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27 June - 3 July 1971

By GEORGE A. HOTTLE

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The recent developments in structure and function of viruses and their components were discussed by about 1000 virologists.

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INTERNATIONAL VIROLOGY CONGRESS IN BUDAPEST
27 June-3 July 1971

The Second International Congress for Virology was held in Budapest, 27 June - 3 July 1971. It was organized by the Virology Section of the International Association of Microbiological Societies. Prof. Joseph L. Melnick (Baylor College of Medicine, Houston) is Chairman of the Virology Section and served as Secretary-General of the Congress. Local arrangements were organized by the Hungarian Society of Microbiology. In the three years since the first International Congress was held in Helsinki, a great amount of work has been carried out and new information on the structure and genetics of viruses has been developed. As witness to the accumulating knowledge in this branch of microbiology over 1000 scientists from 47 countries assembled to discuss recent work.

The natural hospitality of the Hungarian people was evident in many ways. A Welcome Party of gracious proportions with generous buffet was given for the participants on the eve of the Congress by the Minister of Health of Hungary, Dr. Zoltan Szabo. In addition, a similar buffet was provided by Professor Sari Ivanovics, Chairman of the Hungarian Host Committee in the Hungarian National Gallery at the termination of the Congress. Excellent transportation was provided for the scientists from their hotel residences to the Congress Hall, to various social functions and to and from the airport.

The scientific program was arranged with single morning sessions of general interest and multiple afternoon meetings for discussions of specialized aspects of virology for workers in these areas. The unusual nature of this Congress was the complete lack of any comprehensive lectures. Because of the large number of scientists who wanted to report the results of their work, the presentations were limited to 15-25 minutes in the general sessions and 10-15 minutes in the smaller gatherings. This meant that each speaker was forced to organize his dissertation carefully and to present only the new facts and interpretations. The result was an evolution of each meeting into an effective workshop in which active discussions developed.

There were some problems for the participants because of the lack of abstracts of the papers which were presented. The official program contained a listing and short abstract of each symposium and afternoon session with the names of the chairmen. A list of participants was also provided; however, it included only the nationalities but no addresses were given. Presumably, because this was a specialized group, the speakers were well known either personally or through their communications in virology journals. The poor quality of some slides was an indictment against a few speakers. It seems to this writer that so much has been

spoken and written about quality of slides that it is like the pollution problem, we all know about it, but nothing is done about it. With the short time allotted to each presenter, often slides were rapidly passed over and others with enormous amounts of data were used to illustrate a point relating to only a small portion of these data.

The symposia or plenary sessions, as the morning meetings were designated, covered the following areas:

1. Viral Nucleic Acids
2. Structure and Function of Viral Components
3. Replication of Viruses
4. Moving Frontiers in Medical Virology
5. Viruses Related to Cancer.

The afternoon sessions dealt with specific groups of viruses and specialized areas of virology such as: arboviruses (four sessions), Foot and Mouth Disease Virus (two sessions), Adenoviruses, Poxviruses, Small Isometric DNA viruses, DNA cancer viruses, RNA cancer viruses, Plant viruses (two sessions), Influenza and other respiratory viruses, Orthomyxoviruses and Paramyxoviruses, Human and Animal Enteroviruses, Herpesviruses, Slow Viruses, Hepatitis, Invertebrate Virology, Antiviral Effects, and Vector Transmission.

In the first morning symposium on Viral Nucleic Acids, P.G.N. Jeppesen, W. Fiers and M.A. Billeter discussed nucleotide sequences and protein synthesis in the RNA phages R17 and MS2. The MS2 RNA has a molecular weight of 1.1 million and contains 3500 nucleotides, 64% of which are involved in structural codons for three proteins. These are virus coat, protein A, and RNA polymerase. In the synthesis of the three proteins the translation ribosome starts at the 5' end of the RNA molecule.

J. Content in collaboration with P.H. Guesberg described the RNA-genome of influenza virus. By the use of acrylamide gel electrophoresis, it was found that purified virions contained six component pieces of single-stranded RNA with molecular weights varying between 200,000 and 700,000. Extracts of infected cells yielded six pieces of double-stranded RNA which on denaturation yielded single-stranded molecules identical with the RNA from purified virions. The finding that RNA of influenza virus occurs in a number of pieces may explain why, despite intensive efforts, it is so difficult to isolate infectious myxovirus RNA.

