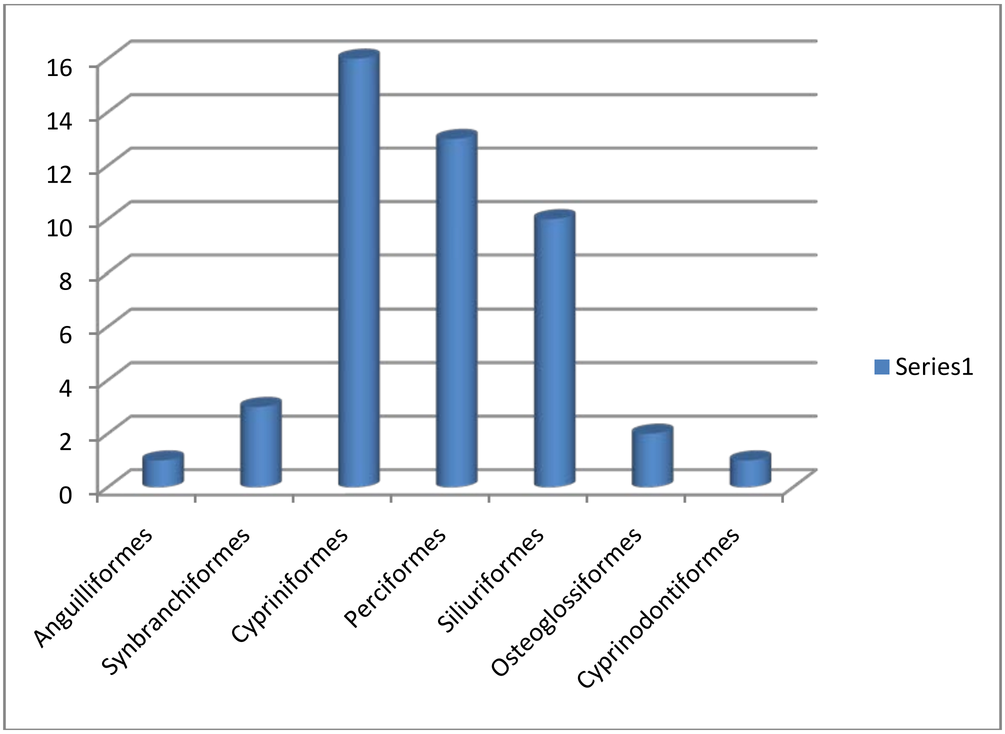

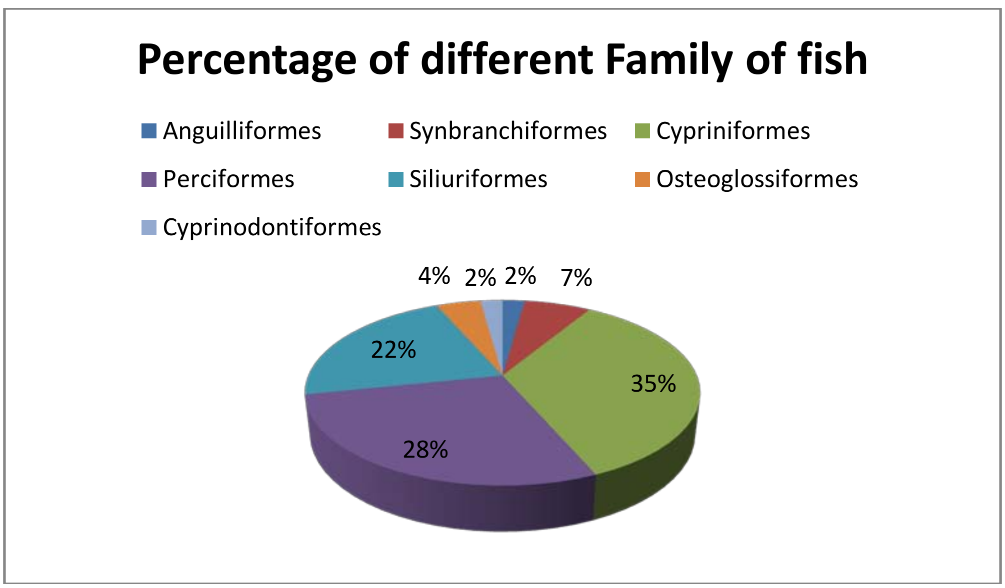

a) *Availability of freshwater families*

Families	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Anguillidae	+	+	+	+	-	-	-	-	-	+	+	-
Synbranchidae	-	-	-	-	-	-	-	-	+	+	-	-
Cyprinidae	+++	++	++	+++	++	+	++	+++	+++	+++	+++	+++
Cobitidae	-	-	-	-	-	-	+	+	+	-	-	-
Gobidae	+	+	+	-	++	++	+	+	++	-	-	+
Nandidae	-	-	-	+	+	-	-	-	-	+	+	-
Pristolepidae	-	-	-	+	+	-	-	-	-	-	-	+
Channidae	+++	++	++	++	++	+	+	+	++	++	++	++
Osphronemidae	+	+	+	+	-	-	-	++	++	+	+	++
Anabantidae	++	+++	+++	++	++	++	+	+	+	++	++	++

	+											
Cichlidae	++	++	++	+++	++	+	++	+++	++	+++	+++	++
Mastacembelidae	+	+	-	+	+	+	-	+	+	+	+	+
Ambassidae	-	-	-	-	+	+	+	+	++	+	+	-
Clariidae	++	++	++	++	++	+	+	+	++	++	++	++
Heteropneustidae	++	++	++	++	++	+	+	+	++	++	++	++
Pangasiidae	+	+	+	+	-	-	-	++	++	+	+	+
Bagridae	++	++	++	++	++	-	-	++	+	+	++	++
Siluridae	++	++	++	-	-	-	+	+	+	-	++	++
Notoptertidae	+	+	+	+	+	+	-	-	+	+	+	+

+ = Rarely observed , ++ = moderately observed, +++ =Highly observed, - =Not found

b) Photograph

Some photography of fishes and ponds are listed bellow with common name-

Study site at morning




Folui Goal Chanda Lamba Chanda Bata




Nilontica Bele Pabda Rui

Fish Market


Tangra

Telapia

Chela

Mourola


Jat punti

katla


Koi

Soal

Pungas Tangra

Pankal


Mrigala

Magur

Singhi


Lata

IV. Conclusion

The final result confirmed that the appropriate conservation strategy and proper planning must be needed to protect those local fish species. The market-based survey of those species showed a considerable drop in productivity in the last few years for several reasons. Overfishing, unregulated uses of pesticides in agricultural field, uses of antibiotics, natural calamity, irrational fish harvesting along with different anthropogenic activities, environmental pollution as well as manmade pollution are the central cause for aquatic diversity loss which also affect on the fish faunal population. Proper supervision along with sustainable developmental thoughts like harvesting fish population size restriction, and breeding technique development may protect those fish species from the door of extinction.

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Energodynamic Theory of Biological Evolution

By Etkin V. A.
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Abstract- The article outlines a more general energodynamic theory of biosystems, considering their global and local heterogeneity with the help of added nonequilibrium parameters. The theory returns the concepts of force, speed, and power of real processes to thermodynamics and complements the theory of irreversible processes by considering the useful (reversible) component of real processes. It is shown that relaxation processes in some degrees of freedom of biosystems are accompanied by work "against equilibrium" in other degrees of freedom, which is consistent with the Darwinian concept of the "struggle for existence." Simpler and more informative non-entropy criteria for the evolution and involution of biosystems are proposed and the unity of energy conversion processes in technical and biological systems is proven.

Keywords: thermodynamics of biosystems, evolution and involution, processes of relaxation and metabolism, bioenergetics and survival.

GJSFR-C Classification: *LCC: QH366.2*

ENERGODYNAMICTHEORYOFBIOLOGICALEVOLUTION

Strictly as per the compliance and regulations of:

Energodynamic Theory of Biological Evolution

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Keywords: thermodynamics of biosystems, evolution and involution, processes of relaxation and metabolism, bioenergetics and survival.

