I. INTRODUCTION

After extensive research\textsuperscript{1,2}, over 10 years, and the treatment of thousands of patients, laser PDT surgery is here and for the future, The National Cancer Institute, USA, declares, with reason, that today, these are the priority cancers for PDT, primarily endobronchial cancer, early gastric cancer, and bladder cancer. This formal recommendation has not interfered with continued research and PDT for many other clinical types of cancer.

Also, as indicated previously, PDT has been used in many fields of biology and for many types of organisms\textsuperscript{3-10}. Thus, there is a great future for the technology of exogenous chromophores and laser photosurgery. With renewed commercial interest and active financial support, unlike for DHE, there will be further extension of the use of well controlled needed exogenous chromophores, suitable for PDT, suitable for other forms of non-ionizing when needed, suitable economically, both for the chromophores and the specific laser system required. All this will make for greater use, in the whole oncology program.

The basic factors and the fields to which many questions continue to be addressed in the PDT program are:

1. What chromophores are still needed and exactly how are they to be used?
2. What special lasers are still needed and are they economical in use and service?
3. What special delivery systems are needed besides those developed by Doiron?
4. What is the real value of induced hyperthermia associated with PDT?
5. What is the value of the new microendoscopes in the PDT program?
6. Can you truly develop effective PDT deep in tissue?
7. Do you need these accessory instruments for PDT: a) instruments similar to those of Potter for detection of the chromophore; b) thermal sensors in the operative tissue field; c) a scanning instrument similar to the Laser Scanning Ophthalmoscope for scanning the operative field after PDT?
8. Do you need suitable vehicles for topical PDT when indicated?

There will be many additions to this list as PDT progresses. In this volume, Doiron and Potter, with their long involvement with PDT and as in-
ternational authorities, present their current programs. This chapter is concerned with my research and my interests and as many will say, my dreams.

In our location, we are interested in some exogenous chromophores developed at the Navy's Ocean Systems Center by Pavlopoulos. These initial dyes were limited to 530-575 nm range and could be energized by a quartz lamp. Tests were done on the standard murine breast cancer. Our present interests are with the flash pumped dye lasers, 577 and 585 nm, and Nd YAG CW and Q switched and the second harmonics, 532 nm, PDT energized with adequate quartz lamps, with appropriate filters, would decrease the expense of PDT in the cancer treatment program.

New exogenous chromophores have to be studied for standardization of the compound, unlike the early days of HpD. Also, perhaps, each commercial batch should have biological testing, for example, with one cell line often suggested, the murine fibrosarcoma cells (RIF1) with the identical PDT with HeNe. More details are needed for the specifications of the quartz lamps and their fiber optic or rod transmission.

II. LASER SYSTEMS REQUIRED

What laser system are required as related to specific exogenous chromophores? In the past, we preferred gold vapor (GVL) for the DHE therapy. As indicated, our interest is to try to use the flash pumped dye laser. With improvements in flash lamps, coaxial, and multiple prism technique, for narrow line width, for precision, adequate protection glasses also with magnification instrumentation on the lesion, the next concern relates to the dye chemistry, scientific or alchemic? More stable mixtures are now available with greater numbers of impacts. We are still waiting for the single small tablet to be dropped into the vat. Other lasers are the argon pumped, copper vapor (CVL), gold vapor (GVL), excimers, nitrogen, Nd YAG. The krypton is used mainly for diagnostics in PDT.

The main developments for the delivery systems in PDT have been done by Doiron. We are interested in the microendoscopes; these microendoscope can serve as light guides themselves or as carriers for fiber optics. With observation, they can also penetrate into tissue to open passages to cancer foci for PDT. The direction of the penetration in their search for the cancer focus is the great challenge to optics today. This will be reviewed later in the review of photon transmission through turbid media. The quartz lamp and its delivery systems are of interest now for PDT. These lamps also may relate to the microendoscopes.

With the known hyperthermia treatments for cancer, and the suspicion of thermal energy for some of the laser systems used for PDT, especially the Nd YAG, it is not surprising that hyperthermia was considered as adjunct therapy for PDT. Dougherty, with his work with veterinary oncol- ogists, initiated this program. Hyperthermia for cancer may be used extensively as for cancer of the breast or locally for basal or squamous cancer of the skin for cancers in the lining of the various cavities of the body. For general hyperthermia, there are the extensive RF instrumentatio and the older models of the special insulated IR body boxes as the Kettering Hypertherm. Also, hot baths and hot electric blankets have been used and microwaves. In experiments in rabbits, we used iron particles, sterile colloidal iron, and Interferon B with iron Dextron, all injected deep in tissue. These areas were exposed to microwaves, then to ruby laser impacts for double impacts for hyperthermia. A basal cell carcinoma in a patient was injected with sterile colloidal iron particles (Ferrofluids), then treated with ruby laser. The non-pigmented skin cancer cleared com-