H. Graenkel-Conrat pointed out that RNA acts much like DNA in mutagenic work. Mutagenic agents such as hydroxylamine and methoxyamine react only with cytosine, forming uracil. The alteration of the base is the genetic change. This transformation has a double effect in an intact cell because it not only alters the template RNA strand but it may alter the messenger activity as well.

S. Spiegelman discussed problems encountered in finding viruses associated with human cancer. In animals, inbred strains of mice have shown that cancer can be easily induced by viruses. This is difficult in humans because there are not many groups where inbreeding has occurred. Such a special group of people have been found in India - the Parsees. They have lived in Bombay as a distinct group of people for 1200 years. Studies have shown that 50% of the Parsee women develop breast cancer. When the milk of healthy women was examined in the electron microscope, 40% showed particles like those seen in mice with high levels of breast cancer. Recently American women, from families where breast cancer had occurred, were examined, and 60% of them showed the same type of particles in their milk. This is the first instance where good data are found for virus association with human cancer.

The second morning symposium covered various topics on structure and function of viral components. P.W. Choppin of New York reported on studies with the myxoviruses: parainfluenza and influenza. It was found by using ferritin-labelled antibody that virus specific protein is inserted in the host cell membrane soon after the cell is infected. When nucleocapsids are formed, they are attracted to the area where the cell surface has changed. The capsid thus migrates out of the cell, acquiring its envelope from a portion of the altered cell surface. When mixed infections were produced with NDV and SV5 in the same cell, it was found that the NDV nucleocapsid combined only with its own membrane protein; however, it would acquire either SV5 spikes or NDV spikes. When structural proteins were studied, it was found that one of the six proteins found in influenza virus type C was smaller in infected cells than in the mature virion. It is apparent that work of this nature should be done with the strains of influenza virus which cause human disease. Then perhaps a protein or several proteins which would provide immunity to individuals could be prepared and used for vaccination.

The structural components of poxviruses and integration within lipoprotein envelopes of late proteins with four enzymic activities were described by S. Dales (USA). Biogenesis of viral proteins in the infected cell is induced only after new DNA has been formed. Four enzymes are formed: RNA polymerase, neutral (pH 7.0) DNase, acidic (pH 5.0) DNase and transcriptase. Translation starts six to eight hours after infection of the cell. The synthesis of virus specific antigens is then started. These are type A inclusions (Downy bodies) and the hemagglutinin.

Studies of reoviruses as reported by A.J. Shatkin (USA) showed that the RNA genome occurs as fragments of single-stranded and double-stranded RNA. With type 3 reovirus there are 10 fragments: four with molecular weights around 5×10^5, three with molecular weights of 1×10^6 and three in the two-million molecular weight range. These RNA segments

translate only seven proteins. It is not known why the 10 RNA molecules of the genome will transcribe for only seven proteins. It has been suggested that the remaining 3 RNA molecules are single stranded adenine-rich RNA that occurs in reovirus infected cells, but does not hybridize with reovirus RNA. There is no endonuclease activity in reoviruses.

Other work discussed was: Structural features of tubular viruses and virus-associated structures of Marburg virus, rabbit kidney vacuolating virus, and some plant viruses by R. Hull (UK); early and late virus-specific polyribosomes in myxovirus-infected cells by A.G. Bukrinskaya (USSR); and endonuclease activity of the penton component of adenovirus capsids and "mapping" of A-T rich regions of the DNA by W.H. Doerfler (USA).

In the third symposium session "Replication of Viruses," W.K. Joklik (USA) opened the discussion with a listing of 10 viruses showing the portions of the nucleic acid which are coded for structure and for regulation.

	Virus	Mol Wt of Nucleic Acid	Portion Coded for Structure	Portion Coded for Regulation
1.	adenovirus	23×10^6	6×10^6	17×10^6
2.	arbovirus	3×10^6	8.6×10^5	2.1×10^6
3.	herpes	100×10^6	9×10^6	91×10^6
4.	influenza**	3×10^6	3×10^6	0
5.	papova	4×10^6	2.7×10^6	1.3×10^6
6.	Picornavirus	2.6×10^6	1.0×10^6	1.6×10^6
7.	poxvirus	160×10^6	24×10^6	136×10^6
8.	reovirus*	15×10^6	10×10^6	5×10^6
9.	rhabdovirus	5×10^6	3.8×10^6	1.2×10^6
10.	tobacco mosaic	2.2×10^6	1.8×10^5	2.0×10^6

* The NA of this virus is in 10 segments
** The NA of this virus is in 6 segments

The above tabulation is helpful in determining some promising areas for future work. Obviously, more work needs to be done on the influenza virus to find the role of the genome in regulation of structure and function of the virus. Some of the results and deductions that have been made by previous workers should be verified.