I. Introduction

Despite certain successes in the study of the processes of evolution of living and inanimate nature from the standpoint of the thermodynamics of irreversible processes [1-9], bioenergy [10-15] and synergetics [16-20], there is still an obvious contradiction between equilibrium and nonequilibrium thermodynamics and the nature of biological evolution . The principle of increasing entropy, interpreted as the essence of the second law of thermodynamics, imposes "thermal death" on the Universe as a whole, and on any of its autonomous regions – degradation [21]. The interpretation of evolution as a random process [22] or the result of the spontaneous emergence of "order" from "chaos" [19], and even more so as the absorption of some kind of "negentropy" [11], did not give satisfactory results. Moreover, the very concept of "self-organization" as spontaneous ordering of an isolated system [21], as well as attempts to "explain" antidissipative (thermomechanical, thermochemical, thermoelectric, thermomagnetic, thermogalvanomagnetic) turned out to be in "blatant" contradiction with thermodynamics. threads, etc.) effects as manifestations of some kind of "synergy" [2,3].

A completely different view opens from the position of a more general and non-postulate thermodynamic theory of energy transfer and transformation processes in nonequilibrium systems [23], defended by the author in his doctoral dissertation [24] and then published in the form of a monograph "Thermokinetics" [24], recommended by the Ministry of Science and Education RF as a textbook for technical universities, and after its generalization to any form of energy in the monograph "Energodynamics" [25] - distributed by the Russian Foundation for Basic Research to university libraries. Unlike "pseudo-thermostatics" by W. Thomson [25] or "quasi-thermodynamics" by L. Onsager [26], this theory does not exclude from consideration any (irreversible or reversible) part of the phenomena being studied and covers the entire range of real processes - from quasi-static (reversible) to extremely irreversible (dissipative). This is achieved by finding the driving forces of real processes and their generalized rates directly on the basis of the law of conservation of energy in systems far from equilibrium, which opens up new possibilities for applying the method of nonequilibrium potentials to the study of biological systems and eliminates its contradiction with the laws of biological evolution.

II. Methodological Features of Energodynamics

The fundamental difference between energodynamics and locally equilibrium thermodynamics of irreversible processes (IRP) and other field theories is the consideration of a nonequilibrium system as a whole, without breaking it up into an infinite number of elementary volumes dV, assumed to be homogeneous. This makes it possible to preserve the so-called system-forming connections that are inherent in the system, but absent in its individual parts. This is what distinguishes a living organism from a simple set of organs as macroscopic and even microscopic "subsystems" formed during such fragmentation. The realization of the hopelessness of attempts to restore the lost system-forming properties by finding "suitable integrals" was, according to A. Poincaré, "the biggest and most profound shock that physics has experienced since the time of I. Newton [28].

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Another methodological feature of energodynamics is considering the opposite direction of processes in various parts (regions, phases, components) of a nonequilibrium system. This circumstance makes nonequilibrium processes irreversible even when they occur quasi-statically (infinitely slow). The inconsistency of the concept of "quasi-stativity" of equilibrium thermodynamics of R. Clausius can be seen by presenting any extensive parameter of the system Θ_i (its mass M, the number of moles of kth substances N_k, entropy S, electric charge Θ_e, impulse P, its moment L, etc.) integral of its local $\rho_i = d\Theta_i/dV$ and average $\overline{\rho}_i = \Theta_i/V$ density $\Theta_i = \int \rho_i \, dV = \int \overline{\rho}_i \, dV$. It at once follows that

$$\int(\rho_i - \overline{\rho}_i)dV \equiv 0. \qquad (1)$$

According to this identity, in the elements of the continuum where local equilibrium exists ($\rho_i - \overline{\rho}_i = 0$), no internal processes $d(\rho_i - \overline{\rho}_i)/dt \neq 0$ are possible. This provision emphasizes the need to consider spatial heterogeneity (internal disequilibrium) in any element of the system where any processes occur.

From identity (1) it also necessarily follows that in different parts (regions, phases or components), inhomogeneous systems of oppositely directed processes (with different signs of speed $d(\rho_i - \overline{\rho}_i)/dt$) arise. This position is called in energodynamics the "principle of counterdirectional nonequilibrium processes" [24]. It is in tune with the dialectical law of "unity and struggle of opposites" and can serve as its mathematical expression.

Another starting point of energodynamics is the "principle of certainty of state" of nonequilibrium systems, according to which the number of independent arguments Θ_i of its internal energy U is equal to the number of independent processes occurring in it. This principle, proven in energodynamics "by contradiction," prevents "underdetermination" or "overdetermination" of a nonequilibrium system, i.e., tries to describe it with a missing or excessive number of parameters. An example of "underdetermination" is the local equilibrium hypothesis of I. Prigogine, according to which the volume elements of a system that is nonequilibrium as a whole are in local equilibrium (despite the occurrence of dissipative processes in them), so that their state can be described by the same number of variables as in equilibrium (despite the appearance of local "thermodynamic forces" X_i), and all equations of classical thermodynamics are applicable to them (despite their inevitable transition into inequalities).

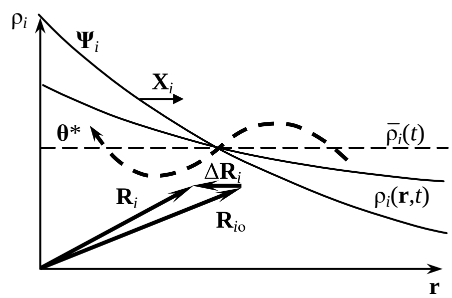

Figure 1: To the Formation of the Distribution Moment

Contrary to this hypothesis, energodynamics proves the need to introduce added parameters for the spatial heterogeneity of the systems under study. To find them, consider an arbitrary system with a non-uniform density $\rho_i(\mathbf{r}) = \partial\Theta_i/\partial V$ of any extensive parameter Θ_i, considered as a quantitative measure of the i-th energy carrier (Fig. 1). As follows from the figure, when ρ_i deviates from the average value, a certain amount Θ_i^* of the energy carrier $\Theta_i$is transferred from one part of the system to another in the direction showed by the dotted arrow. This causes a displacement of the center of its value from the first position $R_{io} = \Theta_i^{-1}\int \mathbf{r}dV = 0$, to the current $R_i = \Theta^{-i1}\int\rho_i\mathbf{r}dV$. In this case, a certain "distribution moment" Z_i arises:

$$Z_i = \Theta_i\Delta R_i = \int_V\left[\rho_i(\boldsymbol{r},t) - \overline{\rho}_i(t)\right]\boldsymbol{r}dV. \qquad (2)$$

with the shoulder $\Delta R_i = R_i - R_{io}$, called the "displacement vector" in energodynamics [25].

Since in a homogeneous state $\Delta R_i = 0$, the state of the nonequilibrium system as a whole is characterized by twice the number of state variables Θ_i and ΔR_i, i.e. $U = \Sigma_i U_i(\Theta_i, R_i)$ In this case, its total differential can be represented as an identity [25]:

$$dU = \Sigma_i dU_i \equiv \Sigma_i \Psi_i d\Theta_i + \Sigma_i F_i \cdot dR_i, \qquad (3а)$$

and the total derivative of the energy of the system with respect to time t is in the form

$$dU/dt \equiv \Sigma_i \Psi_i d\Theta_i/dt + \Sigma_i F_i \cdot v_i, \qquad (3б)$$

where $\Psi_i \equiv (\partial U/\partial\Theta_i)_R$– averaged value of potential ψ_i (absolute temperature T and pressure p, chemical μ_k, electrical φ, gravitational ψ_g and other potentials); $F_i \equiv -(\partial U/\partial R_i)_\Theta$– internal forces in their general understanding as the antigradient of the i-th form of energy; $v_i = dR_i/dt$– speed of the i-th transfer process.

The specificity of equation (3a) is that its terms no longer decide the heat or work of the i-th process, as would be the case for reversible processes. On the contrary, from the very beginning it is recognized that not only entropy S, but also other energy carriers Θ_i can change in the general case both due to external energy exchange and due to internal sources during internal spontaneous processes. In this case, the terms of the first sum in expression (3a) are under conditions of constancy ΔR_i, i.e., in the absence of redistribution processes. This means that local potentials ψ_i in such processes change to the same extent in all parts of the system (as in homogeneous systems). Due to this, the "global" (nonequilibrium) potentials $\Psi_i$buy the simple meaning of averaged values of local potentials ψ_i. This kind of change in state is reminiscent of uniform precipitation on an uneven surface. A special case of them are equilibrium (reversible) processes of heat and mass transfer of a system, the work of introducing k-th substances or charge into the system, its all-round compression, etc.

