

KAPITZA

in Cambridge and Moscow

Life and letters of a Russian Physicist

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you are simply a wet. Don't get offended and don't get cross with me for telling the truth.

(I) To V.I. Mezhlauk

Moscow, 27 April 1936

Comrade Stetskaya told me that you were offended by my letter and that you want me to take back what I said. I am sorry you should react in this way since there was nothing wrong in what I wrote and I hadn't the least wish to offend you . . . You are the Government and I am a scientist, but we are both citizens of the Soviet Union and we both have the same aim in view - to make the country flourish. We both agree that socialism is the most powerful means of realizing this aim. You have more responsible and complex problems to deal with than mine as a scientist, but we must both be equally zealous in dealing with our problems. Do you agree? Therefore I must do all that depends on me for the success of my work. At present the builders with their disgusting inertia stand in the way and they must be made to keep to their schedule. I, personally, have exhausted all possibilities, to such an extent that Borisenko doesn't want to talk to me, but let him go to the the devil, I don't care.

Then I turned to you for help. I wrote to you in March that I'm at a dead end, then I spoke to you on 5 April, I wrote again on the 11th, spoke to you on the 17th, and wrote again on the 22nd, but the construction is at a standstill. On 25 April there were only five painters at work (though it's true there are 30 today). So of course I lost my temper and wrote that either you didn't want to or you couldn't make the builders work. As for the form of what I wrote, that's a matter of temperament. But, let me describe my psychological condition. On 27 March I was having a discussion with the engineers of the Autogenic Board and this brought home to me the importance for the country of the problem of obtaining oxygen from air and also that this problem is scientifically interesting and worth taking up, since theoretical considerations suggest that the separation could be achieved with a ten-fold economy of energy*. I have been working flat out on this problem for the last 12 days - till 4 or 5 in the morning each day, and at last

* This was the beginning of Kapitza's important and successful work on this problem, over the next 10 years or so.

I think I can see a possible solution which I am anxious to try out. Of course theoretical solutions are worthless and I may have made a mistake, so it is essential to start experiments as soon as possible. The technical drawings were ready in three days, the mechanics started work after another three days and the turbine should be almost ready to test by the end of the week . . . So if it weren't for these hundred-fold accursed builders I could start experiments by 11 May and find out if I am on the right road to solving the problem. After all, the builders could have easily finished the laboratory a month ago and then there would have been no hold-up . . . Am I not justified in saying that all this business with the builders is like hammering nails into a wall with a violin?

So to sum up, let me say that my only motive in writing to you was, as always, to promote the welfare of the Institute . . . You have helped us a great deal, which I greatly appreciate and I am ready to continue working as before. But if you think I am behaving improperly and that I should think only of being respectful and polite, that I mustn't say what I think or feel in the interests of politeness, then we shall not be able to work together. I shall not be myself and our affairs will go sluggishly. In that case, better let someone else help me – someone less important than yourself, but someone who won't be offended by what I say. You mentioned such a possibility to me yourself . . . In Cambridge, Rutherford also had a considerable temperament and when we couldn't agree on something I often heard such compliments as "silly ass" or "silly fool", but things quickly settled down because we were drawn together by our mutual interest in the scientific work and by mutual respect for each other. I think that my readiness to draw you into our scientific work and to work with you, indicates my relation to you better than anything else. If I didn't respect you I wouldn't behave in this way.

P.S. I should be very grateful if you could find it possible to discuss such matters with me without using Olga Alekseyevna [Stetskaya] as an intermediary. She takes it all very much to heart and gets upset. She is extremely helpful to me as Assistant Director and I don't want her upset, since this undermines her enthusiasm for the work.

During the summer of 1936 a virulent defamatory campaign was mounted in the Soviet press against the distinguished mathematician Academician N.N. Luzin, and Kapitza (at the time on holiday in the country) wrote a vigorous letter of protest to V.M. Molotov, then Chairman of the Sovnarkom (Council of the People's Commissariat). Molotov returned the letter curtly annotated "Not needed; return to Citizen Kapitza".*

(G, 1) To V.M. Molotov

Zhukovka, 6 July 1936

The articles in *Pravda* about Luzin have perplexed, astonished and angered me and as a Soviet scientist I feel I must tell you what I think.

