A. M. D. G.

BULLETIN

of the

American Association of Jesuit Scientists

Eastern States Division

(Founded 1922)

(for private circulation)

★

Published at

BOSTON COLLEGE

Chestnut Hill, Massachusetts

Vol. XXXII **MAY, 1955** **No. 4**

Contents

Bulletin of the American Association of Jesuit Scientists

EASTERN STATES DIVISION

VOL. XXXII MAY, 1955 NO. 4

OFFICERS OF THE ASSOCIATION

NOTICE TO AUTHORS

Manuscripts are to be submitted to associate editors of the appropriate section and *may* be submitted directly to the editor in chief. Clear manuscript, preferably typed, with wide margin to the left, with double spacing between lines, is desirable. Please try to follow the typographical style of the most recent issue of the Bulletin. Line drawings should be submitted on Bristol board, or similar material, and done in India ink. Figure number should be written on this in pencil. Titles for drawings, with figure numbers, should be typed on a separate sheet. Please try to minimize footnotes. Appended references and bibliographies, clearly so marked, should be done in the style of the A.A.A.S. publication, *Science*.

Physics

THE COLLECTIVE MODEL OF THE NUCLEUS*

WILLIAM G. GUINDON, S.J.

I. INTRODUCTION

The central problem in nuclear theory is the problem of nuclear forces—the forces which hold the neutrons and protons together. The proton, as you know, is the nucleus of the ordinary hydrogen atom and the neutron is very similar except that it has no electrical charge. There are various ways of attack on the nuclear force problem. We may study the static properties of nuclei, or bombard nuclei, or study the radiations which are emitted by nuclei. After we have a collection of facts, and today we have a tremendous mountain of disparate facts, we have to construct a theory to fit them. We make an arbitrary "model" with just enough mathematical complexity to fit the data. Fundamentally, the physicist hopes to explain all the data with a very simple model but he is forever being deluded in this hope.

II. NUCLEAR MODELS

a. Fundamental Ideas

The first thing which is noted about nuclei is that only certain combinations of neutrons and protons are observed to exist in matter. These can be displayed upon a simple graph (Fig. 1) on which it is seen that the combinations which are most likely, and therefore found in matter, are those in which the numbers of neutrons and of protons are about the same. That explains why the graph is mostly a line 45° upward to the right; the fact that the line becomes steeper towards the right end can be explained by the fact that there are now so many electrical charges that the protons repel each other and need more neutrons to hold the mass together.

A vast amount of detailed information has been collected concerning the mass of the various nuclei, their spin or angular momentum, their magnetic moments and their electrical quadrupole moments. Because the nucleus is electrically charged and spins on its own axis

* From a lecture presented by the author at the Science Colloquium at Weston College, Friday, February 18, 1955.

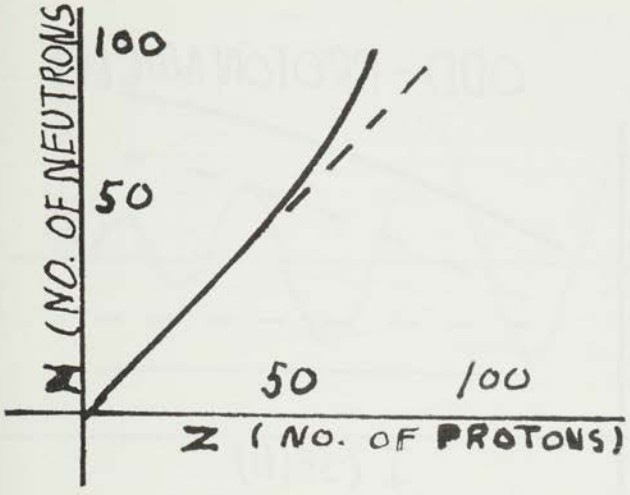

FIG 1 - NATURALLY OCCURRING NUCLEI

it acts like a small loop of electrical current; since a small current loop has the same magnetic effect as a small bar magnet it is reasonable that the nucleus displays a magnetic moment. Many nuclei are not spherical but flattened out like an onion or stretched out like a cigar. The amount of this deformation is what we mean by electrical quadrupole moment, positive for long shapes and negative for flat shapes. We also have a large amount of information concerning the type of radiations (particles and high energy x-rays) which come out of excited nuclei. We also know how rapidly nuclei decay.

The leads which regularities in the above mentioned properties furnish to the theoretical physicist are very significant. First of all, the shape of the line in Fig. 1 shows that the forces between neutron and proton, between neutron and neutron, and between proton and proton are all about alike. Secondly, a careful study of the tightness with which the various combinations of neutrons and protons are bound together show that certain numbers of neutrons and protons are more closely bound than others. These "magic numbers", 2, 8, 20, 28, 50, 82 and 126, being similar to the numbers of electrons in closed atomic shells, suggest that the neutrons and protons fit into various shells in the nucleus. When we have just this number of neutrons or protons a shell is closed and very tightly so. The next neutron or proton will be only loosely bound to the inner shell, much