Studies of poliovirus replication have shown that the RNA genome combines directly with ribosomes. The entire genome is translated into

one large polypeptide chain. Then the chain is cleaved to form the individual proteins needed in forming the virus.

In the replication of reovirus, the virion is broken down to a limited extent in the infected cell. The uncoated portion codes for enzymes which direct regulation. The remainder of the genome remains attached to the virus coat. Much information on the structure of the virus has been obtained from studies of temperature-sensitive mutants.

The replication of adenovirus was reviewed by H.S. Ginsberg (Philadelphia). The sequence of events is as follows: Infection is initiated by attachment of the virus to specific receptor sites. The virus particle is engulfed and a small portion of virus protein is removed. The partly uncoated virion is transported to the nucleus where the viral DNA is released and the transcription of m-RNA is begun at about three hours after infection. Early proteins essential for viral DNA synthesis are soon detected. At seven hours after infection viral DNA formation begins. After another three hours, capsid proteins appear. Mature virus starts appearing 14-15 hours after infection. Host DNA is switched off at the six-hour period after virion entry into the cell, and host RNA ceases functioning nine hours later. Only 10% of the DNA formed in the cell is packaged into virions. It is not known why the long delay occurs between uncoating and appearance of new viral DNA. There are two classes of m-RNA formed. Class I is early RNA, and is detected two to six hours after infection by labelling. It is switched off about six hours later. Class II is late m-RNA. It is different from early m-RNA, and continues to function throughout the entire period of infection.

The adenovirion has a particle weight of 175×10^6 with a viral DNA molecule of molecular weight of 23×10^6, a total molecular weight of capsid proteins (hexon, penton, and fiber) of 100×10^6 and proteins inside the virion with molecular weight of 50×10^6. Nine different polypeptides have been resolved by acrylamide gel electrophoresis of disrupted virions. Three are the capsid proteins listed above. Two minor proteins are associated with the hexons, and four are in the virus core associated with the DNA. Three of the latter are rich in arginine. Only 6% of viral-coded protein synthesized in the infected cell is incorporated into mature virions.

Some work with temperature-sensitive mutants has been done with adenovirus type 5. Several mutants were found which grow at 32° C but not at 39.5° C, as well as two mutants which did not grow at either temperature, but were complementary and did replicate when cells were infected with both together. The mutagen used in this work was hydroxylamine.

The replication of poxviruses was described by A. Kirn (Strasbourg, France). The vaccina virus genome has a molecular weight of 160×10^6 which should be able to code for about 400 average-size proteins. The virus contains about 5% DNA, 2% lipid, 2% phospholipid and the remainder is protein. Studies with virus subjected to gamma radiation have shown that only 20% of the genome is needed for infection and only 3% for DNA synthesis.

Soon after infection, virus particles are converted to viral cores. After a lag period the core is broken down. The lag occurs because an essential protein, the uncoating protein, must be synthesized before the second stage of uncoating can occur. There are two categories of virus-induced proteins: (1) early proteins, those formed within six hours; at least three enzymes (thymidine kinase, DNA polymerase and some nucleases) and three structural proteins: and (2) late proteins, those formed after eight hours' post-infection; about 30 structural proteins. Transcription of early messenger RNA starts soon after infection, reaches a maximum at one to two hours and declines within four hours. The peak of late m-RNA occurs between four and five hours and declines to a low level by 15 hours. Virus DNA replication starts at about two hours and is 90% complete by five hours. It has been estimated that the rate of viral DNA synthesis exceeds that of cellular DNA by five-fold. Thus a pool of viral DNA molecules is built inside the cell. Coating of the progeny DNA stands at about five hours. By the end of the replication cycle only 50% of the genomes have been incorporated into mature virions.

An interesting effect of arginine was seen. With a special strain of purified vaccinia virus (Lister Strain), growth was obtained in arginine-deprived cells but not in normal cells. It was found that arginine was not needed for early virus synthesis, but was required for late virus formation. It was also noted that when arginine was added to cells two hours after infection, a new surge of m-RNA was formed.

Presentations were also made covering recent experiments on the coupled DNA-dependent protein synthesizing system of phage T4 by J. Doskocil (Czechoslovakia) and the structure of the genomes of RNA phages by P.H. Hofschneider.