Luzin is accused of many things and I do not know if these accusations are justified, but even assuming they are completely sound, my reaction to the articles is still negative. I shall start with a few of the milder accusations against Luzin. He published his best work outside the Soviet Union. Many of our scientists do this, for two main reasons: (1) printing here is of poor quality as regards both paper and print. (2) by international custom priority is accorded (if at all) only if the work is published in French, German or English. If Luzin has published bad papers in the Soviet Union the fault lies with the editors of the Journal which accepted them. The complaint that he envied his students and that he sometimes treated them unfairly applies, alas, even to some of our most distinguished scientists.

Thus, there remains only one accusation against Luzin, a very serious one – that he concealed his anti-Soviet sentiments by flattery, though no serious crimes of any kind have been quoted. This raises a very important question of principle: how to deal with a scientist if he fails to respond morally to the demands of the age we live in. Newton, who gave mankind the law of gravitation was a religious fanatic. Cardan, who showed how to obtain the roots of a cubic equation and made important discoveries in mechanics was a debauchee and a libertine. What would you do with them if they lived here in the Soviet Union?

Suppose that someone close to you fell ill. Would you send for the

* This form of address rather than "Comrade" or "Professor" is intended as a snub, with its implication that Kapitza is not "one of us".

best doctor, even if his moral and political opinions were abhorrent to you? . . . I do not wish to defend Luzin's moral qualities but there is no doubt that he is our most important mathematician . . .

People like Luzin, who differ from us ideologically must first be given conditions allowing them to work in their scientific speciality without having any wide influence on society and, second, everything possible should be done to re-educate them in the spirit of the new age and thus make them into good Soviet citizens.

As regards the first point, the fact that Luzin was not a socialist was known to everyone in the Academy, and there are quite a few like him there. It wasn't an unexpected discovery by the Director of the 16th school, based merely on Luzin's flattering comments.* Nevertheless, he has been chosen to carry out a whole series of socially useful tasks, he has been invited to act as a referee, he has been entrusted with the leadership of the mathematical section of the Academy.

On the second point, has everything possible been done to re-educate Luzin and people like him in the Academy and can this be achieved by methods like the publication of the *Pravda* article? I am convinced that it cannot, indeed just the contrary – such methods make the re-education not only of Luzin, but that of many other scientists more difficult. How have you gone about reorganizing the Academy? First you began by electing Party members to the Academy and this would be the best method if there were distinguished scientists in the Party. However, leaving the social sciences on one side, the party members in the Academy are far less able than the old Academicians, so they have little authority.

We have not so far succeeded in producing new scientists from among our young people. I explain this by a very wrong attitude on your part towards science – much too narrowly utilitarian and insufficiently supportive. Therefore our main scientific capital is still the older generation which we have inherited. It would seem to follow that we should do all we can to re-educate them, to tame them and so on, but what you are doing totally fails to achieve this. Lazarev was arrested, Speransky was dismissed from the Academy and now Luzin is under attack. It's no wonder that this kind of "tender" treatment

* This refers to Luzin's visit to the school, following which he was criticized by the Director in a letter to *Pravda* for having given too uncritical and flattering an assessment of the school.

makes scientists like Uspensky, Chichibabin, Ipatiev and others run away. I know from my own experience how callously you can treat people . . .

What have you done to re-educate Luzin? Nothing. And what does this article in *Pravda* achieve? Either he will begin to dispense even more flattery or else he will have a nervous breakdown and cease his scientific work. You will only frighten him, nothing more. Dangerous enemies have to be frightened. But do you think Luzin is a danger to the Soviet Union? The new constitution is better than any other and it shows that the Soviet Union is quite strong enough not to be afraid of such as Luzin. And so, with all the agricultural achievements and political successes that the Soviet Union can claim, I do not understand why it should not be possible to re-educate any Academician, whoever he might be, provided he is given careful and individual attention. Think of Pavlov for instance, and there are not so many scientists of distinction among us to make this method impracticable.

From all these considerations I cannot understand the tactical idea behind the *Pravda* article and I see in it only a damaging step for our scientific work and for the Academy, since it neither re-educates our scientists nor increases their prestige in the country.

And I may add that Luzin's name is sufficiently well known in the West that an article like the one in question will not pass unnoticed. Thanks to its weak and unconvincing tone it may provoke the most varied and absurd comments.