The second sum of identity (3a), on the contrary, owes its origin to the spatial heterogeneity of the systems under study. Its members characterize elementary work of a different kind than in thermodynamics, which is decided by the product of the force of the i-th kind F_i and the displacement dR_i of the object of its application (energy carrier Θ_i) caused by it. Since these forces are in conditions of constant parameters Θ_i, then $F_i = \Theta_i X_i$, where $X_i = -(\partial U/\partial Z_i)$. The work $dW_i = F_i \cdot dR_i = X_i \cdot dZ_i$ performed by the forces F_i or X_i consists of redistributing the energy carrier Θ_i throughout the volume of the system. Thus, energodynamics introduces into consideration a new class of transfer processes that are of a vector (directional, ordered) nature.

In the particular case of homogeneous systems ($\Delta R_i=0$, $\Psi_i = \psi_i$) expression (3) goes into the combined equation of the 1st and 2nd principles of classical thermodynamics of open systems in the form of the generalized Gibbs relation [21], which is given the form in TIP:

$$dU = \Sigma_i \psi_i d\Theta_i, \tag{4}$$

where i =1,2,n – the number of independent forms of energy of the system.

A unique feature of energodynamics, therefore, is that the main quantities with which TIP operates (thermodynamic forces Xi and flows $J_i = dZ_i/dt$ as generalized rates of transfer processes) are found directly from the thermodynamic identity (3b), thereby avoiding the most labor-intensive procedures for compiling an equation for the "production" of entropy.

III. Finding the Driving Forces and Generalized Rates of Biological Processes

In the "quasithermodynamics" of L. Onsager [27], which deals with relaxation processes, the scalar thermodynamic forces Xi* and "fluxes" J_i* are found from the expression for the rate of entropy increase dS/dt in an adiabatically isolated system:

$$dS/dt = \Sigma_i X_i^* J_i^*, \tag{5}$$

where $X_i^* \equiv \partial S/\partial A_i$ is the deviation of some i-th parameter of the system A_i from its equilibrium value A_{io}; $J_i^* \equiv dA_i/dt$ – "flows," which actually have the meaning of the generalized rate of the i-th relaxation process.

However, in equilibrium thermodynamics the parameters A_i are obviously absent. Therefore, Onsager's theory remained a kind of formalism, unrelated to reality, until another future Nobel laureate I. Prigogine proposed moving to the study of so-called "stationary irreversible processes", where the parameters X_i^* and J_i^* acquire a vector nature and are maintained unchanged with the help of "external coercion" i.e. performing work dW_i "against equilibrium" on the system. In this case, the concept of "flow" Ji acquires a very specific meaning as a parameter of the transfer process and could be found from disciplines operating with the concept of its speed, by isolating from their equations that part of the "production" of entropy dS/dt d_iS/dt, which is responsible for dissipation and in such processes is numerically equal to the work done on the system dW_i/dt. However, this required the compilation of cumbersome equations for the balance of energy, mass, charge, momentum, entropy, etc. in order to then isolate the irreversible part of the process. This most labor-intensive part of the TIP required the user not only to have extraordinary knowledge of the relevant fundamental disciplines, but also to apply a number of hypotheses, since these disciplines were deliberately limited to the consideration of conservative (non-dissipative) systems and did not contain dissipative terms. This was the main reason teaching TIP in higher education turned out to be unrealistic due to students being unprepared for this and going beyond the permissible duration of the course.

The situation is completely different in energodynamics, where the required forces X_i and flows J_i are already contained in its main identity (3b). In this case, the concept of force and generalized speed of the process buy a general physical meaning, due to which the inherent arbitrariness in their choice, due to the many ways of dividing the product $X_i \cdot J_i$ into factors, is eliminated. Thus, if the first sum (3a) includes the term TdS, which characterizes reversible heat transfer in classical thermodynamics, then the 2nd sum (3b) will have the term $X_s \cdot J_s$, where $X_s = -\nabla T$ is the "thermomotive" force, $J_s = Sv_s$ – entropy flow. Similarly, if the first sum (3a) includes the term pdV, which characterizes the reversible work of expansion, then in the 2nd sum (3) an additional term $X_\upsilon \cdot J_\upsilon$ will appear, characterizing the power of the process of compression of some and expansion of other parts of the system, for example the ventricle and atria ($X_\upsilon = -\nabla p$, $J_\upsilon =$ – volumetric flow). In the same way, if the first sum (3a) includes the term $M_k dN_k$, characterizing the diffusion of the kth substance across the boundaries of the system, then in the 2nd sum (3b) the term $X_k \cdot J_k$ will appear, characterizing the power of the separation process of this substance in the cell membrane or in the dialyzer ($X_k = -\nabla\mu_k$, $J_k = N_k v_k$ – flow of the kth substance). In an analogous way, driving forces can be found in so-called "polyvariant" systems that perform other types of work in addition to expansion work. Thus, if in the 1st sum (3a) we include the term $\varphi d\Theta_e$, which characterizes the reversible work of introducing an electric charge $\Theta X_k = -\nabla\mu_k$, $J_k = N_k v_k$ into a region with an average electric potential φ, then in the second sum (3) the term $X_e \cdot J_e$ will appear, characterizing the power of the process polarization (charge separation) in a cell membrane or in a galvanic cell ($X_e \equiv E = -\nabla\varphi$ – electric field strength, J_e – electric current).

It is easy to notice that the terms of the second sum (3a) can have different signs depending on whether the system does work, or work is done on the system. This is the fundamental difference between energodynamics and TIP, in which the terms $X_i \cdot J_i$ is always positive (as is the "entropy production" d_iS/dt). Meanwhile, in biosystems that consume free energy from the environment, $X_i \cdot J_i < 0$, which contradicts (5). This approach allows energodynamics to study real processes without excluding from consideration any of their components (reversible or irreversible).

A significant advantage of energodynamics over TIP is that it eliminates the need to draw up cumbersome equations for the balance of energy, mass, charge, momentum, entropy, etc. It is also important that energodynamicscan reflect, at a quantitative and qualitative level, the emergence of new (acquired) properties. Indeed, the parameters Z_i are absent in equilibrium systems ($\Delta R_i = 0$) and their elements and arise only when they deviate from a homogeneous state. Thus, energodynamicsis distinguished by considering not only the local nonequilibrium of the systems under study ($\nabla\psi_i \neq 0$), but also the ability to reflect the evolution of biosystems, which consists in the appearance of new properties (degrees of freedom) in them. It will be shown below that this also makes it possible to substantiate the dialectical unity of the processes of evolution and involution [30].

IV. Correction of the Equations of "Passive Transport" in Biosystems

In "quasi-thermodynamics" by L. Onsager [27], it is postulated that each of the flows Ji linearly depends on all thermodynamic forces X_j (j=1,2,n) acting in the system. The corresponding equations are called "Onsager's phenomenological laws":

$$J_i = \Sigma_j L_{ij} X_j. \tag{6}$$

Here L_{ij} are constant (independent of forces X_j) kinetic coefficients, called phenomenological and subject to the so-called "reciprocity relations" of Onsager $L_{ij} = L_{ji}$. These relationships reflect, in his opinion, the interconnection of Ji flows, which is the cause of the above-mentioned "side" effects of their "overlay."

The terms $J_{ij} = L_{ij} X_j$ of the flow $J_i = \Sigma_j J_{ij}$ according to (6) have the same sign. This is natural for the case of purely dissipative processes when the total rate of approach of the system to equilibrium is the sum of the rates of individual relaxation processes. Meanwhile, a class of so-called "conjugate" processes is known, when some of them go ahead in the direction of equilibrium, while others, on the contrary, move it away from it. These are, for example, cyclic Belousov-Zhabotinsky reactions, called "chemical clocks" [31], "active transport" in biosystems (transfer of substances to the region of increased reaction affinity) [32], "upward diffusion" in metals and alloys [33], processes of concentration of matter in the Universe [30], etc. This means that at least part of the forces X_j and flows J_i have the opposite sign, i.e., when any i-th relaxation process occurs, the system moves away from equilibrium along other, j-th degrees of freedom. In other words, along with dissipative phenomena, processes of the opposite direction are seen in such systems. These include the phenomena of "self-organization" in biosystems, as well as the processes of structure formation in solutions and melts. Since it is possible to remove a system from a state of equilibrium only by performing work on it of an antidissipative nature, we must admit that in biosystems, along with external energy exchange, internal work is performed that is not related to the production of entropy. Equations (6) do not take this specificity of systems performing useful work into account at all. This makes consumer goods inapplicable to biological systems.