In a symposium on Moving Frontiers in Medical Virology a number of virologists brought the participants up-to-date on their work with viral infections in relation to disease in humans and animals.

M. Green (St. Louis) reported on his work of detection of viral RNA by hybridization with viral DNA. The basis of this work is the preparation of RNA from human cancer tissue and the attempt at hybridization with DNA from certain viruses which may be candidates for causing the cancer. This is a two-step process. The success of the hybridization is determined

by exposing the products from the first step to RNA which is specific for the viral DNA. If step 2 hybridization is prevented, the cancer contained RNA specific for selected virus. So far he has examined 141 tissues from 20 types of tumors with no success. He feels that a more sensitive test is needed. His studies have shown that all normal cells contain some DNA which hybridizes with viral RNA. This may confirm the Huebner theory of universal human infection with cancer viruses.

A discussion of the therapeutic possibilities for use of Interferon (In) and Interferon Inducers in cancer and virus diseases was given by I. Gresser of France. Although the mode of action of In is not known, it has prolonged the lives of mice infected with Ehrlich Ascites Tumor Cells. The In inducer poly I:C, has protected rabbits from rabies virus when administered as late as one day after infection. Many other substances will stimulate In formation. Contrary to the generally held belief, In will inhibit cell growth in culture when added at levels of 128 to 12,800 units per 0.2 ml.

In reviewing factors which affect infection of man and animals, N.B. Finter(England) cited antibody, cell-mediated immunity, reduced oxygen tension, change in body temperature and inhibitors such as interferon (In). That there is a close link between immunity mechanisms and In is evident, because lumphocytes are known to release In under certain stimuli. Thus, In may be an element of normal inflammatory response. Many animals are known to produce In, but to date ferret In has not yet been found. Attempts with poly I:C in ferrets have been negative possibly because ferrets contain an enzyme which destroys the inducer. In man, poly I:C has been used to induce In with values of up to 100 units/ml blood. Monkeys have been successfully cured of yellow fever with In prepared by human white blood cells. A study is being planned to follow viremia of humans infected with 17D virus and to find the effect of human interferon on the infection.

Herpes viruses were discussed by A.J. Nahmias (USA) and H. Ratcliffe (UK). There are now about 50 herpes viruses, five of which infect man. These are: Herpes simplex types 1 and 2, Epstein Barr Virus (EBV), Cytomegalovirus (CMV) and Herpes zoster. Of these H. simplex type 2 and CMV have been implicated in venereal transmission and H. simplex 2 and EBV are considered to have the ability to effect the transformation of host cells into neoplastic cells. These viruses can exist in a latent or carrier state in many individuals. The problem of curing this state is difficult. Vaccines have been attempted; in Germany vaccines have been used for H. simplex types 1 and 2, and a vaccine has been prepared for type 1 in the US. There has been some success in the therapy of pigs infected with herpes virus by raising the body temperature to 39° C. This treatment has prevented the dissemination of the virus to uninfected animals. In studies with H. simplex type 1 from skin lesions and H. simplex type 2 from genital tract lesions, differences among 31 strains were found in

ability to grow in VERO cells. All strains grew at 35° C. All type 1 strains grew at 40.3° C. None of the type 2 strains grew at 40.3° C. Only three of the 15 type 2 strains grew at 39.8° C. Thus there was a distinct difference in ability of the two viruses to grow at 40° C.

A small papovavirus was isolated by A.M. Field (UK), from cells in urine of a man who had received a renal transplant and who developed blockage of a ureter. The cells had intranuclear inclusions, and one in five cells contained crystals of virus in the nucleus. When inoculated into VERO cells, very little CPE appeared but many virus particles were seen in the electron microscope. Suspensions of the virus particles hemagglutinated with guinea pig RBC and human group O cells at 4° C only. A CF antigen prepared from infected tissue cultures showed some cross reaction with SV40 serum but none with serums to other papovaviruses. The patient's serum had titers of 1:5000 CF and 1:256,000 HI. This patient apparently had a reactivated latent infection.