In view of the damage to science in the Soviet Union that all this has caused I feel it to be my duty to write to you about it.

(1) To V.I. Mezhlauk
Strictly personal

Moscow, 25 December 1936

Much respected Valerii Ivanovich,

I want to give you something like a report for the year, since looking back we can better judge where we should go next. After all, there has been an element of collaboration between us and a striving for the same objectives, and no one in the Soviet Union knows my work more intimately than yourself.

First of all, the Institute and its living quarters are complete and we

had to devote a great deal of energy to achieve quality and speed – I think everything possible was done in this respect. In spite of everything, the builders were made to rise above their usual level. This was very difficult and without your constant support we should of course have been helpless. I consider that the laboratory has been built satisfactorily, the living quarters a bit better, and my own house well, although the reverse order of merit would have been preferable. But even so, it is good that the builders have shown that they have learnt something and are not absolutely hopeless.

The wiring and plumbing has gone very smoothly. The delivery of the English equipment has all gone well. Both the English and Soviet equipment is 90% installed and operating (all except the helium liquefier which was held up by a misunderstanding about tubes). On the whole . . . I should like to hope that in time you and I will come to be proud of this Institute and our efforts will not prove to have been wasted.

Now as regards people. The most successful has been the replacement of Olbert by O.A. [Olga Alekseyevna Stetskaya] and I particularly appreciate your support in arranging this. I thought that O.A. would be a good assistant, but she has turned out far better than I could have anticipated. She is an exceptionally good comrade and a first-class worker. It is only because of her persistence and endurance with respect to the builders that the Institute has acquired a reasonable shape. The electrical installation was entirely her responsibility and brilliantly carried out. She understands people well, she has raised discipline and manages the administration successfully. She is now taking part in the turbine work and is quite at home with scientific and technical problems. I think that I shall gradually be able to hand over all the technical aspects of the Institute's work to her. It is only thanks to her help that I am able to find time to work peacefully on my own problems. I should be very pleased and it would be entirely justified if you could on some suitable occasion give some kind of official recognition of her work.

As you know we are only gradually taking on scientific staff. At present there are four people and it is not intended that there should be many more. Scientific work started only in October so they have not yet had much chance to show what they can do. I am surprised at the lack of patience and inner discipline they have shown so far, but they do show enthusiasm which is a good thing. . . . But my chief concern

has been finding suitable technical staff – five electricians, eight mechanics, two carpenters and one glassblower. They will be the "human" foundation of the laboratory. The scientific workers will, and indeed should, pass through the lab but the technical staff should be permanent. They have to be taught how to handle equipment and how to make scientific apparatus with interest and understanding. On the whole I am pleased with them and the main thing is that they are enthusiastic. But they lack discipline, they waste a lot of time in discussion and are unable to take quick decisions and go straight to their objective by the shortest path. To organize and instruct so many people at the same time is not easy and takes a lot of time, for they have been taken from factories and elsewhere and are completely raw. Once the laboratory is growing normally and gradually, the education of the technical staff will look after itself, but here we have sixteen people all starting at the same time. However, as I had hoped, the help and example of my English assistants Laurmann and Pearson has proved very important. They have already been working for half a year and I hope it will be possible to prolong their stay here for at least another half year. They get on very well with the other staff . . .

I won't write in detail about our scientific work until next New Year – if something has been achieved by then. For the time being the most hopeful projects are the ones you have seen – the little turbine [for liquefying air], the new helium liquefier and the Zeeman effect [using the high magnetic fields]. But please bear in mind that none of these are finished yet and any of them may still run into a blind alley, either provided by Nature or by the limitations of our mental abilities, and so come to nothing.

As regards the administrative and economic life of the Institute, O.A. and I have been struggling to simplify the administration and reduce the number of staff. I am laying great hopes on the introduction of a new system of financial control and book-keeping: It has taken seven months for this to be born and it is only thanks to your support that it has been born at all, in the face of every effort by the People's Commissariat of Finance to produce an abortion. It gives me no pleasure to recall the considerable time I have had to spend in getting to the bottom of our financial procedures. I found it fiendishly boring and indeed it reminded me of my schooldays when I had to learn the catechism – another boring and formal subject of no scientific value. But without this effort the birth would not have happened . . .

