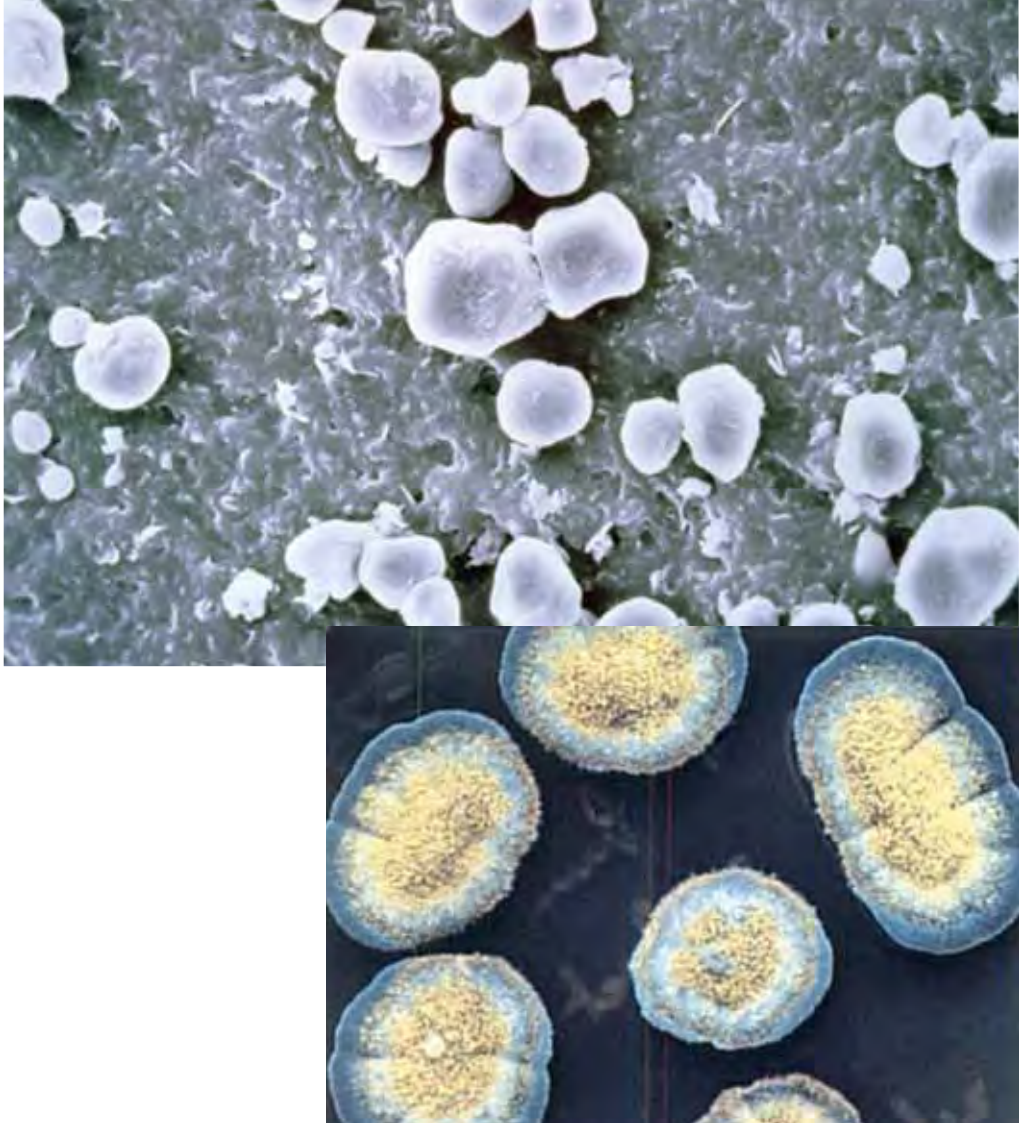
GLOVE POWDER - FRIEND OR FOE?