In TIP, the interpretation of the effects of superposition of heterogeneous processes also turns out to be mistaken. Indeed, if the flows J_i in the TIP are found as derivatives with respect to time t from the independent parameters A_i, then they are also independent of each other and therefore cannot interact (they nevertheless overlap). This is especially obvious for stationary states, when some of the "overlapping" flows simply disappear, and yet the effects of "overlapping" take on a maximum value. This means that the explanation of various (thermomechanical, thermoelectric, thermochemical, electromagnetic, etc. effects) in TIP because of the "superposition" or "entrainment" of heterogeneous flows, and not the summation of forces F_i and F_j, does not correspond to the essence affairs.

The transport equations appear in a completely different light from the perspective of energodynamics. It attracts equations of state or transfer from the outside as a kind of uniqueness conditions but does not build them into the foundations of the theory, as classical thermodynamics and thermodynamics do. This makes the mathematical apparatus of energodynamics independent of the form of these equations and cuts the contradiction between the TIP and mechanics. In it, for each independent process one can find a single (resulting) force F_i that generates the given process and disappears with its cessation [25]. The components of this force F_{ij} differ in their physical nature, but unlike X_i they have the same dimension [H]. If such (resulting) force is found, $L_{ji}X_i = 0$ and laws (6) take on the so-called "diagonal" form, like the equations of thermal conductivity, electrical conductivity, diffusion, etc., i.e., not having cross terms with $i \neq j$ [34]:

$$J_i = L_{ii}F_i = L_{ii}\Sigma_j F_{ij}. \tag{7}$$

In this case, the Onsager reciprocity relations are fulfilled trivially ($L_{ij} = L_{ji} = 0$) and become redundant, and with them the requirement of linearity of laws (6), necessary for the fulfillment of these relations, disappears. This means that the phenomenological coefficients L_{ii} in (7) can be arbitrary functions of the variables Θ_i and forces F_{iji}, and the laws (6) in the general case are nonlinear. As shown in [24], the laws of passive transport of k-substances take the form:

$$J_к = L_k X_к = -L_k \nabla\mu_k, \tag{8}$$

where L_k are the coefficients of osmotic diffusion of the k-th substance, depending on the fields of temperature, pressure, and concentration of all independent components of the system; $\nabla\mu_k$ is the gradient of chemical potential in the membrane. Meanwhile, in the laws of diffusion proposed by Onsager himself, the sum $\nabla\mu_k$ appears, as in (5) [27]. With the diagonal form of laws (7.8), their nonlinearity, due to the variability of the coefficients L_k, no longer prevents the detection of superposition effects. Let us demonstrate this using the example of a biological membrane that is permeable to the kth substance. Expanding the expression for the total differential of the chemical potential μ_k as a function of temperature, pressure, and concentrations of all j – th independent components of the system (j = 2.3, K), we have:

$$d\mu_k = (\partial\mu_k/\partial T)\, dT + (\partial\mu_k/\partial p)\, dp + \Sigma_j\, (\partial\mu_k/\partial c_j)\, dc_j. \tag{9}$$

This means that the transport equation (6) for discontinuous media in their integral form has the form:

$$J_к = -L_k\, [(\partial\mu_k/\partial T)\, \Delta T + (\partial\mu_k/\partial p)\, \Delta p + \Sigma_j\, (\partial\mu_k/\partial c_j)\, \Delta c_j], \tag{10}$$

where ΔT, Δp, Δc_j are differences in temperature, pressure, and concentration of j-th substances on the membrane. The terms of this expression represent the components of the resultant force $X_к = -\Delta\mu_k$, the first of which is responsible for the phenomenon of thermal diffusion (substance transfer due to temperature difference), the second – for the phenomenon of barodiffusion (substance transfer due to pressure difference), and the third – for the phenomenon of ordinary (concentration) diffusion. The mutual compensation of these components of the resulting force ($X_к = 0$) is the reason for the onset of a stationary state, which would be more correctly called the state of "partial equilibrium". At the same time, the stationary effects themselves such as $\Delta T/\Delta p$, $\Delta T/\Delta c_j$ and $\Delta p/\Delta c_j$ are obtained in energodynamics because of the "superposition" of heterogeneous forces and not flows.

From (10) at $J_k = 0$, regardless of the value of L_k, the well-known expression for the stationary effect of the appearance of the so-called osmotic pressure Δp in a binary isothermal system (the first part is the solvent) directly follows:

$$(\Delta p/\Delta c_2)_{set} = -\, (\partial\mu_1/\partial c_2)/(\partial\mu_1/\partial p), \tag{11}$$

where Δc_2 is the stationary difference in the concentration of the dissolved substance on both sides of the biological membrane.

This made it possible to propose a method for studying superposition effects in nonlinear systems [23], which opens the possibility of studying the kinetics of processes in biological systems that are far from equilibrium.

V. Substantiation of the Relationship Between Chemical Reactions and Metabolic Processes

When applying TIP to chemical reactions, another contradiction of this theory was discovered, this time with the Curie principle, which sets up the conditions for the conservation of bonds under various transformations of the coordinate system in crystallography. About transfer and relaxation processes, this principle states that the generalized rate of any i-th process J_i in Onsager's laws (6) can depend only on thermodynamic forces X_j of the same (or even) tensor rank [1,2]. This means that chemical reactions described in TIP by scalar terms of the type $\Sigma_r A_r d\xi_r$ (where A_r is the standard chemical affinity of the r-th chemical reaction, ξ_r is the degree of its completeness) cannot interact with metabolic processes that have a vector nature. Meanwhile, it is known that metabolism plays a decisive role in the vital processes of biosystems. To resolve this contradiction, I. Prigogine put forward the theory of "stationary coupling", in which the fact of the presence of active transport of substances through biological membranes due to the occurrence of chemical reactions on them was explained by the specificity of stationary processes with their inherent relationships between the costs of individual reagents. However, this did not solve the problem since the mentioned relationship between chemical reactions and metabolic processes was preserved in non-stationary processes. The solution to this problem is given by the basic identity of energodynamics in the form (3a) and (3b). If in the first sum (3a) the term $\Sigma_r A_r d\xi_r$ appears, describing the r-th scalar chemical reactions in homogeneous media, then in the second sum (3b) additional terms of a vector nature $\Sigma_r \mathbf{X}_r \cdot \mathbf{J}_r$ will appear, describing the same reactions, but carried out in a flow (in flow reactors, Van't Hoff boxes, cell membranes, etc.), where $\mathbf{X}_r = -\nabla(A_r\xi_r)$, where $A_r\xi_r$ is the current (local) value of the chemical affinity of the r-th chemical reaction in a given section of the flow reactor; $\mathbf{J}_r$ is the flow of reagents participating in it. Indeed, for steady-state reactions, the term $\Sigma_r A_r d\xi_r$ can be represented as $\Sigma_r[\partial(A_r\xi_r)/\partial R_m]\, dR_m = -\Sigma_r \mathbf{F}_r \cdot d\mathbf{R}_m$, where $\mathbf{F}_r = -\nabla(A_r\xi_r)$ is the local value of the driving force of the r-th flow chemical reaction; R_m is the coordinate of the "reaction front" in the flow reactor. In this case, the laws of active transport of substances in membranes take the form:

$$\mathbf{J}_m = -L_m \Sigma_r \nabla(A_r\xi_r), \qquad (12)$$

where $\mathbf{J}_m = \Sigma_k N_k d\mathbf{R}_m/dt$ is the flow of chemically reacting substances through the biological membrane. Thus, under conditions of spatial separation of reagents (as in a Van't Hoff box), chemical reactions buy a directional (vector) character, which decides their interaction with metabolic processes in full accordance with the Curie principle. In the absence of transfer of reagents in the field of intermolecular forces, chemical reactions inevitably buy a dissipative character, which is considered in the TIP by assigning the term $\Sigma_r A_r d\xi_r$ to heat sources. This removes one of the main contradictions between consumer goods and bioenergy [24].