But our system of supplies for science is scandalously bad. I first wrote to you about this on 15 November 1935 and since then I have written letters and memos to you, to Comrade Bauman and a particularly sharp letter to Pyatakov, all over two months or so and with absolutely no result. So far you have only promised, but essentially nothing has been done. This is very unsatisfactory and I feel rather like Don Quixote battling with windmills. For me as a scientist, the most important question at present is bringing order into the scientific economy. Apparatus and materials are just as necessary for a scientist as is a good instrument to play on for a musician. At present our scientists can be compared to a virtuoso pianist who is asked to play a broken down untuned piano with several strings missing. I must repeat that I am able to develop my scientific work, only thanks to Rutherford who sends everything I need. You cannot reproach me that I haven't achieved any significant improvements in the matter of scientific supplies, and it is you who should blush that we are still standing where we were 14 months ago . . .

So 1937 is almost upon us. Will you continue to help me as before? Without your help we shall get nowhere. And this too cannot be regarded as normal, since I know very well that your personal work for the whole country is exceptionally important and responsible and yet I have to bother you with all sorts of trifles due to the lack of organization of Soviet life. But if I do this, it is only because I imagine that you will be able to use the experience gained in our Institute to bring about a healthier organization of our scientific life. If in the course of a few years our science is indeed based on healthier foundations, and I can feel that I have contributed my mite, then all that I have lived through will have been worthwhile. This hope is the basic source of my energy. In the meantime I think I shall have sufficient strength and spiritual courage to see me through 1937 and I hope you will have sufficient patience. My greetings for the New Year.

In 1937 the mass arrests of the great purges were beginning to get into swing and Kapitza wrote to Mezhlauk, then Deputy Chairman of the Sovnarkom, and also to Stalin, to plead for the release of V.A. Fok, the distinguished theoretical physicist who had been unjustifiably arrested. Fok was in fact released quite soon afterwards, following a harangue from an official of the NKVD, who he later discovered was Ezhov, the notorious head of the NKVD.

(G, I) To V.I. Mezhlauk

Leningrad, 12 February 1937

While here in Leningrad, I was greatly disturbed by the news that the physicist V.A. Fok was arrested yesterday. I regard him as our most capable theoretical physicist; his work on approximate methods of integrating the wave equations of modern electrodynamics is considered classic. These methods are known everywhere today and are taught in courses for students. He is still young (38) and is quite cut off from ordinary life by almost total deafness. His whole life is a persistent struggle with scientific problems. I cannot conceive that such a person could commit a serious crime. There must have been some mistake.

It is said that he is indicted in connection with some serious sabotage which occurred as a result of careless evaluation of electrical exploration techniques in geological work. Fok provided certain theoretical formulae and it is, of course, possible that others used them improperly but it seems to me totally improbable that Fok deliberately gave an incorrect theory. Not because this could very easily be found out but because Fok is far too good a scientist to do such a thing. Don't you see, he is like a great musician who cannot strike a false note because it would grate on his own ears first of all. These considerations compel me to conclude with 99% certainty that the arrest of Fok is a mistake. And if this is so there will be a whole lot of very dismal consequences for Soviet science. It will distance our Soviet scientific circles still further from building socialism and may, moreover, undermine Fok's ability to work and so provoke a bad reaction from scientists here and in the West.

It is said that, besides Fok, very many other theoreticians were arrested a few months ago in connection with this same affair. In fact, so many were arrested that in the university faculty of mathematics and physics no one could be found to lecture to students. I hardly

know any of these people and not one of them is of the same calibre as Fok so I cannot feel as sure about them as I do about him. It is to be hoped that the investigations by the NKVD will show that the majority of them were not implicated in any criminal activities and in that case all those who were wrongly suspected will harbour a strong resentment. This will prevent our scientists from being, as you have put it, "won over". And what if they are proved guilty? This would be still worse, for there are so many of them that they must be called "enemies" rather than just "criminals". Most of them are still young and this implies that after twenty years the Soviet authorities have not yet understood how to win scientists over to their side, not even understood how to persuade them to be neutral but actually turned them into enemies.

I am afraid I am becoming quite fanatical in support of the ideas about which I have spoken and written so much to you. In order to "win over" scientists you have to provide them with conditions which they clearly see to be better here in our Soviet Union than in capitalist countries . . .