THE HAZARDS ASSOCIATED WITH POWDERED GLOVES

Powdered disposable gloves have been a constant feature of our daily life in the laboratory, although increasingly they are being replaced by powder-free gloves. For those of us that have used powdered gloves for many years, the transition to powder free may represent a retrograde step. Powdered gloves are easy to don and even better with prolonged use we do not get the same sweaty sensation as we do with powder-free gloves. Therefore what are the facts surrounding this shift to powder-free gloves and why might it be beneficial for those working in a laboratory.

The role of powder in gloves

Many of us refer to the powder in gloves as talc, but in reality USP Absorbable Dusting Powder (as defined in the United States Pharmacopoeia) is the most commonly used donning agent. It consists of modified cornstarch and less than 2% magnesium oxide to prevent caking. Phosphorous oxychloride or epichorhydrin are often added to prevent the glove powder dissolving. This process is performed in order to make the starch particles more resistant to breakdown during steam sterilization and when immersed in ▸



A microphotograph of the surface of a powdered glove and the particles of absorbable dusting powder are clearly evident.

sweat from the hands. Indeed the USP requires that the powder is capable of resisting twenty minutes of boiling and then it is held in suspension for twenty-four hours during which it must not dissolve. Hence glove powder is not readily dissolved.

Powder is typically used to facilitate donning. While the majority of powder is maintained on the interior, some does migrate to the outer surface during packaging. Likewise the highly absorbent properties of powder make it ideal for donning gloves when the hands are moist.

What impact can glove powder have on those working in the laboratory

As we have already noted, glove powder is very absorbent. This means that during the glove manufacturing process, the powder potentially attracts chemicals, micro-organisms, natural rubber latex proteins, silicones, antiozonants etc. Once the gloves are donned, then the powder continues to absorb substances producing a cocktail of substances that are potentially in direct contact with your skin. The irritant properties of powder are combined with its potential to absorb lipids and natural moisture, leaving the hands more vulnerable to chapping, infection and further injury. Mechanical abrasion of the glove wearer's skin has often been reported with the powder particles abrading the skin. Similarly though aerosolization, powder disperses widely in the laboratory and may expose colleagues to nasal, throat and respiratory complications [1]. The particulate nature of the powder or the high pH of most glove powder may cause irritation. Likewise chemicals from the glove manufacturing process or even those in the surrounding laboratory may bond with the powder and be subsequently inhaled causing irritation.

The role of powder in transporting allergens is a further cause of concern. Chemical contact sensitizers (including powder ingredients such as epichlorhydrin [2]) may be absorbed by powder and cause allergic contact dermatitis. The issue may be exacerbated by the potential of powder to cause skin cracking, thereby facilitating the entry of chemical allergens and increasing the chances of allergic contact dermatitis [3].

Perhaps of greater concern is the role of powder in exacerbating the problem of natural rubber latex allergy. Here natural rubber latex protein can bond with the powder particles and be aerosolized throughout the laboratory. Symptoms of natural rubber latex allergy are potentially more serious extending to asthma-like attacks and anaphylactic shock [4]. In both allergic contact dermatitis and natural rubber latex allergy, it should be remembered that only those individuals with the genetic predisposition to be sensitized to a specific allergen are at risk. The importance of powder as a vector for allergens is demonstrated by the ▸