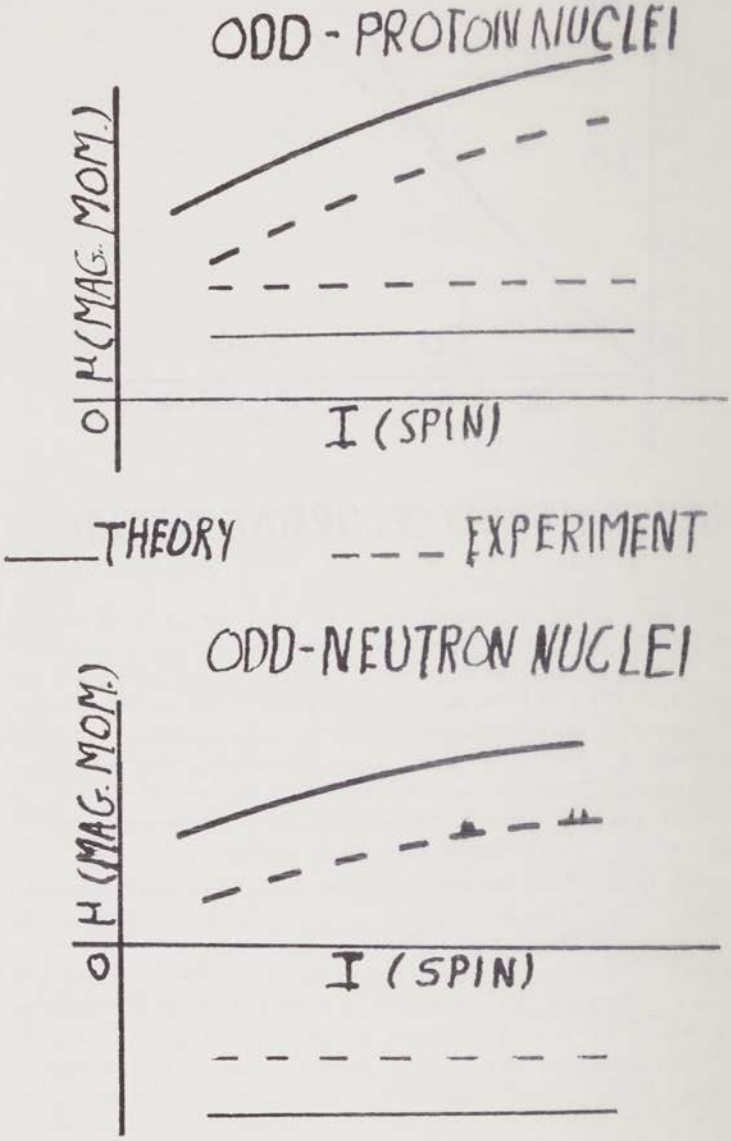

FIG 2 - SPIN AND MAGNETIC MOMENT

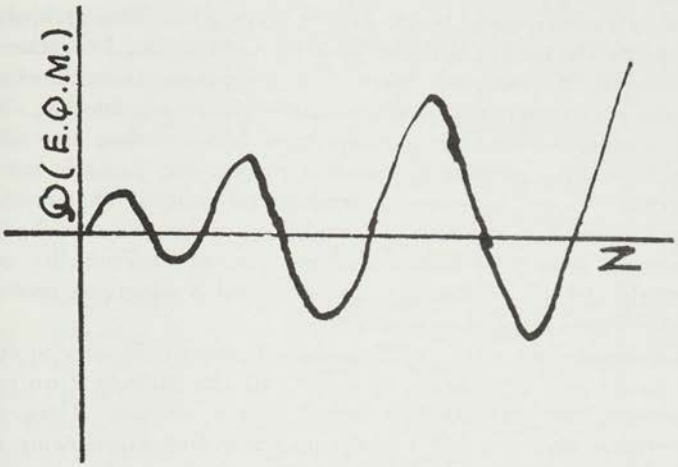

FIG 3 - ELECTRIC QUADRUPOLE MOMENTS

as an electron outside a completed atomic shell. Thirdly, there are some interesting correlations between observed properties of nuclei. For instance (Fig. 2), if we plot magnetic moments against spin for all nuclei with an odd number of protons or an odd number of neutrons we find that we have in each case two more or less well-defined lines. This will prove to be an interesting hint to the theoretical physicist. Finally, if we plot (Fig. 3) the quadrupole moments as a function of the number of protons we find a very wavy curve which always manages to cross the axis on the way down right at a magic number, being positive just before a shell closes and negative just afterwards. This also is an interesting hint.

b. Simple Models

The notion of a nuclear model is a simple one. Some people define it as the sum of all the assumptions which are made concerning the force between nuclear particles. Of course, one tries to make the assumptions as simple as possible so that one can make calculations easily. The only proof that a model is a good one is in the results. If calculations using the model agree with the measurements made in experiments the model is satisfactory. If it goes further and predicts new, unsuspected effects then it is not merely good, but fertile; it provides an increase in the knowledge of the nucleus.

We will consider three simple models. They are simple because

the data is so numerous and the problem so complicated that anything but a simple model would be too hard to work with. The liquid-drop model treats the nuclear particles as being tightly bound together as the molecules of a drop of water. The independent particle model treats the nuclear particles as almost unaffected by one another. The so-called collective model is a compromise between these two ideas in which we have partially independent motion and partially strong interactions. Given the current international political climate it is not hard to see how the first two models are sometimes described as the extreme collectivist model and the extreme individualist one, respectively. In this terminology the last model is sometimes referred to as the "creeping socialism" model.

The liquid-drop model, which is applied successfully only to very heavy nuclei such as uranium, considers that the particles (neutrons and protons) are very strongly bound to one another. Thus, the whole nuclear mass acts like a miniature water drop experiencing effects analogous to those of inter-molecular forces, surface tension, vibrations, etc. This model, in the hands of Bohr and Wheeler, explained most of the aspects of the fission process. They were unable, however, to explain why it is so unlikely that a fission nucleus will split into two exactly equal parts; in other words, the asymmetry of fission is not explained by this model (or by any other, incidentally).