VI. Non-Entropic Criteria for the Evolution and Involution of Biological Systems

In classical thermodynamics and in thermodynamics there are no parameters or state functions that could be sufficiently general and strict criteria for the development (ontogenesis) and evolution (phylogeny) of biosystems. Entropy S is inapplicable for this purpose, since in biosystems exchanging energy and matter with the environment, it can change due to heat or mass transfer in the absence of chemical reactions, or, on the contrary, remain unchanged if the system moves away from equilibrium or approaches it due to useful (reversible) work. In particular, the entropy of a biosystem can increase when more organized biomass is added to it, although in this case such an "extended" system only moves away from equilibrium.

As for the known "global" thermodynamic potentials such as the Helmholtz free energy F or Gibbs free energy G, they are defined only for closed homogeneous systems and are not applicable in the boundary conditions specified by matter flows [27]. Nor can its exergy (technical performance) [35] serve as a measure of the orderliness of a biosystem, since in extended systems it depends on environmental parameters, as well as on energy coming from outside in the process of performing work, and therefore is not a function of the state of such systems.

The so-called "production" of entropy d_iS/dt (the rate of its increase due to irreversibility) also does not meet these requirements, since this indicator has a minimum only for stationary states of linear systems, and then only near equilibrium [36].

Energodynamics again suggests a way out of the situation. The inhomogeneity parameters $\mathbf{Z}_i = \Theta_i\Delta\mathbf{R}_i$ and $\mathbf{X}_i = -\partial U/\partial \mathbf{Z}_i$ introduced in it, expressed by potential gradients $-\nabla\psi_i$ averaged over the volume of the system V, are already such criteria. The advantage of such (non-entropy) criteria is that they are able to reflect the evolution of the system for each of its inherent degrees of freedom (mechanical, thermal, pressure, chemical, electrical, etc.), and are able to reflect not only its approach to equilibrium, but also removal from it:

$$d\mathbf{R}_i,\ d\mathbf{Z}_i,\ |d\mathbf{X}_i| > 0 \text{ (эволюция)}, \qquad (13)$$

$$d\mathbf{R}_i,\ d\mathbf{Z}_i,\ |d\mathbf{X}_i| < 0 \text{ (инволюция)}, \qquad (14)$$

These criteria for the evolution and involution (degradation) of systems are suitable not only for biological, but also for any other systems. They are simpler, more visual, and informative, since they allow us to monitor the behavior of each degree of freedom of systems separately, which entropy criteria cannot do. This also applies to evolution in various parts (regions, phases, and components) of the system, which makes it possible to detect the opposite direction of processes in them. Such criteria make it possible to distinguish the stationary states of nonequilibrium systems from the state of partial equilibrium, in which not only their differentials, but also these nonequilibrium parameters themselves vanish:

$$d\mathbf{R}_i,\ d\mathbf{Z}_i,\ d|\mathbf{X}_i| = 0 \text{ (стационарный процесс)}, \qquad (15)$$

$$\mathbf{R}_i,\ \mathbf{Z}_i,\ |\mathbf{X}_i| = 0 \text{ (частичное равновесие)} \qquad (16)$$

The ability to distinguish partial (incomplete) equilibrium from complete (characterized by the cessation of all processes) allows one to distinguish the relaxation time of different subsystems of the body, which entropy criteria also cannot do. Finally, since in isolated systems all processes are spontaneous, the presence of non-entropic criteria makes the concept of self-organization meaningful, if we mean not the system, but its individual degrees of freedom. All this gives researchers a simple and extremely informative tool for analyzing evolutionary problems.

VII. Unity of the Laws of Energy Transformation in Technical and Biological Systems

One of the most important achievements of energodynamics is the establishment of the unity of the laws of energy conversion in thermal and non-thermal, cyclic, and non-cyclic, direct, and reverse machines. Let us now show that this unity extends to biological systems, including muscular movers. To this end, consider the expression $\Sigma_i X_i \cdot J_i = 0$, which follows from the energodynamic identity 3b in the steady process ($dU/dt = 0$, $d\Theta_i/dt = 0$) of energy conversion of the i-th form of energy into the j-th. It implies numerical equality and the opposite sign of the power of the process of transforming the i-th form of energy into the j-th:

$$X_i \cdot J_i = - X_j \cdot J_j \qquad (17)$$

This means that previously independent flows and forces in energy conversion have a relationship $J_i/X_j = - J_j/X_i$, independent of their direction in space. At the same time, the laws of thermal conductivity, electrical conductivity, diffusion, etc. give way to more complex equations reminiscent of L. Onsager's laws of relaxation.

$$J_i = \Sigma_i L_{ij} X_j, \qquad (18)$$

but differing from them in the antisymmetric nature of the matrix of its phenomenological coefficients L_{ij}. For the considered case of a two-stream system, they have the form:

$$J_i = L_{ij} X_i - L_{ij} X_j. \qquad (19)$$

$$J_j = L_{ji} X_i - L_{ji} X_j. \qquad (20)$$

This nature of the phenomenological laws of the energy transformation process becomes more understandable when considering, for example, a welding transformer, which converts the electrical energy of one voltage X_i into a lower one X_j while simultaneously increasing the current strength J_i to J_j. As is known, it clearly distinguishes between the "no-load" modes, in which the current in the primary circuit $J_j \to 0$, and the voltage in the secondary circuit X_j reaches its maximum value X_{jo} (open circuit voltage), and the "short circuit" mode, when $Xj \to 0$, and the current J_j is maximum and equal to the "short circuit current" J_{jk}. Moreover, as the overcome forces X_j increase (approaching the "no-load" mode), the current in both the primary J_i and the secondary circuit J_j decreases. This is reflected by laws (19) and (20).

An analogue of such an energy converter in biological systems is a muscle element - a fibril, which can contract when a chemical reaction is started, i.e., converting chemical energy into mechanical energy. In it, the analogue of the primary energy carrier flow J_i is the flow of reagents J_r of a given chemical reaction, and the secondary flow J_j is the impulse of the contracted muscle. Each of these flows, in accordance with (19) and (20), depends on both forces, the first of which X_i in this case is the current value of the affinity of the chemical reaction $Xi = Ar\xi r$, equal to the product of the standard affinity of this reaction A_r and the degree of its completeness ξ_r, and as X_j – the force of fibril contraction. In this case, the analogue of "idling" ($J_j = 0$) is the so-called "unloaded muscle contraction" mode, and the "short circuit" mode ($X_j = 0$) is the so-called "isometric muscle contraction" mode.

Expressing X_{jo} and J_{jk} through phenomenological coefficients L_{ij} (assuming their constancy), under conditions of constant forces X_i, laws (19) and (20) can be represented in a dimensionless form that does not contain phenomenological coefficients:

$$X_j/X_{jo} + J_j/J_{jk} = 1. \qquad (21)$$

The applicability of these equations to biological systems is confirmed by the experimentally found Hill kinetic equations, which quite accurately describe the characteristics of muscles taken from various animal species [5]. The load characteristics of muscular movers constructed on their basis are shown in Figure 2.

Curves 1, 2, 3, 4 in this figure correspond to varying degrees of nonlinearity of Hill's kinetic equations. In linear systems, the dependence of X_j/X_{jo} on J_j/J_{jk} is expressed by a straight line intersecting the ordinate axes at $J_j/J_{jk} = 1$ and $X_j/X_j = 1$ (curve 1). It is easy to notice that precisely this character follows from the kinetic laws (21). Thus, the work of the fibril as an element of any muscle is subject to the same laws as technical energy converters.