So why not bravely and energetically set about providing the right conditions? Surely this is a much simpler problem than those the Bolsheviks have already succeeded in solving. Only three things are necessary. First, eliminate the "rubbish" from scientific circles (improve the key personnel), second, create better scientific management and, third, create a healthy scientific community.

I am very greatly upset by Fok's arrest and torn apart by the fear that this is a crude and insufficiently considered action. It could cause great harm to our science. I am so worried that I have also written, very briefly of course, to Comrade Stalin about Fok. Otherwise I would feel that I had not done all I could to put right what seems to me a great mistake. You can be as angry as you like with me but I couldn't do anything else . . . Naturally, you take a wider view of the question and moreover you have all the facts available and greater experience. But still, it seems to me you should not be indifferent to what a scientist thinks about such questions.

(A, G, I) To J. V. Stalin
Leningrad, 12 February 1937
Comrade Stalin,

I heard yesterday of the arrest of Professor V. A. Fok, a corresponding member of the Academy of Sciences and considered both in the West and here to be an exceptionally strong scientist . . . In my opinion he is the most outstanding theoretical physicist in the Soviet Union . . . and I am extremely disturbed by his arrest . . .

Some years ago there were several cases of scientists being arrested, admittedly only for a few months, where it turned out later that they had done nothing wrong. If this should be the case with Fok it would be extremely sad since:

- (1) It would enlarge still further the gap between our scholars and the country - a gap which it would be so desirable to eliminate.
- (2) Fok's arrest is crude treatment of a scientist, which just like rough treatment of a machine, is bound to damage performance. And spoiling Fok's ability to work would seriously damage world science.
- (3) Such treatment of Fok is bound to provoke indignation both here and in the West, like that provoked when Einstein was driven out of Germany.
- (4) We have not got many scientists of Fok's calibre and Soviet science can be proud of him before the whole world - but this becomes difficult when he is thrown into prison.

I think no one but a fellow scientist can tell you about this and that's why I have written this letter.

(I) To V. I. Mezhlauk
Moscow, 22 February 1937

Today we have made liquid helium, so the laboratory can be regarded as finished. We are all very happy, I in particular, since I can take up my research again. Greetings!

(I) To J. V. Stalin
Moscow, 10 July 1937

The condition of science here is unsatisfactory. All the usual public statements that our science is better than anywhere else in the world

are just untrue. Such statements are bad not only because any lie is bad, but are even worse because they hamper the process of improving scientific life in our country. That the situation of science is bad, I can assert with some certainty, since I worked for a long time in England and both living and working there were much better than here. However, the purpose of this letter is not to praise the English or to tell you how good it was there, but to explain the basic causes for our weak position and how we should struggle to raise the level of science in the Soviet Union.

The most astonishing thing about the state of our science is of course that it is weaker than in the capitalist countries and its growth and development does not correspond at all to the tempo of our economic and cultural life. However, in spite of everything, I still believe that under socialism science should be at a higher level than anywhere under capitalism. It is impossible that it should be otherwise, since science is the basic motive power and index of progress. So what are the most prominent defects? The economic basis of science is bad; there is hardly any scientific industry; the economic organization of our scientific institutes is muddled and absurd; the multiplicity of jobs held by each scientist breaks up our scientific forces and makes poor use of them and there is absence of unity and integrity in scientific organization, etc., etc. So who is responsible for this situation and how can it be improved? There must of course be some basic cause which has to be discovered and eliminated.

The first and most natural explanation is that it is because of the absence of attention paid to science on the part of leading comrades in the Government. This is the opinion of many scientists but I do not share it. It's true that I often disagree with a whole lot of measures, especially those concerning individual scientists, and in spite of everything I then speak out. However, basically I think that the Party leaders and comrades in the Government have a sincere desire to put our scientific life in order and a genuine recognition of the significance of science.