The independent-particle model assumes an imaginary center of attraction in the field of which all the nucleons (neutrons and protons) move. Since there is nothing in the nucleus but neutrons and protons, there is no obvious source of this attraction other than the neutrons and protons themselves. The success of the model, however, justifies the assumption of such an attraction. Once the attraction—or in the language of the physicist, the potential—has been set up, it is easy to find how to put the nucleus together out of neutrons and protons. Only certain energies are allowed; only limited numbers of neutrons and/or protons can have these energies and so on. It turns out that this model leads to a shell structure in the nucleus, shells closing just at the magic numbers. This is one of the chief successes of this model which was developed almost simultaneously by Jensen and by Mrs. Mayer. Among the other successes of the model is the fact that it can be correlated with nuclear magnetic moments and quadrupole moments. Its first disadvantage is that the predictions it makes for magnetic moments do not agree exactly with the measured values. This can be seen in Fig. 2. Secondly, while the ups and downs of Fig. 3 come at the precise places at which this model predicts them, the size of the humps in the quadrupole moment curve is very much larger than follows from the theory.

The collective model is really only a minor variation of the independent-particle one, adding in just enough interaction between particles to fit experimental observations like the quadrupole moments. If these can be explained by a group of particles moving in concert, then the collective model is useful. It turns out that such an assumption does predict the large quadrupole moments which have been found in experiment and also gives information concerning the radiations which come out of nuclei.

c. Independent Particle Model

We are going to give the Mayer-Jensen type of model—also called the "spin-orbit coupling" model. Let us draw the allowed energy levels for this type of model. Quantum mechanics shows that only these values of energy, which are shown very schematically in Fig. 4, are allowed. They are all negative, that is, one has to put in a positive amount of energy to pull the particle out of the nucleus. Each level is specified by a "quantum number" n. For each n there are several values of angular momentum. The orbital momentum (like that of a stone whirled at the end of a string) is given by number l. Each nuclear particle spins on its own axis with spin momentum equal to one-half. Since this spin can be either parallel or anti-parallel to the orbital motion, j, the quantum number for total angular momentum, can only take on the values $l + \frac{1}{2}$ or $l - \frac{1}{2}$. n takes on the values 1, 2, 3 . . . , l takes on the values 0, 1, 2 . . . , n — 2, n — 1. To make a long story short we can put into a nucleus $2j + 1$ neutrons which have the same n, l and j; we can do the same thing for the protons. That means that there is only a limited number of particles which we may put on any one level.

Suppose we draw two different versions of Fig. 4, one for protons, the other for neutrons, and start putting the particles in one at a time, starting from the bottom. This is, of course, reasonable, since they always seek the lowest unoccupied energy level. When we do this, we see that the magic numbers come out of the model easily; when a level (or group of close levels) is completed we have put in just one of the magic numbers of that kind of particle. Furthermore, magnetic moments and the rough features of the quadrupole moments also appear naturally. Further study would show the connection between excited nuclear states (one of the particles in a higher level) and the energy and life-times of nuclear radiations.

Of course, as we mentioned before, the quadrupole moments are much too small. Also, some of the radiations from excited nuclear states are much, much too rapid.

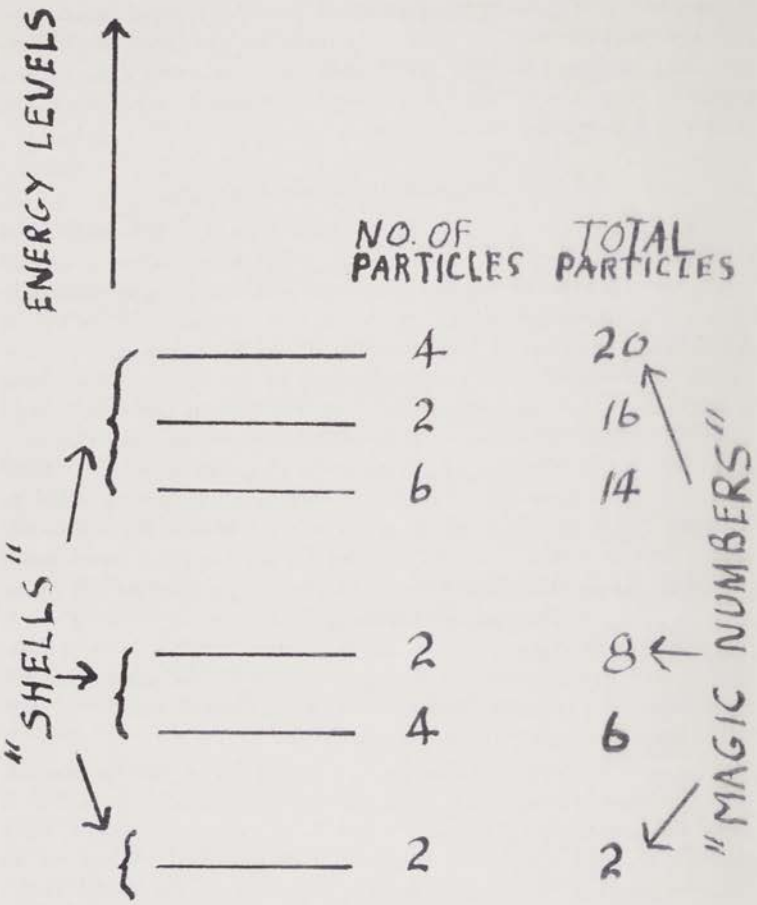

FIG. 4. SPIN-ORBIT LEVELS

d. Collective Model

This model is not completely different from the one we have just been discussing. Actually, it grew out of the difficulty with quadrupole moments. The fact that these are large, among other things, suggests that the inner completed shells of nucleons are not spherical but distorted by the few outer particles. This, of course, means that the particles are not, strictly speaking, independent.

