

## DISCUSSION

The CHAIRMAN (Dutz, Berlin): Thank you very much, Dr. Gordon. The three papers are now open for discussion. Any questions, any remarks?

YOUNG (Liphook): I should like to address a question to Dr. Muir first. Could he tell me what he thinks is the maximum improvement in urea transfer rate for a membrane one thousandth of an inch thick, relative to the rate for Cuprophan?

KLINKMANN (Rostock): I think there is no possibility of bringing down the urea transfer rate for Cuprophan any further, because you could not use Cuprophan as a thinner material. We tried to bring it down just beyond 10 microns, but, if you even touched it, it would leak.

YOUNG (Liphook): I think the question has been misunderstood. I am talking of a hypothetical material and I wish to know what you think is the maximum improvement in rate for a hypothetical material we can obtain relative to Cuprophan?

KLINKMANN (Rostock): I am afraid I cannot answer this question.

MICHELSSEN (Louvain): Dr. Klinkmann kindly provided me with some of his Nephrophan membrane and I can confirm the excellent characteristics of this membrane in clinical use. The dialysance, especially for uric acid and phosphorus, was very high, especially if you compare it with the viscose. However, we had some problems with leaks, especially when we tried to manufacture coils with this type of membrane and I wonder if he could comment on this problem of leaks occurring with this membrane.

KLINKMANN (Rostock): I am sorry about these leaks, but you got a very bad piece: it was amongst the first material we produced. I think it was among the first 500 m and you will confirm that there was a bad wind-up on the very big coil. You can see it now on the exhibition stand: it is wound up in another way and we no longer have these leaks, because of its ability to swell and because the burst strength is up to 70% higher than Cuprophan.

KOPP (Frankfurt): Dr. Klinkmann, would you please tell us something about the ultrafiltration capacity of your membrane?

KLINKMANN (Rostock): Due to the very thin wall thickness of this membrane, the ultrafiltration rate is rather high. Using the Nephrophan membrane on our second dialyser—this is 65 cm flat, 4 metres long, without negative pressure and with an inner resistance of the kidney of about 100 mm Hg—we got an ultrafiltration rate of about 500 ml per hour.

OREOPOULOS (Athens): I should like to ask Dr. Gordon if they have studied the influence of the absorption of zirconium phosphate on the other waste products, such as uric acid and the phenolic compounds and if he has found any improvement in the clinical symptoms?

From the work we have done in Athens, we have found that 200 g charcoal can absorb approximately 3–4 g urea; you have used 850 g of zirconium phosphate and you have removed amounts ranging between 20 and 30 g. The same amount of charcoal would absorb 10–12 g of urea. I am wondering if you have found that the charcoal has the advantage of absorbing all the other waste products and improving the clinical symptoms in spite of not breaking down the blood urea?

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GORDON (Los Angeles): The zirconium phosphate in essence absorbs very little other than the cationic species and this is why the second cartridge containing the charcoal is included. Our studies with the entire system indicate, as you have found, that the activated charcoal removes most of the other uraemic waste products. We have not identified these quantitatively, but have identified all of them qualitatively. It appeals to us not as a haemo-perfusion technique, but rather for the augmentation of dialysate by including it in the dialysate compartment. The zirconium phosphate's removal of urea goes beyond the level which is necessary to remove from a person on two or three times a week dialysis, whereas equivalent amounts of activated charcoal or carbon will not remove that quantity for us, as judged by the literature from others who have attempted this.