The second explanation is that our scientists are no good and lack talent. This too is not so. Comparing our scientists with those abroad I consider that on the average ours are no worse. But what astonishes me most of all is that morale in our scientific community is bad and that there is no enthusiasm for work . . . Our scientists are not united and are separated from the life of the country. But worse than that,

they are not only not ashamed of their isolation, but assume a priestly attitude, regarding themselves as something superior and independent. The general mood is unhealthy - "everything should be done for us and we should work only at our science". Naturally in these conditions the position of our leading comrades [in Government] becomes somewhat difficult. How should they provide for such scientists? However clever the comrades in the Government may be, they cannot understand scientific work in detail nor can they decide which scientific researches should be supported more strongly than others and it is absurd to expect them to do so.

For instance in the organization of scientific work it is important to assess scientific workers and in normal conditions this is of course part of the business of a healthy scientific community - to point out who are the serious scientists and expose the charlatans. But this communal side of our work is unpleasant and since our scientists have no enthusiasm for raising the level of Soviet science, each of them selfishly tries to avoid such work and bothers only about his own work and life . . . In order to get recognition he looks for evaluation of his work not from his own comrades in the Soviet Union, but abroad, where there is indeed a real scientific community. And our scientists cannot be blamed for this since they have no other way. But this absurd and intolerable situation is only one more proof of the weakness of scientific life in the Soviet Union. It is in the absence of enthusiasm of our scientists for raising the level of Soviet science that we must seek the reason for the present sad state of science. If our scientists were to get together in a friendly way and try to achieve a healthier organization of science, things would change rapidly. If our scientists knew how to explain clearly what was essential for their work, I am sure their requests would be met better than in a capitalist country.

So why don't our scientists have the enthusiasm which there is for instance among the English scientists? Our scientists are cut off from contemporary life and that is the root of the evil. How to change this situation? The view I want to develop here may seem paradoxical to the majority of our scientists but I am more and more convinced that it is the only correct one. Scientific work is creative and modern scientific work is moreover collective. Every artist if he is to create with enthusiasm must feel that his work is recognized and understood.

Let us consider for instance the theatre in the Soviet Union which, without doubt, is the best in the world. Who created it and why has

it become the best? I think the reason is the innate love of our people for theatrical art. By appreciating good actors and directors they raise the level of the art and give it the enthusiasm of creative work. Our theatre is, of course, created by the audience rather than by the actors and this is the case with any creative work. Its level is established not by the theatrical workers but by those for whom they work. The main difference between our system and capitalism is that with us the audience is the whole mass of the people rather than the select class of wealthy people who are the judges of art under capitalism. That is why our theatre is developing so successfully – because it is an example of art for the wide masses.

In other areas of artistic creativity where the masses have not yet been drawn in, the situation with us is worse. Consider for instance painting – we are evidently weak in this respect. We cannot have wealthy patrons and meanwhile other means have not been discovered to make a connection between the artist and the masses, such that the artist could feel his work is appreciated. That is why pictorial art is so weak with us. The situation is the same for any area of creative work – it cannot develop unless it is consciously accepted by the masses.

The situation is just the same for scientific creativity. The masses are far removed from it and the scientists work on their own, the most important of them being mainly interested in the recognition they get in the West. They are not proud of their Soviet science because they don't appreciate for whom it is needed. And until at least the most cultured of the working and peasant classes recognize and welcome every achievement of our science, our scientists will remain an isolated little group, which may provide fertile soil for every kind of wrecking activity, and who will desert the Soviet Union when a convenient opportunity offers itself. What should be done? There are two possibilities – the first is to let things take their course and wait until the industrial hunger of the country has been satisfied and culture can rise so that interest in science and scientific creativity will appear.

The alternative solution – and in my opinion the only sound one – is to begin now to instil the masses with an interest for science. But in order to arouse this interest an energetic propaganda campaign must be initiated. I think that if an appreciable part of the money given to science were to be spent on such propaganda, it would be repaid in ten or fifteen years by a rise in the whole level of science in the Soviet Union. I'm afraid my scientist colleagues do not share my

opinion and that is why I am writing to you as leader of the Party, since it seems to me that you will better appreciate the correctness of my views. Of course there is a certain amount of propaganda for science, but it is very little and very weak, even by comparison with the West and I propose that it should become the centre of attention.