There is a whole class of excited nuclear levels which have been called by Bohr rotational levels which decay (radiate) too fast for the independent model, but yet are not high enough to indicate a rotation of the whole nucleus. The fact that these levels are rotational, that is, correspond to the nucleus spinning, is shown by their spacing. The formulae for the spacing of rotational levels always contain the moment of inertia of the rotating object in the denominator. If we put in the moment of inertia of the whole nucleus the level spacing is too small. This suggested to Bohr that only part of the nucleus rotates and not the whole of it. Starting from this hint he developed the theory of coupled motion of particles within the nucleus. If a few particles oscillate back and forth in key positions in the nucleus with exactly the right timing it will look as though a ripple rolls around on the outside; thus (and Bohr has published many calculations to back this up) we have equivalently rotation of something less than the whole nucleus.

III. Conclusion

It will not be very surprising to say at this point that the whole story on the structure of the nucleus has not been written yet. There are many aspects which can be studied in many of the models today—for instance, the detailed calculation of magnetic moments and quadrupole moments in the Collective Model, etc. Secondly, we still have to discover that "simple" law of inter-nuclear forces which will explain all the things we have been discussing, including why these simple models fit the data even imperfectly.

SPECTROCHEMICAL ANALYSIS OF SOLUTIONS

JOSEPH F. MACDONNELL, S.J. AND ROBERT F. O'BRIEN, S.J.

In ordinary spectrochemical analysis the source of emission must be in the gaseous state, such as in the Geissler tube, or in a solid state, as in the arc or spark source. The Todd Scientific Company[1] is selling an instrument, called the Todd Spectranal, which is capable of spectroanalysing metallic ions in solution. The following information was obtained by experimentation based on the information published in bulletins advertising the instrument. It summarizes the results of an attempt to test the practicality of this commercial unit to qualitatively analyse metallic solutions.

Except for the spectroscope, the apparatus is not costly, nor is its construction complicated. For the excitation, two fine platinum wires are passed through a two-hole stopper and fixed in a test tube one-quarter filled with a solution of the sample dissolved in six normal nitric acid. One electrode is three centimeters below the solution's surface, while the other (excitation) electrode is only three millimeter below the surface. The electrodes are connected to a variac which is connected to a 110 volt A.C. source. The test tube is put in a beaker of water to prevent being overheated, and then placed before the slit of the spectroscope. It is important to keep the excitation electrode aligned with the slit, and as close as possible to the sides of the beaker and tube for maximum visibility.

When the current is applied the excitation electrode will emit a sort of fluctuating arc which causes an emission line spectrum observable by means of an ordinary spectroscope. The spectrum is that of the unknown metallic ion in solution, in addition to the characteristic red line of hydrogen. This line (5477 Å) is used as a reference line for correlating the readings of the arbitrary scale of the spectroscope to the wave lengths of the spectral lines. Since the excitation is not strong, only a few of the most persistent principal lines will appear. These lines are listed for fifty-five metallic elements in *Bulletin 140, Todd Spectranal.*[2] An element may be identified by a characteristic combination of three or four lines found on the list.

The operation of the Spectranal requires only small quantities of the sample, and the procedure is relatively simple and can be performed rapidly. There are, however, several disadvantages to this process. The spectrum is faint and fluctuating, hence difficult to observe. The intensity of the light can be strengthened only by in-

[1] Todd Scientific Company, Springfield, Pa.

[2] Published by the Todd Scientific Co., 1953.

creasing the voltage, but this causes the electrodes to become heated and to burn out faster and causes the solution to evaporate more rapidly. In a more recent model of the Spectranal, heat has been eliminated to some extent by a more elaborate cooling process. In the light of these advantages and disadvantages the success of the Spectranal in industry may be limited, but it would seem to be of some value for demonstrations in school laboratories.

Biology

EFFECTS OF ADRENAL EXTRACTS ON HEMOPOIESIS IN THE KIDNEY OF THE TADPOLE OF *RANA PIPIENS* WITH SPECIAL EMPHASIS ON THE EOSINOPHILS*

ROCH G. BELMONTE, S.J.

It has been recognized for some time that the endocrine glands exert an influence on the process of hemopoiesis, but until recently research in this field had been confined almost exclusively to mammals. Results of the first investigation on the hemopoietic response of the adult frog, *Rana pipiens*, to various endocrine factors were reported in 1948. The investigators concluded that a relationship between the endocrine system and blood-cell formation in the adult frog appeared to be established.

The purpose of the present investigation was to ascertain the effects of cortisone, cortisone acetate, ephedrine sulphate and epinephrine bitartrate on the process of hemopoiesis in the kidney of the tadpole of *Rana pipiens* with special reference to the eosinophils. It was hoped that further information might be obtained on the role played by the endocrines in relation to blood-cell formation in cold-blooded animals. The emphasis on eosinophil formation seemed warranted in view of recent findings indicating that eosinophils in the peripheral blood are sensitively affected by adrenal factors.

The tadpoles used in this study were reared from eggs obtained by induced ovulation according to the methods described by Rugh (1935). The tadpoles were approximately fifteen weeks old or in the

* Abstract of a dissertation submitted to the faculty of the Graduate School of Arts and Sciences of the Catholic Universiy of America in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

premetamorphic stages when the treatments began. Groups of fifty tadpoles were used in each experiment. One group was placed in an 0.01 percent solution of ephedrine sulphate. A second group was similarly treated in an 0.05 percent solution of epinephrine bitartrate. A third group was immersed in an 0.005 percent solution of cortisone.* A fourth group was injected on alternate days with 0.25 mg. of cortisone acetate. A control group received an equivalent injection of 1/100 cc. of the suspension medium which served as the vehicle in the commercial preparation of the cortisone acetate. A sixth group received no treatments.