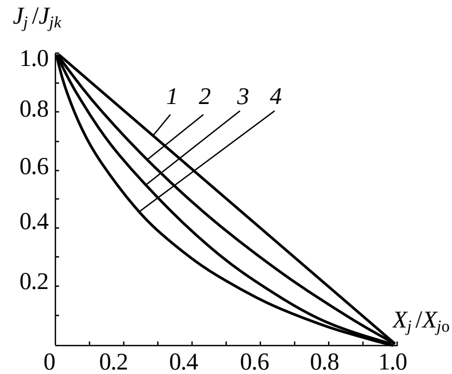

Figure 2: Load Characteristic of the Muscular Propeller

This unity makes it possible to use the theory of similarity of energy installations developed within the framework of energodynamics [37] to analyze biological energy converters. Based on equation (21), this theory introduces a number of dimensionless criteria for the similarity of linear energy-converting systems. One of them, the "constructiveness criterion" $\Phi = L_{ii}L_{jj}/L_{ij}L_{ji}$, is similar to the ratio of reactive and active resistances, known in radio engineering as the quality factor of the circuit, and, up to the temperature multiplier, coincides with the so-called "quality factor" Φ, introduced by A. Ioffe when analysis of thermoelectric generators (TEG) as their general characteristics. Its value ranges from zero to infinity (0 < Φ <), increasing with an increase in "reactive" resistances $R_{ji} = L_{ii}^{-1}$ (from the payload side) and a decrease in "active" resistances (from the side of dissipation forces) R_{ii} and R_{jj}. Like thermal resistances in the theory of heat transfer, these resistances depend on the properties of muscle tissue and their cross-section, composition, etc.

Another dimensionless criterion $B = J_j/J_{jk} = 1 - X_j/X_{jo}$, called "relative load", is composed of boundary conditions specified by the value of forces X_j, X_{jo} or flows J_j, J_{jk}. It changes from zero in the "idle" mode ("unloaded muscle contraction") to one in the "short circuit" mode ($X_j = 0$). As a determined criterion, this theory uses the "power" efficiency $\eta_N = N_j/N_i$, expressed by the ratio of the output power N_j and the input power N_i. This efficiency is numerically equal to the so-called "exergetic efficiency" and complements this concept by considering the kinetics of the energy conversion process through the transition to exergy flows. It considers all types of losses and therefore most fully reflects the perfection of the converter, i.e., the degree to which it realizes the capabilities that nature provides. Using these criteria, expression (21) can be given the form of a criterion equation for the energy conversion process:

$$\eta_N = (1 - B)/(1 + 1/B\Phi). \qquad (22)$$

Criterion equation (22) allows us to construct a universal load characteristic that expresses the dependence of this efficiency η_N on the power Nj and load B of the energy converter at varying degrees of its design perfection F (Figure 3) [37]. The solid lines on it reflect the dependence of the efficiency η_N on the load criterion B for various values of the quality factor factor Φ, and the dash-dotted line shows the dependence of the output power of the installation Nj on it. These characteristics reveal a circumstance unknown to classical thermodynamics - the efficiency η_N goes to zero twice: at idle (B = 0) and in the "short circuit" mode (B = 1). Another, also previously unknown, application is to demonstrate that the loads corresponding to maximum efficiency and maximum power diverge more noticeably the more advanced the energy converter is. In the absence of any energy losses (from friction, heat generation, all kinds of "leaks" of reagents, losses during no-load operation of the installation, etc., i.e., at Φ = ∞), the power efficiency of the installation increases linearly with decreasing load, and at B → 0 reaches, as one would expect, one. This case corresponds to an ideal Carnot machine, which has the highest thermodynamic efficiency, but has negligible power. This shows the existence of a best operating mode for each type of energy converter, including a muscular propulsion device. Universal characteristics facilitate the search for such a regime and allow the results of research on one of them to be transferred to others. Thus, a significant step is taken towards bringing the results of theoretical analysis of energy converters closer to reality.

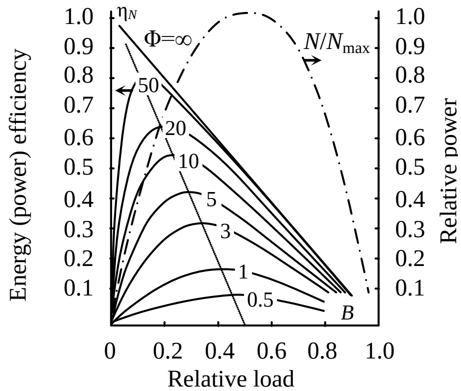

Figure 3: Universal Load Characteristics of Linear Energy Converters Systems

VIII. Survival as the Basic Law of Evolution of Biosystems

Among the numerous nontrivial consequences of energodynamics [38], associated with its introduction of nonequilibrium parameters X_i and R_i, is the possibility of studying the kinetics of relaxation processes in systems that simultaneously perform useful work. This allows us to raise the question of the life expectancy of living organisms and their reproductive period, which the "quasi-thermodynamics" of L. Onsager and TIP could not do. Meanwhile, this is precisely what decides the life expectancy and its reproductive period of bioorganisms. According to identity (3b), after isolating a nonequilibrium system ($\dot{U} \equiv dU/dt = 0$), processes of interconversion of energy occur in it until complete equilibrium occurs (all Ji = 0), subject to the condition

$$\Sigma_i X_i{\cdot}J_i = 0. \tag{23}$$

Let us now consider that a change in any parameter Z_i can be caused not only by the relaxation of a given degree of freedom, but also by the external $dW_i^e = F_i{\cdot}dr_i$ and internal $dW_i^u = X_i{\cdot}dZ_i$ work by the forces F_i and X_i. This circumstance can be expressed by equations like the entropy balance equations $dS = d_eS + d_uS$ proposed by I. Prigogine:

$$dZ_i = d_eZ_i + d_uZ_i + d_rZ_i, \tag{24}$$

where $d_eZ_i = \text{đ}W_i^e/X_i$; $d_uZ_i = \text{đ}W_i^u/X_i$; $d_rZ_i = \text{đ}W_i^r/X_i < 0$– components of the total change in the parameter Z_i caused by external Wie, internal Wiu and dissipative work W_i^r, respectively.

So, the flow $J_i = dZ_i/dt$ as the generalized rate of any i-th transfer process includes external J_i^e, reversible internal J_i^u and dissipative internal J_i^r components:

$$J_i = d_eZ_i/dt + d_uZ_i/dt + d_rZ_i/dt = J_i^e + J_i^u + J_i^r. \tag{25}$$

In this case, condition (24) takes the form in isolated systems ($J_i^e = 0$):

$$\Sigma_i X_i{\cdot}(J_i^u + J_i^r) = 0. \tag{26}$$

It follows that if relaxation processes ($J_i^r \neq 0$) occur in the system, oppositely directed (anti-dissipative) processes of performing internal work "against equilibrium" will also occur in it. In energodynamics, this position is called the "principle of counterdirectivity" of nonequilibrium processes, which can be considered as a mathematical expression of the law of "unity and struggle of opposites" in dialectics [39].

In this case, this principle means that the approach to equilibrium of some (i-th) degrees of freedom of the system ($X_i{\cdot}J_i > 0$) is accompanied by the removal of other, j-th degrees of freedom ($X_i{\cdot}J_i < 0$) from it. This implies the unity of the processes of evolution and involution (degradation) of nonequilibrium systems. Unlike classical thermodynamics, which cannot say anything about the rate of approach of a biosystem to equilibrium, energodynamics allows us to raise the question of the time of approach of a system to a state of equilibrium, depending on the distance of the biosystem from the state of equilibrium. According to (3b), under comparable conditions, the rate of relaxation of the system prescribed by the second law of thermodynamics depends on the rate of reversible processes Jiu. In this case, one can compare the rate of approach to equilibrium of two arbitrary biological systems of varying complexity (with different numbers of degrees of freedom). If in an arbitrary system there are no reversible processes associated with the performance of internal work "against equilibrium" ($J_i^u = 0$), then the rate of its approach to equilibrium will be equal to

$$\dot{U}_r = -\Sigma_i X_i{\cdot}J_i^r. \tag{27}$$

In the presence of reversible work W_i^u, this speed is decided by expression (26). Comparing (23) and (26), considering the work of W_i^u, we find that their ratio is decided by the expression:

$$\dot{U}/\dot{U}_r = 1 + \Sigma_i X_j{\cdot}J_j^u/\Sigma_i X_i{\cdot}J_i^r. \tag{28}$$