In studies of progressive multifocal leukoencephalopathy, G.M. Zu Rhein (see Lancet, end of June) of the US obtained an area of affected brain after death of the patient. A 10% suspension of the tissue was inoculated on VERO cell cultures. No cytopathogenic effect was seen in 66 days of incubation. Cultures of the brain cells were prepared with Eagle's medium plus 1% calf serum. After ten days, two types of cells appeared: spongioblasts and glial cells. The cells piled up in small mounds. When examined in the electron microscope, intranuclear inclusions were seen with 40-nm particles and some crystal formation. When the cells were trypsinized and the fluid was passed to new cultures, the inclusions were seen again. The virus has been designated JC virus and is considered a papovavirus.

K. Sanders reported some work with Hodgkins Disease. To overcome the problem of working with cell cultures of mixed or unknown cell populations, a conventional organ culture system was used in which pieces of tissue were suspended in medium on a grid. As the tissue grew some cells fell through to the floor of the culture compartment (Petri dish). The grid was then removed and placed into fresh medium, and the cells growing on the floor were maintained as a monolayer. By use of this system, tissues from 25 cases of Hodgkins Disease were studied and cells were grown from each tissue. One culture has been maintained for over three years. The cells which were cultivated were not fibroblasts, some had more than one nucleus. When some cultures were labelled with tritiated uridine at 1 to 2 microcuries/ml, a particle was released into the supernatant. This particle was found to contain RNA. Five of these preparations of particles have been recovered so far. Occasionally a type of cell transformation occurred. The new cells look like lymphocytes (but they are not lymphocytes). At this time particles which resemble herpes virus appear in the medium. These particles are under further study.

According to the official program, the symposium on Viruses Related to Cancer was organized by Saul Kit and Michel Boiron to cover the molecular biology of the papovaviruses: SV40 and polyoma, and the avian and murine leukosis viruses from the following considerations:

1. Replication of tumor virus nucleic acids
2. Maintenance of the viral genome in transformed cells by regulated replication
3. Production of infectious particles by cells transformed by papova and leukosis viruses
4. Identification of virus-specific nonvirion and virion antigens
5. Chemical and antigenic conversions induced on the surface of cells by oncogenic viruses
6. Transforming and replicative capabilities of leukemia and sarcoma viruses
7. Mechanisms of reversion or pseudo-reversion of virus-transformed cells
8. Regulated expression of viral genetic information in transformed cells

These subjects were discussed by P. Bourgaux (Canada), E. Winocour (Israel), H. Bauer (West Germany), P. Black and H. Hanafusa (USA) and L. Montagnier (France).

In the specialized workshop on the genetics of animal viruses, J.L. Williams (Glasgow) described the production of temperature-sensitive mutants of adenovirus type 5. Using a restrictive temperature of 38° C and a permissive temperature of 31° C, he found a 5-6% mutation rate with nitrous acid and a 9% rate with hydroxylamine when held at 30° C for 40 hours. Virus titers of 10^8 were obtained in HeLa cells, and the frequencies of complementation were quite high with some mutants. Two mutants were found which were not able to induce interferon at 38° C but could at 31-33° C.

H. Stäber (East Berlin) reported on his work with pseudorabies virus which was attenuated for pigs. He added Iodo-deoxyuridine to induce mutations. Temperature-sensitive mutants, some of which grew at 34° C but not at 40° C, with plaques measuring 0.5 mm in diameter were obtained. Four groups among the nine mutants that he found showed complementation.

In the workshop on molecular biology of arboviruses, M. Horzinek (Tübingen) discussed studies on hemagglutination (HA) of Sindbis virus. HA was constant at different pH values down to pH 5.6, at which point the red blood cells agglutinated spontaneously. K and Ca ions enhanced HA. The detergent NP40 interfered with HA at a concentration as low as 0.3%.

The molecular structure of Semliki Forest virus was described by L. Kaariainen (University of Finland). The virus grown in BHK cells measured 65 nm in diameter and contained 7.6% RNA, 24% lipid, 6.6% carbohydrate and 62% protein. This corresponds to 9500 molecules phospholipid, 700 molecules glycolipid, 9500 molecules cholesterol and 540 molecules of protein per virion. Two main components could be separated in CsCl gradient: nucleocapsid and a lighter fraction; the envelope component. The nucleocapsid was a nucleoprotein of 150 S with a protein to RNA ratio of 0.62:0.38 and it was sensitive to RNase and pronase.

N. Goldblum (Jerusalem) reported results of his work with the togaviruses: Sindbis, EEE and WEE. By disrupting purified virus with non-ionic detergents, two subviral components, a ribonucleoprotein and a lipoprotein, were obtained. Rabbits immunized with each of the isolated proteins produced serums which were specific for each protein. The serums prepared against the whole virion and against the lipoprotein inhibited hemagglutination and prevented plaque formation. Studies are planned to determine the degree of cross reactions with the same components of other togaviruses.