Four tadpoles in each group were sacrificed every fourth day. They were simultaneously killed and fixed by immersion in Bouin's fluid. The kidneys were dissected out and imbedded in paraffin. All the sections were cut at 5 micra and stained in Giemsa following Lillie's (1941) modified technique. Blood counts were made with the aid of a Whipple grill, forty to fifty typical fields under oil immersion being used until approximately 5,000 cells were counted for each stage studied.

The normal hemopoietic activity of the mesonephros or tadpole kidney had not previously been described from a study of sectioned material and an attempt was made to do so in this study. The observations were limited to the mesonephros of the premetamorphic and early postmetamorphic tadpole.

The mesonephros consisted of a pair of relatively large, elongated, flattened bodies of irregular size, the right body almost invariably larger than the left. A longitudinal section through the mesonephros showed that it was a compact organ covered with a delicate capsular layer. The body of the organ contained a large number of tubules and glomeruli and was richly furnished with blood vessels. Although the hemopoietic tissue was present throughout the subcapsular and intertubular stroma, it was more abundant towards the ventral or coelomic surface and in the lateral margin of the kidney.

The blood-forming tissue of the mesonephros appeared to be granulopoietic. Neutrophils, eosinophils, monocytes, small and large hemoblasts (hemocytoblasts) were present in considerable numbers but there was a preponderance of neutrophils. In occasional areas irregular patches of small hemoblasts predominated, suggesting the splenic or lymph nodules of mammals. No thrombocytes were found and the few basophils observed were clearly in the blood vessels. Erythrocytes were present in large numbers but these appeared to be confined to

---

* The cortisone used in this study was generously supplied by Dr. Karl Pfister of Merck & Co., Inc.

the blood vessels and sinuses and to the capillaries making up the glomeruli. No evidence of erythropoiesis was observed outside the blood vessels or sinuses.

In determining the mitotic index of the hemopoietic tissue only those cells that were clearly dividing were included. The rate of cell division was found to be approximately one percent in any tissue examined. It appeared that fewer cells were in division in the coelomic and lateral margins of the tissue than in the deeper tissue. It is quite probable, therefore, that the blood cells multiply at a greater rate deeper in the tissue and between the tubules and then migrate to the coelomic and lateral margins of the kidney where they are stored.

No striking changes were noted in the growth pattern of the tadpoles during treatment with the various drugs. The treated tadpoles transformed at approximately the same time as the normal controls. A microscopic study of the hemopoietic tissue of the mesonephros revealed no significant alterations in its appearance; there was no apparent drainage of blood cells from the tissue nor was the hemopoietic capacity of this organ affected by the treatments.

Because it is practically impossible to identify all the types of blood cells from a study of sectioned material alone, a differential blood count was not attempted for each stage in the experiments. Such a count was limited to the mesonephroi of four-day treated animals and of twenty-four-day treated animals. For the remaining stages emphasis was placed on the eosinophilic cell count.

With two exceptions very little change was observed in the differential blood counts of animals treated with adrenal extracts for four days and of those treated for twenty-four days. The first variation was a relatively marked decrease in the number of neutrophils in the cortisone acetate-treated group. The second variation consisted of a noticeable increase in the percentage of large hemoblasts (hemocytoblasts) in those tadpoles treated for twenty-four days with cortisone acetate and in the corresponding cortisone acetate control group. Since the mechanism for the neutropenia in the cortisone acetate-treated group and for the increase in hemocytoblasts in both the cortisone acetate-treated tadpoles and the cortisone acetate controls was not established, the possibility must be considered that such responses were due to injuries sustained by the tadpoles through repeated injections.

Observations on the blood counts of eosinophils after treatment with adrenal extracts indicated that only cortisone acetate, and possibly cortisone, had any significant effect on the numbers of eosinophils in the tadpole kidney. The response to cortisone acetate was characterized by a decrease in the number of eosinophils and followed essentially the

pattern reported in the blood of cortisone acetate-treated rats. The eosinophilic cell level remained normal for the first eight days, then decreased gradually for the next twelve days and thereafter returned to normal.

The effect of cortisone on the hemopoietic tissue was less significant. There was a definite decrease in the number of eosinophils after twenty days treatment but the eosinopenia was limited to this one period. At the end of twenty-four days treatment the normal eosinophilic level had been restored.

Ephedrine sulphate and epinephrine bitartrate produced no noteworthy changes in the hemopoietic tissue of the mesonephros. The occasional, slight variations observed in the differential and in the eosinophilic blood counts were well within the range of normal variation that may be expected in a study involving blood cell counts.

Varia

SOVIET SCIENCE (*continued*)

KENNETH M. JUDGE, S.J.

PSYCHOLOGY

After 1936 when the Central Committee of the Communist Party issued a decree abolishing pedology[9] because of pedological misdemeanors against the Soviet child, psychology was made to serve pedagogy. Pedologists maintained that the psyche is determined once and for all by an "irrevocable heredity and a somehow immutable environment". This view proved to be too static for the dynamic Soviet state, which was evolving from the old to the new.