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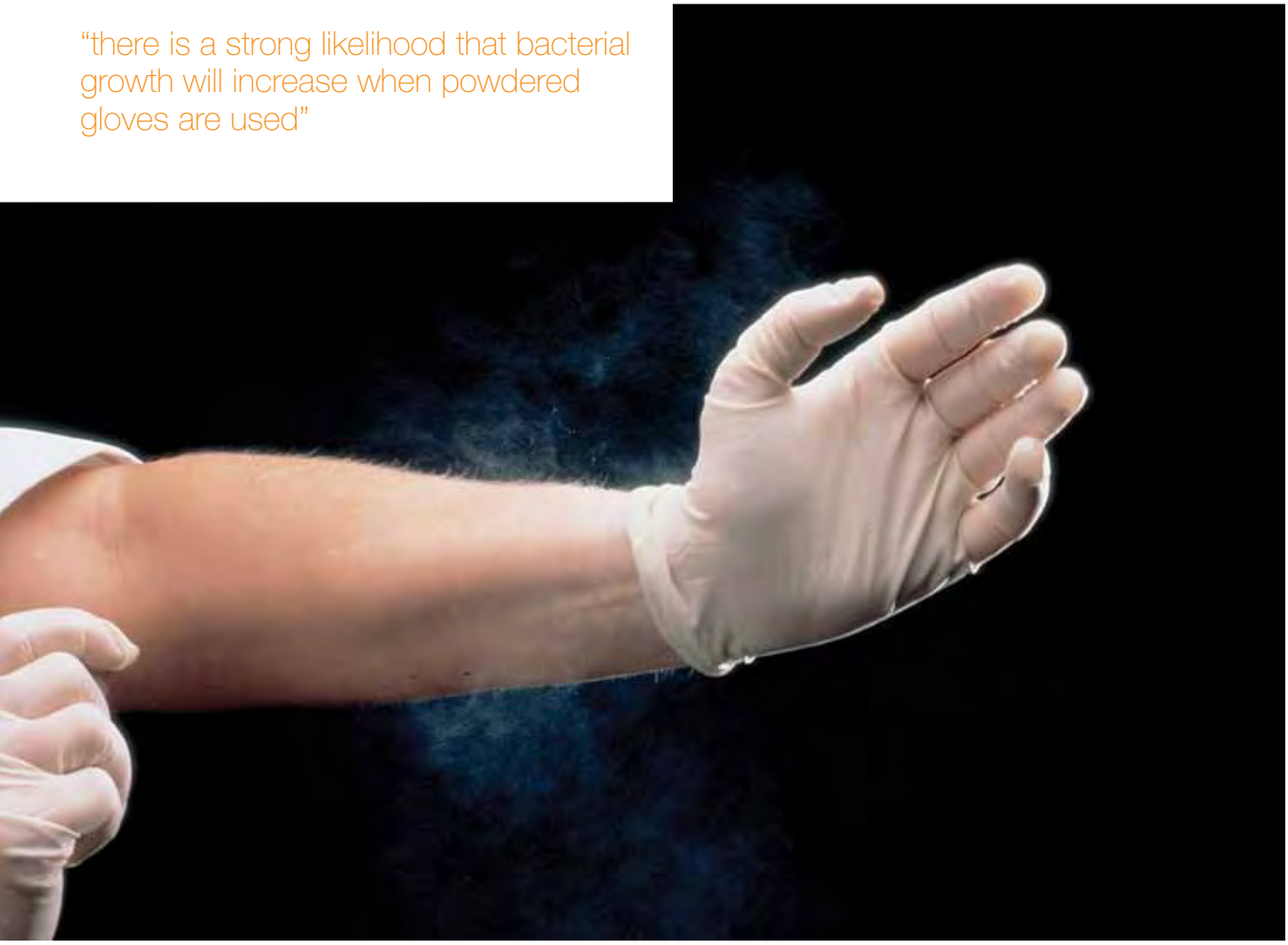


Diagram to show the potential of glove powder to aerosolize in the laboratory

report that the concentration of aero-allergens is five-ten times higher with powdered gloves than when powder free gloves are used [5].

The absorbent characteristics of powder make it an ideal media for adhering to micro-organisms [6]. Whilst most of these micro-organisms are likely to be harmless, they could also be infectious pathogenic micro-organisms transported from within the laboratory environment or from external sources. There is a strong likelihood that bacterial growth will increase when powdered gloves are used.

The potential for glove powder to impair healing in hospital patients has been widely publicized [1]. However laboratory personnel may also be exposed to this risk, as small cuts on the hand may be frequent. Not only does powder in the wound reduce the resistance to infection [7], but powder contaminated with micro-organisms is more likely to cause an infection than if the wound was exposed to the micro-organism alone.