The problem is I think clear – we must educate the masses to have an interest in science and to appreciate its significance for progress. I don't think this should be difficult, since there is a large natural interest in science among the masses, which is no less than their interest in the theatre. This can be illustrated by many examples. How eagerly people listen to popular lectures, read popular articles, visit scientific exhibitions, etc. But this interest is far from being satisfied and we are not only far behind European countries in this respect but, even worse, the significance of this kind of propaganda is not sufficiently appreciated. A great deal of attention is given to scientific propaganda in the capitalist countries. It is particularly well developed in England . . . and to a certain extent this may explain the exceptionally high standard of science there.

In England special societies were already established 100 years ago for the popularisation of science, such as the Royal Institution and the British Association for the Advancement of Science. Its museums, such as the British Museum and the Science Museum in South Kensington, are the best in the world, and more space is devoted to science and scientific life in its Press than in any other country. This policy is due to a number of circumstances but the most important reason is that English science is and always has been supported by individual benefactors. In this way very large sums of money have been collected and evidently this is only possible if there is a broad interest in science in the country. With us of course the motive for scientific propaganda is different . . . but it is important for us to study critically how it is done in capitalist countries.

So what can be done here and what is being done? Let me list the main points:

(1) *Scientific museums.* Museums are the most powerful and graphic means of educating scientific interest and understanding in the masses. It is sufficient to point out that the single colossal Science Museum in New York has up to 14 million visitors a year, while just the technical department of the South Kensington Science Museum has two million visitors and so on . . . Here there are no museums of

comparable size. Our Academy of Sciences proposes to set up a number of such museums but only in 10 years' time. I am a member of its Museums Committee, but it is a very feeble committee. It does not accept the principle of museums being a means of mass education - I had a big disagreement with them on this point and was in a minority of one. At the general meeting of the Academy on 29 June a number of Academicians proposed that we should have nothing to do with a museum on the history of science and technology. I consider this attitude to museums incorrect and that on the contrary we must start setting them up in the Soviet Union energetically and without delay - we cannot afford to wait ten years.

I therefore proposed that the Academy of Sciences should straightaway organize exhibitions illustrating various scientific problems and in this way gain experience and exhibits, so that as soon as a museum building was complete its contents would be immediately available. I suggested that we should start with aviation since there is exceptional interest in it in the country. It would be a good idea if a building like the Manezh* were made available and the exhibition would show how science has helped aviation and how aviation has helped science. Later we could go on to transport, metallurgy and so on. At first this was approved by the Praesidium of the Academy and a provisional plan for the project was drawn up, but later the Praesidium decided that it could not set aside the 1½ million rubles needed and everything came to a standstill and there seems no prospect of any movement. However I consider that we should immediately devote funds and effort to this project.

(2) *Cinema*. This is the next most important means of scientific propaganda. I am a member of the committee of our cinema organization concerned with scientific films. Of its fifteen members only two attend its meetings. We have few scientific films, mostly for teaching, and usually of rather mediocre quality - they do not reach the screens of the cinema for the public. Although in England almost every cinema shows short films of a scientific, technological or ethnographic character in addition to the main drama features, we have nothing at all of this kind. Moreover in London there is a special cinema which

* This is a large building adjacent to the Kremlin. Manezh is the Russian equivalent of the French manège, a riding school. This building, erected in 1817, is, in fact, often used for large exhibitions.

shows only scientific films and again we have nothing of this kind. This powerful means of scientific propaganda is not exploited at all with us and here too we must move away from our 'dead point'.

(3) *Popular literature and lectures*. We are weak in this respect too and our popularisation of science is rather of the pot-boiler variety. The English example is very instructive here. I have already mentioned the Royal Institution whose object is to organise popular lectures and courses both for adults and children. This is a large organisation and has its own large house in the centre of London. It is considered a great honour to be invited to lecture there and such lectures are better paid than anywhere else . . . The activity of the British Association is somewhat different - it organizes daily scientific meetings of a general kind during the holidays, which attract a wide audience from all layers of society. We have no organizations with similar aims.

(4) *Scientific journalism*. Our newspapers publish scientific material only incidentally and it is often completely garbled. Neither *Pravda* nor *Izvestiya* have a scientifically literate journalist who could put together an interview on a scientific theme independently. When I ask why this is so, I am told it is because there wouldn't be enough work for such a person. But I have met very good journalists of the leading English and American newspapers with whom it is both pleasant and interesting to talk, since they are well informed on scientific topics. However, our own newspapers are very poorly and inadequately informed about scientific life both here and abroad . . .