Throughout the twenties psychology withstood various attacks and remained non-Pavlovian until the joint session of the USSR Academy of Sciences and the USSR Academy of Medical Sciences (1950) declared Pavlov to be the guiding light of Russian pathology, physiology, and psychology. There were a number of conversions among the psychologists. Even Bykov, one of the apotheosizers of Pavlov, remarked, "Strange how many Pavlovians we now have among us". The new resolution scarcely effected psychology considering the fact

[9] Pedology is a form of educational and child psychology.

that it was not a major discipline in Russian science.[10] The Pavlovian Conference put a wet blanket on a good part of the original development that was being planned; psychologists have been afraid to commit themselves in print in any matter that is basic. There is good work being done in sensory interaction where the government has not greatly interfered. Even here however, psychologists are being alerted to the necessity of including references to Pavlov and the superiority of "native science".

Psychiatry

Theoretical psychiatry was hard hit by the Pavlovian recrudescense as well as psychology, a less important field than psychiatry because the latter has practical medical applications. Pavlov worked in psychiatry but his influence was not so strong in the science as it was in pathology and physiology until the Pavlovian Conference of 1950 previously referred to. His methods centered mainly about sleep and suggestive therapies which were called necessary to the practise of Soviet psychiatry. Lack of trained personnel, hospital space, and drugs limit these remedies at present.

Of the four therapies applicable under the Pavlovian system (physio-therapy, work therapy, psychotherapy and active therapy) the first three are used mainly for the elite and consist in chemical, electrical, and surgical intervention. Active therapy includes use of insulin shock and electroconvulsive treatments. Insulin shock therapy is more popular on the grounds that it is conformable to Pavlovian methods.

Mathematics

No other country except the United States surpasses the USSR in mathematics. Russia has had a rich tradition in the subject. Peter the Great and Catherine the Great brought the famous Bernoulli's, Nicholas and Daniel, and later through them, Leonhard Euler. Nicholas Lobatchewsky (1793-1856) was the genius who with the Hungarian mathematician, Bolyai, officially discovered non-Euclidean geometry. Another pillar of Soviet mathematics was Sophie Kowales, the first great woman mathematician. With the advent of the Revolution many noteworthy mathematicians left their native land for other countries.[11]

---

10 The future is none too bright for psychology either, if the number of graduate students in the science is any indication of its importance. At the University of Moscow, Russia's leading institute of higher learning, the number of graduate students in psychology was only twenty-five in 1951.

11 Tamarkin came to Dartmouth, then Brown; Shohat, to the University of Michigan and the University of Pennsylvania; and Upsensky, to Stanford.

The Soviet mathematicians are active in all fields and are unimpeded by politics. Indeed, it would be hard to see how there could be diverging party lines in mathematics. They are very strong in applied mathematics using deepest mathematical methods for various problems in physics and engineering.

Russian mathematical publications are extensive and up-to-date. Certain of these publications, for example on ballistics and aerodynamics, as well as atomic research periodicals, are restricted and unavailable outside Russia. The number of high-level books published allow the research man independent activity. Of course there has been the same intensely nationalistic coloring in mathematics as in the strict sciencies.

Outstanding contributions to mathematics have been made by Russian mathematicians. Urysohn, together with the Austrian, Karl Menger, founded the modern theory of dimensions. Pontriggin generalized the famous Brouwer-Alexander duality theorem for the most general equations. Another mathematician that deserves mention is Vinogradov for he showed that sufficiently large odd numbers are their sum of three odd primes. Probability and statistics were firmly established by Kolmogorov; also, Serge Bernstein's work on the theory of approximation and analysis is excellent.

In general it can be said that free from thought control, mathematics in Russia has produced fundamental results. Nevrtheless, there is extremely little personal contact with colleagues outside the USSR.

Social Sciences

The social sciences play a minor role in the Soviet. There are eight sections of the Soviet Academy: Chemistry, Physics and Mathematics, Geology and Geography, Biology, Technical (applied), History and Philosophy, Economics and Law, Literature and Language. As can be seen from this division the social sciences are not regarded as separated disciplines, yet work is being carried on in the field by philosophers and economists.

In 1946 the Central Committee, dissatisfied with the propagandist work of the Academy of Sciences set up its own Academy of Social Scientists which was charged with the functions of planning and statistical operations involved in governmental agencies.

The sloth of contemporary philosophers in not extending the philosophical tenets of Marx, Engels, Lenin, and Stalin, was scored by A. Zhdanov in 1947 when he addressed the Party's Central Committee: "Our philosophers have lagged behind. Apparently they have not taken note of the absence of principle and idea content in philosophical

work, of the neglect of present-day themes, the existence of servility and fawning before bourgeois philosophy".

History is of prime importance since Soviet social science is historically orientated. It is all pervasive and includes much of what we consider the social sciences. The main function of dialetical and materialistic historicism is to find further proof for the fundamental laws of society as proposed in Communistic philosophy. The static historical method employed to this end makes use of criteria that are rationalistic and pragmatic.

Conclusion

The life of a scientist under the Tsars was not a very comfortable one at times when it was necessary to battle for the freedom of scientific enquiry and teaching. But the leading thinkers of nineteenth century Russia had an unbounded enthusiasm for science; and therefore when the Tsarist regime would first grant privileges and then revoke them there would inevitably ensue a strong reaction to the government's attitude, especially among students. An important thing to note is that there was no interference with the subject matter of teaching or research in the Russian institutes of higher learning between the middle of the nineteenth century and the Revolution.[12]

No such freedom was realized under the Communists after the twenties. The economists were the first to be purged for "faulty evaluations of economic conditions and prospects" from 1929 to 1930. Next all fields of Russian life felt the lash of Stalin's policy of conformity in 1936-38. The geneticists were attacked in 1948 by A. Zhdanov.[13] Present-day patterns are easily changeable and the scientist in vogue today may wake up tomorrow to find himself unable to publish his work through loss of a job, slated for the concentration camp, or condemned to work on so-called "research on arctic problems".[14] These are the possible rewards of one who would thwart in the slightest way, the government's will for science.