This ratio can be either greater or less than one depending on the sign of the sum $\Sigma_i X_i \cdot J_i^u$, since $\Sigma_i X_i \cdot J_i^r$ is always positive. If $\Sigma_i X_i \cdot J_i^u < 0$, i.e., work is done in the system "against equilibrium," then the rate of approach of such a system to equilibrium decreases in comparison with a system where such processes are absent:

$$\dot{U} / \dot{U}_r = 1 - \Sigma_i X_i \cdot J_i^u / \Sigma_i X_i \cdot J_i, \tag{29}$$

Among the macroprocesses in which this kind of work is carried out is the so-called "active transport" of substances, which leads to the accumulation of reagents with a high Gibbs energy in the corresponding organs. These are the above-mentioned processes of "upward diffusion" in alloys, as well as the so-called "conjugate chemical reactions." Some of them, like the cyclic reactions of Belousov-Zhabotinsky ("chemical clock") or the process of circulation of matter in the Universe, can continue indefinitely. All processes of this kind arise only at a certain stage of their evolution. The lifespan of biosystems, as well as their reproductive period, depends on their intensity, which affects the evolution of the entire subsequent population of this type of bioorganism. When the work "against equilibrium" done by external forces $dW_j^e/dt = X_j \cdot J_j^e$ becomes equal to the work of a dissipative nature, the so-called "stationary state" of the nonequilibrium system will occur.

Here lies the key to understanding the general direction of the evolution of a biological system, understood as a transition from simple to complex. This direction of evolution is not imposed by a "higher mind" - it is a consequence of purely physical reasons, reflected in the energodynamic principle of "counter-directivity" of nonequilibrium processes. These are any processes leading to the ordering of the system, its acquisition of new properties (increasing the number of degrees of freedom), complication of the structure, etc.

Since it is precisely this environment (including the field form of matter) that is responsible for the emergence of the biosystem and its further evolution, the advantage in extending the reproductive period is given to those systems in which mutations of hereditary characteristics lead to the complication of the system and the consolidation of new degrees of freedom and forms of interaction of the biosystem with this environment. This position can be briefly formulated in the form of the "principle of survival": "The more complex the biosystem and the more intense the evolutionary processes in it, the longer their life expectancy." This position is so general that it can be considered the basic law of biological evolution. It is easy to show that this law corresponds to the well-known "triad" of Darwin's doctrine of evolution – adaptability, variability, and heredity [40]. He also removes the "blatant contradiction between thermodynamics and biological evolution" emphasized by I. Prigogine. At the same time, it also debunks the myth of "the emergence of order from chaos" [20], which contradicts classical thermodynamics, since maintaining "order" requires the expenditure of a certain external work, due to the absence of which the ordered energy of the system decreases. In other words, "order" in the system arises not from chaos, but due to a higher order in its environment. This fundamentally changes our worldview.

IX. Conclusion

1. The introduction of the missing parameters of spatial heterogeneity into thermodynamics reveals the occurrence in nonequilibrium systems of reversible processes of redistribution of energy carriers throughout the volume of the system and their opposite direction in different regions or degrees of freedom of the nonequilibrium system. This "opposite direction of processes" reflects at the physical level one of the main laws of dialectics, according to which the processes of evolution in some parts of a nonequilibrium system are invariably accompanied by processes of involution in others.
2. Description of the state of nonequilibrium systems requires the introduction of intensive Xi and extensive Z_i parameters of spatial heterogeneity, characterizing their deviation from equilibrium. This cuts the limitations of the thermodynamics of irreversible processes, which excluded their reversible part from consideration, which is why it also turned out to be unable to cut the contradiction between thermodynamics and evolution.
3. The introduction of nonequilibrium parameters X_i and Z_i allows us to return the concepts of force, speed, and power of real processes to thermodynamics, and obtain an energodynamic identity that remains valid for irreversible processes. It follows from this that the simultaneous occurrence in various parts (areas, phases, and components) of a non-equilibrium system of counter-directed processes of relaxation and the performance of work "against equilibrium" in the system, which reflects the dialectical unity and "struggle" of opposites.
4. The use of nonequilibrium parameters X_i and Z_i as criteria for the evolution and involution of biological systems makes it possible to reflect their approach to equilibrium and their distance from it both as a whole and for each inherent degree of freedom separately. Considering their vanishing in a state of equilibrium, this makes the mentioned criteria simpler and more informative than entropy.
5. Energodynamic identity allows us to develop a theory of similarity of energy machines, which allows

us to consider the dependence of the efficiency of technical and biological propulsion on the conditions and mode of their operation. The theory implies the unity of the laws of transformation of thermal and non-thermal forms of energy, including biological (muscular) and technical propulsion, which makes it possible to transfer the experience of studying one of them to others.

6. The occurrence of oppositely directed processes in biological systems slows down their approach to equilibrium and allows us to formulate the basic law of biological evolution as "the principle of their survival," which is based on the increase in the reproductive period of life and as they self-organize."
7. The reason for the "flagrant contradiction" of equilibrium thermodynamics to the laws of biological evolution is the absence of time as a physical parameter in its equations, which deprives it of the ability to consider the kinetics of real processes. It is precisely this that holds the key to understanding the relationship between reversible and irreversible processes occurring in them and deciding the duration of the reproductive period of biosystems.
8. The energodynamic theory of evolution confirms the main provisions of Darwin's theory of evolution, explaining them, however, by natural causes. This once again confirms the validity of the laws of materialist dialectics.

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11. Pick a good study spot: Always try to pick a spot for your research which is quiet. Not every spot is good for studying.

12. Know what you know: Always try to know what you know by making objectives, otherwise you will be confused and unable to achieve your target.

13. Use good grammar: Always use good grammar and words that will have a positive impact on the evaluator; use of good vocabulary does not mean using tough words which the evaluator has to find in a dictionary. Do not fragment sentences. Eliminate one-word sentences. Do not ever use a big word when a smaller one would suffice.

Verbs have to be in agreement with their subjects. In a research paper, do not start sentences with conjunctions or finish them with prepositions. When writing formally, it is advisable to never split an infinitive because someone will (wrongly) complain. Avoid clichés like a disease. Always shun irritating alliteration. Use language which is simple and straightforward. Put together a neat summary.

14. Arrangement of information: Each section of the main body should start with an opening sentence, and there should be a changeover at the end of the section. Give only valid and powerful arguments for your topic. You may also maintain your arguments with records.

15. Never start at the last minute: Always allow enough time for research work. Leaving everything to the last minute will degrade your paper and spoil your work.

16. Multitasking in research is not good: Doing several things at the same time is a bad habit in the case of research activity. Research is an area where everything has a particular time slot. Divide your research work into parts, and do a particular part in a particular time slot.

17. Never copy others' work: Never copy others' work and give it your name because if the evaluator has seen it anywhere, you will be in trouble. Take proper rest and food: No matter how many hours you spend on your research activity, if you are not taking care of your health, then all your efforts will have been in vain. For quality research, take proper rest and food.

18. Go to seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

19. Refresh your mind after intervals: Try to give your mind a rest by listening to soft music or sleeping in intervals. This will also improve your memory. Acquire colleagues: Always try to acquire colleagues. No matter how sharp you are, if you acquire colleagues, they can give you ideas which will be helpful to your research.

20. Think technically: Always think technically. If anything happens, search for its reasons, benefits, and demerits. Think and then print: When you go to print your paper, check that tables are not split, headings are not detached from their descriptions, and page sequence is maintained.

21. Adding unnecessary information: Do not add unnecessary information like "I have used MS Excel to draw graphs." Irrelevant and inappropriate material is superfluous. Foreign terminology and phrases are not apropos. One should never take a broad view. Analogy is like feathers on a snake. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Never oversimplify: When adding material to your research paper, never go for oversimplification; this will definitely irritate the evaluator. Be specific. Never use rhythmic redundancies. Contractions shouldn't be used in a research paper. Comparisons are as terrible as clichés. Give up ampersands, abbreviations, and so on. Remove commas that are not necessary. Parenthetical words should be between brackets or commas. Understatement is always the best way to put forward earth-shaking thoughts. Give a detailed literary review.

22. Report concluded results: Use concluded results. From raw data, filter the results, and then conclude your studies based on measurements and observations taken. An appropriate number of decimal places should be used. Parenthetical remarks are prohibited here. Proofread carefully at the final stage. At the end, give an outline to your arguments. Spot perspectives of further study of the subject. Justify your conclusion at the bottom sufficiently, which will probably include examples.