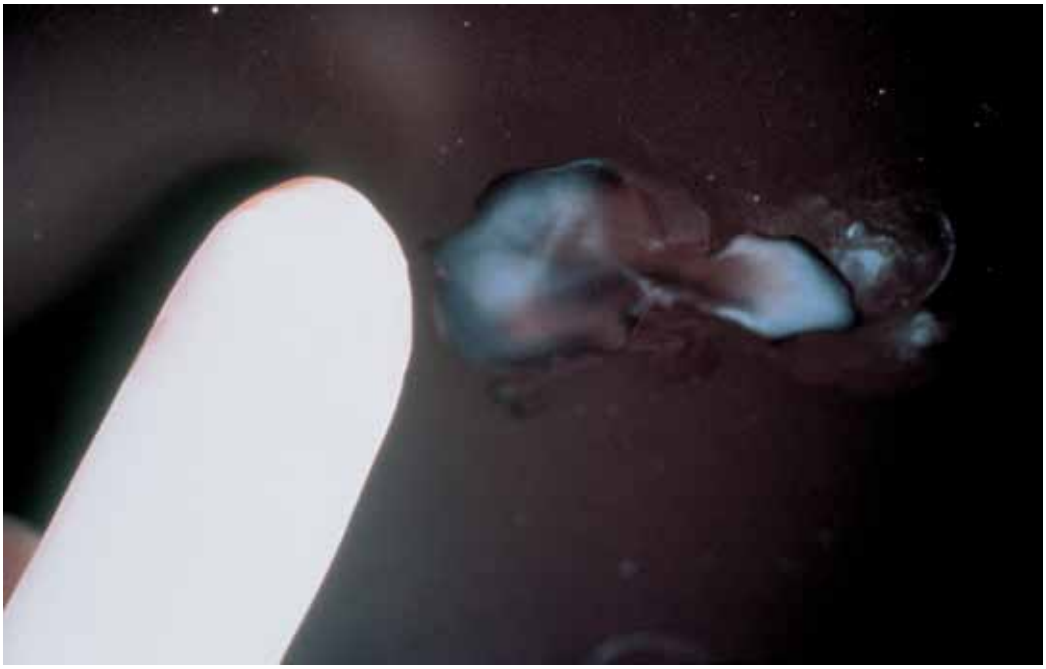
The role of glove powder in contaminating assays

Even if powder was restricted to the interior of the glove, the reality is that gloves frequently develop holes or tears. The image opposite shows what happens when a needle is used to puncture a glove. Here powder along with sweat is released into the laboratory environment with the real prospect of contaminating laboratory assays.

"the cytotoxicity of powder laden with chemicals and micro-organisms is especially evident with cell cultures"

The potential of powder contamination is particularly evident with some of the more sensitive diagnostic procedures such as polymerase chain reaction (PCR). PCR is widely used in biological and medical laboratories. It is a valuable forensic diagnostic procedure for the purpose of identifying genetic fingerprints. Here minute amounts of glove powder can lead to inaccurate results [8]. Specifically false-negative determinations have been reported for HIV antibodies [9]. Likewise powder contamination has contributed to false pregnancy tests [10]. Where optical scanners are used, distortions can emerge due to powder particles being counted. The problem is exacerbated as the plastic optical reader plates may be prone to attracting and retaining glove powder. The cytotoxicity of powder laden with chemicals and micro-organisms is especially evident with cell cultures.

Image to show how powder and sweat is released once the glove is punctured



It is difficult to quantify the risk posed by powdered gloves in the laboratory, but if it is assumed that there is a correlation between concentration of powder in the laboratory environment and potential powder complications then this may be a guide. In this context [11] reported that where powdered gloves are used concentrations of powder vary from 13-208 ng/m^3 compared to 0.3-1.8 ng/m^3 in powder-free environments. Extrapolating this data to a small laboratory with just 5 persons working and changing their gloves six times a day, we could imagine that as much as 2 kg of powder could be aerosolized over the year into the surrounding laboratory environment.

Conclusion

The above article highlights the hazards associated with powdered gloves, both in terms of the glove wearer and the laboratory environment. Whilst the role of powder as a vector for transporting allergens was explored, the abrasive properties of powder were also considered. Likewise the potential for erroneous laboratory assays through powder interference has been discussed. Based on the substantial evidence against the use of powdered gloves, there seems to be little justification for their continued use in the laboratory. ■

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