This iron-fisted control of science will produce results that will be well nigh disastrous for some branches of science, particularly the social sciences and genetics. On the other hand, other branches have prospered and will prosper because of their lack of political implications.[15] This is true to a great extent of mathematics, chemistry, and physics. Certainly the technological knowledge needed for warfare is

12 Even Marxist doctrine was being taught at the University of St. Petersburg.

13 Also geologists, paleontologists, and geographists met with the same criticism.

14 The fate of N. I. Vavilov, the geneticist, who was the brother of the present President of the Academy.

15 The astronomers have done excellent work within the limits allowed them.

very adequate for years to come, and anyone who thinks that the Soviet military potential will suffer because of some atrophied sciences is sadly mistaken.

Bibliography

The following publications cover the research work being done in the various sciences:

"Current Digest of the Soviet Press." Published by the joint Committee of Slavic Studies appointed by the American Council of Learned Societies and the Social Science Research Council.

"Soviet Press Translations" published by the University of Washington for the Far Eastern and Russian Institute.

"Occasional Pamphlets" published by the Society for Freedom in Science.

"The Journal of Heredity, Science, and The Scientific Monthly," every now and then publish a translation of some particularly glaring example of the Russian distortion of science.

Other books treating of science in Russia are:

"Death of a Science in Russia", C. Zirkle. University of Pennsylvania Press, Philadelphia, 1949.

"Russian Medicine", W. H. Gantt. Hoeber, New York, 1937.

"Scientific Sessions on the Teaching of Pavlov", Foreign Language Publishing House, Moscow, 1951.

"Soviet Studies", University Glasgow.

"Soviet Psychiatry", Williams and Wilkins, Baltimore, 1950.

"Pavlov and His School", London.

"Conditioned Reflexes and Psychiatry", Translated by W. H. Gantt. International Publishers, New York, 1941.

"Soviet Education; Its Psychology and Philosophy", Philosophical Library, New York, 1947.

"Essays on Literature, Philosophy, and Music", International Publishers, New York, 1950.

"Freedom of Artistic Expression and Scientific Inquiry in Russia", The Annals of the Am. Academy of Political and Social Science, Vol. 200.

UNIVERSITY CHEMISTRY PROFESSORS AMONG JESUIT ALUMNI

BERNARD A. FIEKERS, S.J.

A recent special publication* of the American Chemical Society's Committee on Professional Training includes a listing of the faculties in chemistry at ninety American Universities which grant the doctorate in chemistry.

A reasonably careful perusal of this compilation revealed the Jesuit baccalaureate origin of fourteen of these academic chemists. The large Fordham staff claimed four of its own bachelor alumni and one from Georgetown. Catholic University lists one from Boston College and one from Regis; St. Louis claims one from Rockhurst; Carnegie Institute of Technology, one from Creighton; Cornell, one from St. Joseph's College in Philadelphia; Illinois Institute of Technology, one from the University of Detroit; Purdue University, one from Xavier; the University of Massachusetts, one from Holy Cross; and Yale University, one from Canisius College. Six assistant professorships are listed: five instructorships and three associate professorships. Not all of these hold the doctor's degree.

While the present study was not extended to include baccalaureate origins from Catholic universities in general, it was readily noticed in passing that the non-Jesuit Catholic institutions seemed to contribute fewer than fourteen and that the contributing Catholic institutions could be counted on one hand. One also finds in passing a number of master and doctorate alumni of "ours" who received their first academic degree elsewhere before coming to us for graduate work.

The fundamental data for the present survey have serious limitations too. Most of our alumni offices might be able to designate a much larger number of graduates engaged as academic chemists. But then the institutions which they may serve do not grant doctorates, or granting them, are not included in the ninety reported by the committee.

It seems to this contributor that we have a long row to hoe in placing the next generation of our alumni into eminent academic positions with such tremendous potential for good. The state universities, in the East at least, now expanding and obviously minded for

* Committee on Professional Training, American Chemical Society, "Faculties, Publications, and Doctoral Theses in Chemistry and Chemical Engineering at United States Universities, 1953." Special Publications Dept., American Chemical Society, 1155 Sixteenth St., N.W., Washington 6, D. C. 245 pp., $2.00.

proportional faculty representation according to race, color and creed, seem to offer a ground floor for our influence.

So much for the statistical approach. The ideal approach is to make our graduates as desirable as those from Haverford, Hamline and Oberlin; and if we insist that our own graduate schools get our best graduates, let our graduate degrees be consistently as impressive as any "ivy" or Mid-Western State doctorates. Our domestic difficulty over sending our best to our own schools, within the dictates of the candidate's own choice, can be overcome by increasing our production of scholars who have graduate calibre.

At any rate, annual faculty surveys of this type are to be expected in the future. It will be interesting to keep abreast of our progress.

News Items

PUBLICATIONS OF THE DEPARTMENT OF CHEMISTRY, 1950-1955

1-43. Jesuit Science Bulletin, *22*, 77-80 (1945).

44-61. Hormone, *16*, 69-70 (1950).

62. Kilmartin, E. J. and VanHook, A., Heats of Crystallization from Water Solution. Sugar, *45*, (10), (1950).

63. Turner, C. F., Galkowski, T. T., Radle, W. F. and VanHook, A., *Grain Formation* by Sonic Irradiation. Internat. Sugar J., *52*, 289-99 (1950).