23. Upon conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print for the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects of your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form which is presented in the guidelines using the template.
- Please note the criteria peer reviewers will use for grading the final paper.

Final points:

One purpose of organizing a research paper is to let people interpret your efforts selectively. The journal requires the following sections, submitted in the order listed, with each section starting on a new page:

The introduction: This will be compiled from reference matter and reflect the design processes or outline of basis that directed you to make a study. As you carry out the process of study, the method and process section will be constructed like that. The results segment will show related statistics in nearly sequential order and direct reviewers to similar intellectual paths throughout the data that you gathered to carry out your study.

The discussion section:

This will provide understanding of the data and projections as to the implications of the results. The use of good quality references throughout the paper will give the effort trustworthiness by representing an alertness to prior workings.

Writing a research paper is not an easy job, no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record-keeping are the only means to make straightforward progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear: Adhere to recommended page limits.

Mistakes to avoid:

- Insertion of a title at the foot of a page with subsequent text on the next page.
- Separating a table, chart, or figure—confine each to a single page.
- Submitting a manuscript with pages out of sequence.
- In every section of your document, use standard writing style, including articles ("a" and "the").
- Keep paying attention to the topic of the paper.
- Use paragraphs to split each significant point (excluding the abstract).
- Align the primary line of each section.
- Present your points in sound order.
- Use present tense to report well-accepted matters.
- Use past tense to describe specific results.
- Do not use familiar wording; don't address the reviewer directly. Don't use slang or superlatives.
- Avoid use of extra pictures—include only those figures essential to presenting results.

Title page:

Choose a revealing title. It should be short and include the name(s) and address(es) of all authors. It should not have acronyms or abbreviations or exceed two printed lines.

Abstract: This summary should be two hundred words or less. It should clearly and briefly explain the key findings reported in the manuscript and must have precise statistics. It should not have acronyms or abbreviations. It should be logical in itself. Do not cite references at this point.

An abstract is a brief, distinct paragraph summary of finished work or work in development. In a minute or less, a reviewer can be taught the foundation behind the study, common approaches to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Use comprehensive sentences, and do not sacrifice readability for brevity; you can maintain it succinctly by phrasing sentences so that they provide more than a lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study with the subsequent elements in any summary. Try to limit the initial two items to no more than one line each.

Reason for writing the article—theory, overall issue, purpose.

- Fundamental goal.
- To-the-point depiction of the research.
- Consequences, including definite statistics—if the consequences are quantitative in nature, account for this; results of any numerical analysis should be reported. Significant conclusions or questions that emerge from the research.

Approach:

- o Single section and succinct.
- o An outline of the job done is always written in past tense.
- o Concentrate on shortening results—limit background information to a verdict or two.
- o Exact spelling, clarity of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else.

Introduction:

The introduction should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable of comprehending and calculating the purpose of your study without having to refer to other works. The basis for the study should be offered. Give the most important references, but avoid making a comprehensive appraisal of the topic. Describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will give no attention to your results. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here.

The following approach can create a valuable beginning:

- Explain the value (significance) of the study.
- Defend the model—why did you employ this particular system or method? What is its compensation? Remark upon its appropriateness from an abstract point of view as well as pointing out sensible reasons for using it.
- Present a justification. State your particular theory(-ies) or aim(s), and describe the logic that led you to choose them.
- Briefly explain the study's tentative purpose and how it meets the declared objectives.

Approach:

Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done. Sort out your thoughts; manufacture one key point for every section. If you make the four points listed above, you will need at least four paragraphs. Present surrounding information only when it is necessary to support a situation. The reviewer does not desire to read everything you know about a topic. Shape the theory specifically—do not take a broad view.

As always, give awareness to spelling, simplicity, and correctness of sentences and phrases.

Procedures (methods and materials):

This part is supposed to be the easiest to carve if you have good skills. A soundly written procedures segment allows a capable scientist to replicate your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order, but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt to give the least amount of information that would permit another capable scientist to replicate your outcome, but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section.

When a technique is used that has been well-described in another section, mention the specific item describing the way, but draw the basic principle while stating the situation. The purpose is to show all particular resources and broad procedures so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step-by-step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

Materials may be reported in part of a section or else they may be recognized along with your measures.

Methods:

- Report the method and not the particulars of each process that engaged the same methodology.
- Describe the method entirely.
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures.
- Simplify—detail how procedures were completed, not how they were performed on a particular day.
- If well-known procedures were used, account for the procedure by name, possibly with a reference, and that's all.

Approach:

It is embarrassing to use vigorous voice when documenting methods without using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result, when writing up the methods, most authors use third person passive voice.

Use standard style in this and every other part of the paper—avoid familiar lists, and use full sentences.

What to keep away from:

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings—save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part as entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Use statistics and tables, if suitable, to present consequences most efficiently.

You must clearly differentiate material which would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matters should not be submitted at all except if requested by the instructor.

Content:

- Sum up your conclusions in text and demonstrate them, if suitable, with figures and tables.
- In the manuscript, explain each of your consequences, and point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation of an exacting study.
- Explain results of control experiments and give remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or manuscript.

What to stay away from:

- Do not discuss or infer your outcome, report surrounding information, or try to explain anything.
- Do not include raw data or intermediate calculations in a research manuscript.
- Do not present similar data more than once.
- A manuscript should complement any figures or tables, not duplicate information.
- Never confuse figures with tables—there is a difference.

Approach:

As always, use past tense when you submit your results, and put the whole thing in a reasonable order.

Put figures and tables, appropriately numbered, in order at the end of the report.

If you desire, you may place your figures and tables properly within the text of your results section.

Figures and tables:

If you put figures and tables at the end of some details, make certain that they are visibly distinguished from any attached appendix materials, such as raw facts. Whatever the position, each table must be titled, numbered one after the other, and include a heading. All figures and tables must be divided from the text.

Discussion:

The discussion is expected to be the trickiest segment to write. A lot of papers submitted to the journal are discarded based on problems with the discussion. There is no rule for how long an argument should be.

Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implications of the study. The purpose here is to offer an understanding of your results and support all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of results should be fully described.

Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact, you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved the prospect, and let it drop at that. Make a decision as to whether each premise is supported or discarded or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."

Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work.

- You may propose future guidelines, such as how an experiment might be personalized to accomplish a new idea.
- Give details of all of your remarks as much as possible, focusing on mechanisms.
- Make a decision as to whether the tentative design sufficiently addressed the theory and whether or not it was correctly restricted. Try to present substitute explanations if they are sensible alternatives.
- One piece of research will not counter an overall question, so maintain the large picture in mind. Where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

When you refer to information, differentiate data generated by your own studies from other available information. Present work done by specific persons (including you) in past tense.

Describe generally acknowledged facts and main beliefs in present tense.

The Administration Rules

Administration Rules to Be Strictly Followed before Submitting Your Research Paper to Global Journals Inc.

Please read the following rules and regulations carefully before submitting your research paper to Global Journals Inc. to avoid rejection.

Segment draft and final research paper: You have to strictly follow the template of a research paper, failing which your paper may get rejected. You are expected to write each part of the paper wholly on your own. The peer reviewers need to identify your own perspective of the concepts in your own terms. Please do not extract straight from any other source, and do not rephrase someone else's analysis. Do not allow anyone else to proofread your manuscript.

Written material: You may discuss this with your guides and key sources. Do not copy anyone else's paper, even if this is only imitation, otherwise it will be rejected on the grounds of plagiarism, which is illegal. Various methods to avoid plagiarism are strictly applied by us to every paper, and, if found guilty, you may be blacklisted, which could affect your career adversely. To guard yourself and others from possible illegal use, please do not permit anyone to use or even read your paper and file.

Criterion for Grading a Research Paper (Compilation) by Global Journals

Please note that following table is only a Grading of "Paper Compilation" and not on "Performed/Stated Research" whose grading solely depends on Individual Assigned Peer Reviewer and Editorial Board Member. These can be available only on request and after decision of Paper. This report will be the property of Global Journals.

Topics	Grades		
	A-B	**C-D**	**E-F**
Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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