D.W. Verwoerd (South Africa) discussed the place of Blue Tongue virus in viral taxonomy. Like African Horse Sickness virus, it has properties resembling reoviruses, but is somewhat smaller. In acrylamide gel electrophoresis the RNA shows four main and six minor components. Thus, the genome resembles that of reoviruses. A suggested name of Diplornavirus was given for these viruses, since they all contain double-stranded RNA.

The workshop on slow viruses covered viruses such as Visna, Boerner disease of horses and sheep, measles, and scrapie. The question of a spectrum of viruses was discussed: from those like smallpox which cause acute disease, thru polyoma virus in mice where persistent infection with shedding of virus occurs in urine even in the presence of antibody, to such latent viruses as Herpes zoster and also the leukemia viruses where infections with the latter occur in utero and disease appears much later, to scrapie-like agents where the incubation period is a large fraction of the lifetime.

D.H. Harter (USA) described work with Visna virus. It was first isolated in Iceland from sheep which showed instability that progressed eventually to quadraplegia. The incubation period is $1\frac{1}{2}$ to $6\frac{1}{2}$ years. When the illness appears, the animal usually dies within a month. The CSF contains an elevated cell count and demyelination occurs in the animals. At the time of death, virus is found in all parts of the animal. In infected cell cultures multinucleate cells are formed. In the electron microscope, the virus shows two forms:

(1) particles 65-100 nm in size with 30-nm electron-dense cores

(2) particles 100-140 nm without cores.

Virus purified in CsCl or K tartrate gradients is a suspension of particles like those of (1) above. The virus is like the oncogenic RNA viruses and will produce tumors in hamsters.

R.H. Kimberlin (UK) described work on the properties of the scrapie virus in mice. He has found that it is resistant to ether, pH 2.5 to 10.5, formalin, beta propiolactone, detergents, DNase, RNase, strong salt and ultraviolet light. It is destroyed by 0.01 M periodate, 90% phenol and 6M urea. Its size is between 40 and 50 nm. Its RNA is 1×10^7 Daltons. It is thought that the scrapie virus is an integral part of the cell membrane and part of the membrane is required for the virus to function. A glycoprotein is a significant part of the virus.

In a workshop on Immunosuppression and Cell-mediated Immunity in Relation to Viral Infections, T. Beladi (Hungary) reported on immunosuppression by human adenoviruses in chickens. When compared with rabbits, chickens injected intravenously with adenovirus type 6 or type 12 show a much lower response. Chicks, two to three months of age, injected IV with a mixture of adenovirus and sheep RBC showed spleen antibody plaque counts of 87, but when virus was injected four days before the RBC, the plaque count was 32. The depression in plaques persisted 16 to 20 days after the virus injection before it returned to normal. It was speculated that some cells may be involved with both interferon production and antibody formation, and the interferon induction by the adenovirus may have depressed antibody formation. Other discussions emphasized that Friend leukemia virus and Rauscher leukemia viruses have greater immunosuppression on immunization than Maloney leukemia virus. It was apparent from these discussions that viruses can influence many aspects of immune function including antibody production, phagocytosis, lymphocyte activation, induction of immunological tolerance and the various manifestations of cellular immunity.

M.S. Hersch (USA) discussed the susceptibility of immuno-suppressed animals to virus infections. He pointed out that in these animals there is enhanced susceptibility to such viruses as herpes, vaccinia, measles and papova. In humans, studies have revealed that among 4400 people who received tissue transplants and were under immuno-suppressive therapy, 51 cases of tumors developed. Twelve were mammary gland tumors and 23 were epithelial tumors. This incidence is higher than in the non-transplanted population. In considering the possible choices for helping these people, the following were mentioned: lymphocyte transplantation, injection of transfer factor from lymphocytes, vaccination with virus preparations and use of interferon inducers such as poly I:C or other poly-

anions to suppress virus multiplication. Experimentally, 10^8 normal lymphocytes protected mice against polyoma virus. The use of the transfer factor from normal human lymphocytes has been tried in cases of Hodgkins Disease and in disseminated Herpes zoster infection.

The session chairmen were asked to prepare detailed summaries of the proceedings based on both contributors' papers and discussions. These will be published this year as International Virology II (edited by J.L. Melnick, published by Karger, Basel).