64. VanHook, A., Size Distribution of Sugar Crystals. Proc. Am. Soc. Sugar Beet Technicians, *1950*, 576-6.

65. VanHook, A. and Biggins, W. F., Surface Tensions of Pure and Impure Sugar Solutions. Internat. Sugar J., *54*, 7-10 (1952).

66. VanHook, A., The Place of Viscosity in Sugar Boiling and Crystallization. Sugar J., *14* (8), 9-10 & 32 (Jan. 1952).

67. VanHook, A. and Kilmartin, E. J., The Surface Energy of Sucrose. Z. Elektrochemie, *56*, 302-5 (1952).

68. Himmelsbach, R. K., A Technique for Hot Filtrations. Chemist-Analyst, *41*, 35-8 (1952).

69. VanHook, A. and Frulla, F., Nucleation in Sucrose Solutions. Ind. Eng. Chem. *44*, 1305-8 (1952).

70. VanHook, A. and Reardon, E. J., Liesegang Rings on Metallic Bases. Nature, *171*, 177 (1953).

71. VanHook, A. and MacInnis, M. B., Graining by Sound. The Sugar J., *16*, (5), 20 (1953).

72. Martus, J. A. and Hovey, R. J., Study of a Series of Related Ligands with Specific Metals at Constant Ionic Strength at Different Temperatures. 20 pp., illustr., tables, (15 July 1953). Contract DA 19-020-ORD-1614. Listed in ASTIA Bull. no. U-28, Oct. 19, 1953. AD-14H367. Tech. Rept. no. 1.
73. VanHook, A., Sucrose Crystallization. SOCKER Handlingar II. (Malmö), *8* (6), 45-51 (1953).
74. VanHook, A. and Brodeur, E. A., Rate of Adjustment of Seeded Sucrose Solutions. Internat. Sugar J., *55*, 332-4 (1953).
75. Fiekers, B. A., Alternative Method for the Calculations of Indirect Gravimetry. J. Chem. Educ., *31*, 100-1 (1954).
76. Fiekers, B. A., Determination of the Density of Oxygen Gas. J. Chem. Educ., *31*, 139-40 (1954).
77. Martus, J. A., Hovey, R. J., Cullen, R. J. and others, Study of a Series of Related Ligands with Specific Metals at Constant Ionic Strength and at Three Different Temperatures. Tech. Rept. no. 2 (15 Jan. 1953-20 May 1954). AD 40-605. Contract DA-19-020-ORD-1614. 40 pp. illustr. and tables. Listed in ASTIA, Bull. no. U-63, 12 Nov. 1954.
78. Ibid., tech. rept. no. 3 (15 Jan. 1953-20 May 1954). 30 pp. illustr. and tables. AD 40-606.
79. Fiekers, B. A., The Chemist's "Magna Charta," Sci. Counselor, *18*, 11 & 28 (1955); A "Magna Charta" for the Chemist, Holy Cross Alumnus, *29* (2), 9 (Nov. 1954).
80. Fiekers, B. A., The Laws of Definite Composition and of Multiple Proportions, A Graphical Approach. J. Chem. Educ., *32*, 89-90 (1955).
81. VanHook, (W) Alexander, Constant Level Device for Water Baths. Chemist-Analyst, *44*, 26-7 (1955).

COLLEGE OF THE HOLY CROSS

Department of Chemistry

Recent curriculum changes include an advanced organic chemistry course for senior BS students in which elemental organic analysis (quantitative) is replaced by advanced organic preparations, while the qualitative organic analysis of the first semester is retained. Further the two and a half years of mathematics has been reduced to a two year course as is the ever increasing college practice in undergraduate training of chemists. The new curriculum still retains a full year of the calculus and a half year's introduction to differential equations. The half year slack was taken up for the first time this year in an added half year of electricity (physics), so as to provide a better practical introduction to the instruments of physical chemistry.

College was host to the Cen. Mass. Sec. of the Am. Chem. Soc. on November 8, 1954 at which Dr. Laurence J. *Heidt* of the Mass. Inst. Tech. spoke on the conversion of Sunlight into Chemical Energy. HEADLINES IN CHEMISTRY still permeates the air waves

at 645 Kc., WCHC, campus carrier station on the Hill, every Thursday evening, when basketball schedules do not conflict. Fr. *Fiekers* was appointed alternate national ACS councillor to fill unexpired terms during the autumn of 1954, and will commence a three year term as nat'l councillor on Jan. 1, 1955. The most recent material improvements in the department include the acquisition of an Abbe B & L Refractometer, model no. 56, and the fluorescent lighting of the smaller lecture amphitheatre (rm 17) of the department.

Holy Cross can now boast of its 36 alumni who are definitely known to hold the Ph.D. degree in chemistry: 23 of whom received the bachelor's degree here; 3 of whom are ex-men; and 10 hold the HC master's only; of the 23 who hold the bachelor's from here, 2 received the doctorate before 1936; 8, before 1946; and 15 since 1946 (Tryton report deadlines). Further, between 24 and 27 alumni are known to be working for the doctorate in chemistry at the present time. The list of their universities is too long to record—except to mention that since 1940 we have continually had at least one man at Clark Univ. in Worcester.

While the record is impressive, we are pessimistic about present enrollments in chemistry: until recent years about 25 freshmen were enrolled each year; this year, 15! This decline can be ascribed to many causes, local and national. Suffice it here to emphasize that it is part of a national pattern which set in a few years ago and is only being felt here now.