(5) No broad general scientific interest is inculcated at an early age into our children at school. I was amazed to discover this when I talked to teachers and lectured to children and I am clear that we are badly behind in this respect.

From this short review it is evident that we are very far behind in the matter of instilling scientific interest in the masses. There is a great deal to be done, and it should not be difficult if sufficient attention is devoted to the question. It seems evident that an interest in science by the masses is needed not only to provide the right atmosphere for scientific work but because of its colossal importance in other ways. It would give the possibility of selecting scientists from a much wider public, it would raise the awareness of workers and peasants in their work, it would encourage inventiveness and so on. I am sure that if it were possible to raise the interest of the masses in science, it would arouse enthusiasm among the scientists for their own work. They

would become a part of the country and would be proud of their Soviet science. They would take a hand themselves in the organization of science and get over our organizational disease. The Government in its direction of science would have to pull on the reins, as with a good racehorse, rather than having to lay on the whip as at present . . . So we must take up this work energetically to accelerate the process or else we shall not have a healthy science, and this would mean that we could not go forward independently in technology, agriculture, etc. Without a properly developed science we shall be restricted to a purely imitative role in our technical development for far longer than is necessary.

(I) To V. I. Mezhlauk

Moscow, 19 November 1937

There are a number of journals such as *Nature*, *La Science et la Vie* and others, which publish all that is new in science and the scientific world. These journals are very important for us since they publish all the latest discoveries briefly and rapidly, so that they appear well before the full accounts in the large scientific journals. They also report on all conferences, meetings and discussions. For the last two months these journals have ceased to reach us. I made enquiries and was told that they were held up by the censorship. But last week when I was in Leningrad I found that the censor there was a more reasonable person and all the journals had got through. That the journals should be held up at all is in itself a shame but it's even worse that it is done in such an absurd way. I read through the relevant issues in Leningrad to discover why the censor had held them up, but I didn't find it an easy task.

For instance in one issue it mentions that there was a total absence of Soviet scientific delegates at a congress in Paris organized on the occasion of the World Fair. What is there in that to forbid the journal coming through? We all know that we are like schoolgirls who are kept in secluded boarding schools so that they cannot be deprived of their virtue or abducted. In another issue there was an account of the discussions between [N. I.] Vavilov and Lysenko, based on shorthand records published in the Soviet Union. I enclose a translation of their account and as you can see there is some unfriendly comment, but what is remarkable about that? And why hide it from Soviet scientists? . . .

I should like to say a few words about Lysenko's dispute with Vavilov. In my view every dispute and discussion in science, however far apart the opinions of the two sides may be, provides an extremely useful stimulus. For after all what is science but a generalization of experimental results? The experimental material, like Nature itself, is immutable for all time, provided it is correct, but the theoretical generalizations change gradually as new experimental material becomes available. Thus any theoretical edifice will eventually change, however sturdily it is built. Usually scientific disputes are about theories, but what is important is that a dispute should be based on experimental material. Only then is the dispute productive.

Our discussions, however, have started to use methods which are not only absurd, but harmful. This is shown not only in the disputes of the geneticists but also in physics - as in the scientifically illiterate article by A. A. Maksimov*, and in history as, for instance, in a criticism published in *Pravda*, of Tarié's book on Napoleon. Schematically, the argument goes as follows. If you are not a Darwinist in biology, a Materialist in physics, or a Marxist in history, then you are an 'enemy of the people'. This argument sticks in the throats of 99% of our scientists. Of course such methods of dispute are not only harmful for science but compromise such strong theoretical edifices as Darwinism, Materialism and Marxism. What should be said to the scientists in dispute is that they should base their arguments on the force of their scientific knowledge rather than the forces of Comrade Ezhov [the then head of the NKVD, the secret police] . . . Greetings.

As recounted earlier (p. 67), the outstanding theoretical physicist L. D. Landau (see fig. 35) was arrested in April 1938 and Kapitza wrote immediately to Stalin (see next letter) and nearly a year later to Molotov pleading for his release. Landau was released soon after the second letter, subject to the guarantee given by Kapitza in a brief formal letter to L. P. Beria, then head of the NKVD (the secret police).

* This was a polemical article in No 7 *Under the Banner of Marxism* on "The philosophical views of Academician V. F. Mitkevich".